

**Interim Compilation of Discussion Points for the
Formulation of “Innovative Strategy for Energy
and the Environment”**

July 29, 2011

The Energy and Environment Council

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Interim Compilation of Discussion Points for the Formulation of “Innovative Strategy for Energy and Environment”

July 29,2011

The Energy and Environment Council Decision

Introduction

-Reestablishing the energy and environment strategies on the basis of lessons from the Fukushima nuclear power plant accident

On May 17, the government approved the Guideline on policy promotion at the cabinet meeting and decided to make the Council on the Realization of the New Growth Strategy develop innovative strategies for energy and environment. On the Guideline on policy promotion we will consider an innovative strategy for energy and environment consisting of a short, medium, and long-term that not only overcomes the power restrictions and strengthens safety measures, but which also corrects the distortions and vulnerabilities in the energy system and meets appeals for a safe and stable supply, efficiency, and for the environment. .

In response to this, the government held a Council on the Realization of the New Growth Strategy meeting on June 7 to intensively discuss energy matters. At the meeting, the panel reconfirmed the following points:

- 1) As Japan is currently facing unprecedented troubles of the Great East Japan Earthquake and Fukushima nuclear power plant accident, it is necessary to reexamine from scratch the current the Strategic Energy Plan of Japan that calls for boosting dependency on nuclear power generation to 50% in 2030.
- 2) Japan has substantively transformed the best- mix of energy sources and has changed the main energy source. It changed hydro with coal, coal with oil, and then oil with nuclear energy. Nations in the world have also been developing their energy strategies suitable to their own circumstances. Energy choice for economic growth and for stabilizing citizen life is always an important issue for all nations.
- 3) Japan must reexamine its energy and environment strategies from scratch, including matters recognized as the given conditions in the past, and must form a new national consensus as soon as possible.

In this sense, the Council on the Realization of the New Growth Strategy will set up the Energy and Environment Council (chairperson: Minister for National Policy) to redevelop Japan’s energy and environment strategies on the inter-ministerial scale without sanctuary.

The Energy and Environment Council held its first meeting on June 22 and identified its review policy for immediate future. With an unprecedentedly tight energy supply resulting from the Great East Japan Earthquake, Fukushima nuclear power plant accident, and the problem of restart of nuclear power plant operations after periodic inspections, the Council has decided to develop Measures to Stabilize the Immediate Supply of and Demand for Energy as soon as possible, sort out issues in innovative strategies for energy and environment consisting of new technology schemes, and make them public by the mid-year.

To develop concrete innovative strategies for energy and environment that would become the foundation for revitalizing Japan and reconstructing Eastern Japan, the Energy and Environment Council has sorted out the important issues as follows, which are derived from deep reflection on the Fukushima nuclear power plant accident. As for short-term top priority matters described in this paper, the government will separately develop Measures to Stabilize the Immediate Supply of and Demand for Energy in order to identify specific actions and take related actions ahead of initial schedule.

1. Four energy problems on energy identified from the Great East Japan Earthquake

The Great East Japan Earthquake and Fukushima nuclear power plant accident have been making significant impacts both on Japan and on foreign countries. In Japan, people have come to pay more attention to energy problems, including appropriate use of nuclear power. While people are questioning nuclear safety, requesting drastic safety actions in operating nuclear power generation, and discussing the appropriateness of energy structure with dependence on nuclear power, they are also making efforts for saving electricity, reflecting the current mass energy-consumption structure. People are getting more concerned that electricity shortage and higher energy cost might make significant impacts on the economy and people's daily life. Japan's actions are attracting much attention from the world and some major nations have reexamined their energy policies including nuclear energy policies. We learned four points from this process and indicated below.

(1) Developing new strategies from scratch

Energy is one of the infrastructures for economy and society, but Japanese energy structure is vulnerable to risks, making negative impacts on people's daily life especially in Fukushima and nearby prefectures and it brings much anxiety to the Japanese economy, people's lives in Japan, and foreign countries. The government needs to restructure a safe, stable, low-cost, and environment-friendly energy structure urgently.

For this end, the government must reexamine from scratch the current Strategic Energy Plan of Japan developed prior to the Great East Japan Earthquake. It is necessary to enhance and review the so-called green innovation-related strategies, including renewable energies, energy-saving technology, clean fossil fuels, and implement them as soon as possible.

(2) Verification without exception

In the process of reexamining these strategies, the government must thoroughly examine the following points: nuclear safety, which has been recognized as one of the prerequisites in the current energy plans/strategies; effectiveness of the current electric power systems on the basis of the large-scale, centralized, and local monopoly regime; and unit price of nuclear power generation, which has been recognized as low level.

(3) Construction of energy market where invention and competition of various actors are encouraged

To create a safe, stable, and environment-friendly energy structure, it is necessary to promote energy-saving efforts, encourage the introduction of renewable energies, strengthen the clean use of fossil fuels, and thoroughly enhance nuclear safety. These efforts will require new investment. Without investment returns, they will take much cost.

It is necessary to create new energy markets which not only power utilities and large corporations but every consumer are able to participate in and the markets will make energy production/consumption more efficient and enhance their creativity, leading on-site improvements, innovations, and cost competition.

(4) Construction of strategies from various points of view

It is necessary to deploy new strategies from diversified perspectives in a manner suitable to the situations. As tight supply is anticipated for the near-term, to implement energy structural reform ahead of initial schedule, the government will put emphasis on providing enough electric power for the peak time, thoroughly reducing electricity cost, and taking policy actions aimed at shifting to an energy-saving structure.

At the same time, it must drastically accelerate green innovations in the medium and long run, mainly consisting of energy-saving, renewable energies, and clean use of fossil fuels, in order to create innovative energy systems based on new technical paradigms.

2. Strategy perspectives

Energy is one of the infrastructures for the economy and people's life and should be economical and stably supplied. In particular, Japan has a low energy self-sufficient ratio and high risks of supply shortage. For this reason, when developing energy strategies, policymakers always put the top priority on keeping the energy security. In particular, since the first Oil Crisis in 1973, the government has been putting emphasis on securing resources stably available, diversifying the power source mix, and promoting energy-saving efforts in order to reduce dependency on foreign resources.

Since the 1990s, with the advent of the global warming issue, environment-friendliness is added as a new target. Energy strategies are requested to meet the three requirements: Economic efficiency, Energy security, and Environment-friendliness.

From the experience of the Great East Japan Earthquake and Fukushima nuclear power plant accident, the government recognizes Safety of energy supply as a new principle which is important in addition to these three principles. Now the government must develop the innovative strategy for energy and environment not only with a view to ensuring Economic efficiency and Energy security but also to caring about Environment-friendliness and constructing Safe energy structure.¹

It is not an easy task to create an "Efficient," "Safe," "Environment-friendly," and "Energy-secured" energy structure. This is a common issue for Japan as well as for other countries.²

Which energy source is more economical and better from the security perspectives? As reduction of dependence on fossil fuels has been an important agenda for Japan, how should policymakers keep energy security and environment-friendliness, while cutting down dependence on nuclear power generation? Considering the possibilities of future innovations, how will be the view of economic efficiency or energy security changed? Or how should the government change them? Energy innovation is a key to overcoming the cost problems of economic efficiency and energy security. On what area in energy innovation should Japan put emphasis from the international context? How should Japan address the global warming problem?

¹ See the reference material 1): Japan's energy strategies so far (pp. 26).

² See the reference material 2): International comparison of national energy policies (pp. 27).

After examining these issues, Japan must aim at a best-mix of energy sources and energy systems evidenced with new technology schemes. For this end, national discussions should be required.

In this context, the authors suggest three common philosophies as follows to develop concrete innovative energy and environment strategy in the future. They are a best energy mix, appropriate energy systems, and the formation of a national consensus.

3. Strategies' basic philosophy

(1) Basic philosophy 1: Three principles for realizing a new best energy sources

Principle 1: Draw up scenario of reducing dependency on nuclear energy

The government will reexamine on the zero basis the present energy mix, in which nuclear power generation consists more than a half of the electric power supply.³

In other words, it will enhance the safety of nuclear power plants and utilize them continuously but reduce its dependence.

At the same time, it will cultivate energy frontiers, such as increasing the percentage of renewable energies, drastically reforming the energy demand structure through energy-saving efforts, and enhancing the clean use and efficiency of fossil fuels.⁴

Principle 2: Utilize a clear and strategic schedule in order to avoid energy shortfalls and price rises

To enhance the foreseeability of government policies and minimize possible impacts on economic activities or people's lives, the government will examine and make a clear process flow for restructuring an efficient and environment-friendly energy structure.

It will always make the best efforts to prevent energy shortage and steep rise of cost from making negative impacts on economic activities or people's lives. In this process, the government will develop the process flow, paying due attention to energy strategies in the international context, the trend of energy resources, and other major countries' energy policies.

Principle 3: Conduct a thorough review of nuclear power policies and operate under a new framework

When developing a specific scenario for reducing dependency on nuclear energy, the government will comprehensively check out nuclear policies.

How long and how much should the government reduce dependency on nuclear power? How should the government handle new-generation nuclear technology R&D? What should it do with back-end issues or nuclear fuel cycle policies? How should the government secure/foster technologies or human resources for attaining the world's top class safety or keeping safety of existing nuclear power plants? How

³ See the reference material 3)-1: Present energy basic plan, and the reference material 3)-2: Trend of electric power generated and power source mix (pp. 28 and pp. 29)

⁴ See the reference material 4): "Actually installed capacities and target on renewable energy-based power generation (pp. 30)

should the government enhance collaboration or cooperation with international organizations or foreign nations? The government will make these issues clear.⁵

⁵ See the reference material 5): Nuclear policies in foreign nations (pp. 31).

(2) Basic philosophy 2: Three principles for the realization of new energy systems

Principle 1: Seek to realize distributed energy systems

The government will aim at innovative energy systems based on new technology schemes. Rather than improving the current concentrated energy system (in which local monopoly-based power utilities are playing central roles in supplying electric power from their large-scale power sources), the government will aim to realize new distributed energy systems.

A shift to distributed energy systems will stimulate the private sector's investment in energy/environment technologies and help the formation of new business models. It will also serve for economic growth. A shift to distributed energy systems will help transform Japanese social and economic structure into a regionally decentralized structure, leading to the conservation of Japan's national territory and environment as well as maintaining and developing local communities.

Principle 2: Seek to make an international contribution as an advanced problem-solving nation

Japan will contribute to the world as a problem-solving developed country by identifying appropriate solutions evidenced with technologies and policies.

The government will collect knowledge both in Japan and in foreign countries to attain development of new energy systems ahead of other countries.⁶

Principle 3: Take a multifaceted approach to the realization of distributed energy systems

The government will develop a specific near-term energy demand-supply stabilizing project as well as medium-term and long-term strategies for actualizing future-oriented new energy systems.

The near-term project and the medium/long-term strategies should be complementary to each other. In other words, the near-term project should include medium-term and long-term perspectives and should be a portion of the energy structural reform program implemented at an early stage. Even if several policies in the near-term project are expected to show effects in the medium and long run, policymakers should launch and take specific actions as early as possible.

⁶ See the reference material 6): Foreign nations' actions to set up distributed power source systems (pp. 32).

(3) Basic philosophy 3: Three principles for the formation of national consensus

Principle 1: Stimulate national discussion overcoming the confrontation between the opposition to nuclear power generation and its promotion

The confrontation between the opposition to nuclear power generation and its promotion has blocked discussions and brought about an unfortunate gap between expert opinions and public opinions in general.

As to nuclear power plants consisting of existing technology, if people can agree with the idea that the government should reexamine the current Strategic Energy Plan of Japan from scratch and it should reduce the dependency of nuclear power, the national discussions will be developed with the theme of “creating specific scenarios for reducing dependency of nuclear power”. Such discussions should help effective energy choice in the future.

Principle 2: Verify objective data

The government should practically and objectively check out nuclear power generation cost as well as renewable energies introducible amount on the basis of data.⁷

The Energy and Environment Council will set up the “Cost Estimation and Review Committee” (tentative name) to examine power generation costs and reflect them to the basic policy scheduled at the year-end.⁸

Principle 3: Formulate innovative energy and environmental strategies while maintaining dialogue with a broad range of national people

The government should organically combine the inter-ministerial broad direction lead by the Prime Minister Office, and specific programs planned by related ministries.

By listening to a wide variety of stakeholders, the government will realize energy strategies with focus on national interests.

⁷ See the reference material 7): Comparison of estimated power generation costs (pp. 33).

⁸ See the exhibit for more information (pp. 21).

4. Strategy processes

To develop specific strategies in line with the basic philosophies, the Council clearly suggests short-term, medium-term and long-term actions as follows.

(1) Short-term (actions for the next three years)

Conducting energy structural reform ahead of initial schedule

Making all efforts to stabilize immediate supply and demand for energy

Deepening national discussions for reducing dependency on nuclear energy and deciding the measures

The government will start reform of demand structure, diversification of supply structure that is more efficient and more environment-friendly, and electric power system reform projects. At the same time, it will thoroughly investigate nuclear accident/safety programs and reexamine policies and regulations for nuclear power. It will decide appropriate actions for reducing dependency on nuclear energy after deep national discussions.

For immediate supply and demand for energy is unstable, the government stabilizes it by taking measures for peak-time electricity shortage and cost increasing based on Measures to Stabilize the Immediate Supply and Demand for Energy. As for nuclear energy, nuclear power plants will be utilized if their safety is confirmed.

The government will immediately develop policy supports and systemic reform plans in half a year or a full year to reform demand structure and diversify supply sources, aiming at synergy effects with social awareness-raising programs.

(2) Medium-term (toward 2020)

Aiming at a new best mix and new energy systems

Around 2020 at latest, the government will work on diffusing and encouraging distributed energy systems.

It will implement full-scale strategies based on a new energy mix, including reduction of dependency on nuclear energy.

(3) Long-term (toward 2030 or 2050 from 2020)

Realizing outcomes from a new best-mix and new energy systems

The government will attain a new best energy mix from 2020 to 2030 or 2050 and make efforts so that new electric power systems based on new technology schemes be established and take root.

5. Discussion points of six important issues

To identify the new structure of the best energy mix, the government will make clear targets (missions) and priority matters on energy saving, renewable energies, resources/fuels, and nuclear energy. Furthermore, it will also suggest missions and priority matters in electric power systems and energy/environment industries as their common foundations.

Here are the missions and short-term, medium-term, and long-term priority matters in the six important categories.

(1) Energy saving: Challenges for social awareness-raising, changing lifestyle and reforming energy demand

[Missions]

- Attaining a sustainable, energy-saving structure that will provide comfortableness in daily life and contribute to economic growth
- Implementing appropriate solutions for the consumer, transportation, and industrial sectors

[Priority matters in short-term, medium-term, and long-term strategies]

- Short-term: Starting consumer-centered energy demand management supported with technologies and products

- Accelerating energy-saving consumption (HEMS/BEMS,⁹ high-efficiency air-conditioning, high-efficiency lighting equipment such as LED lights, and etc.)
- Encouraging energy-saving investment (energy-saving housings, plants, buildings, and etc.)
- Encouraging consumers' electric power investment (distributed power sources, storage batteries, electric cars and etc.)
- Accelerating R&D and manufacture of energy-saving products
- Encouraging "visualization" (such as smart grids and smart meters), diversifying fee menus, and subsequently changing lifestyles
- Introducing a new tax for the measures against global warming that contributes to green innovation

- Medium-term: Diffusing consumer-centered energy demand management

- Making full efforts to construct energy-saving buildings and housings
- Diffusing demand-supply management systems in which consumers participate
- Accelerating energy-saving R&D
- Rising of energy-saving industries
- Exporting energy-saving systems overseas

⁹ HEMS (Home Energy Management System): Energy management system for housings and BEMS (Building Energy Management System): Energy management system for buildings

- Long-term: Actualizing green innovation

- Realizing an energy-saving social and economic structure based on new technologies
- Establishing energy-saving industries
- Overseas export and international contribution of problem-solving social systems

(2) Renewable energies: Challenges for creating more useful renewable energies through innovation and market expansion

[Missions]

- Introducing a new framework for reducing costs sustainably and creating both domestic and foreign demands through economically efficient mechanisms
- Creating a wide variety of approaches for introducing renewable energies, such as expanding choices for consumers
- Establishing renewable energy industries

[Priority matters in short-term, medium-term, and long-term strategies]

- Short-term: Diversifying renewable energies supply by encouraging the introduction of renewable energies

- Introducing and utilizing a fixed-price purchase (FIT: feed-in tariff) program
- Reforming regulations for locations (expanding and identifying acceptable locations for introducing renewables)
- Encouraging the introduction of distributed energy systems
- Introducing a new tax for the measures against global warming that contributes to green innovation

- Medium-term: Accelerating the introduction of renewable energies through innovation and market expansion

- Realizing market expansion and lower prices through the introduction/utilization of a fixed-price purchase (feed-in tariff) program
- Accelerating R&D on renewable energies
- Diffusing renewable energies across the society
- Rising of renewable energy industries
- Exporting new energy systems overseas

- Long-term: Realizing green innovation

- Expanding renewable energies sustainably
- Realizing a low-carbon social and economic structure based on new technologies
- Establishing renewable energy industries
- Overseas export and international contribution of problem-solving social systems

(3) Resources and fuel: Challenges for the strategic use of resources/fuels through more efficient utilization and enhancing environment-friendliness

[Missions]

- Using fossil fuels efficiently
- Taking comprehensive actions for mitigating resource risks
- Accelerating R&D on CO₂-cutting technologies

[Priority matters in short-term, medium-term, and long-term strategies]

- Short-term: Stable supply and strategic utilization

- Improving the efficiency of thermal power generation (encouraging utilization of high-efficiency technologies)
- Utilizing private power generation and encouraging companies' market entries to electric power business
- Stable supply of oil and gas
- Improving strategies for resource procurement (smoothing procurement of natural gas, oil, and coal)
- Establishing a supply structure immune to risks (constructing pipelines, storage, and a supply base)
- Introducing a new tax for the measures against global warming that contributes to green innovation

Medium-term: Accelerating clean use and strategic utilization of fossil fuels

- Accelerating R&D on CO₂-cutting technologies (carbon capture and storage (CCS) technologies, etc.)
- Strategic use of natural gas, etc.
- Increasing investment for resource development
- Improving strategies for resource procurement
- Establishing a supply structure immune to risks (such as constructing pipelines, storage, and a supply base)

Long-term: Realizing green innovation and pushing ahead with international strategies

- Developing practical use of the technologies for reduction of CO₂ emission from fossil fuels
- Fostering total energy service companies and expanding business operations overseas

(4) Nuclear energy: Challenges for keeping high-level safety and reducing dependency on nuclear energy

[Missions]

- Verification without exception
- Intensifying safety of nuclear energy
- Taking actions for reducing dependency on nuclear energy after having national discussions

[Priority matters in short-term, medium-term, and long-term strategies]

- Short-term: Utilizing nuclear energy with keeping high level security, and deciding to reduce dependency on nuclear energy based on national discussions

- Investigating the nuclear accident thoroughly
- Intensifying safety programs for existing nuclear power stations and taking appropriate actions on the basis of these safety programs after periodic inspections
- Establishing compensation programs for nuclear damages
- Arranging an appropriate reactor-decommissioning process
- Investigating nuclear operations thoroughly (checking the feasibility of private sector operations under national policy and the way of government's involvement)
- Investigating policies and regulations for nuclear security thoroughly
- Investigating policies for nuclear technology development thoroughly (back-end issues, nuclear fuel cycle policies, etc.)
- Based on these factors and national discussions, deciding appropriate actions for reducing dependency on nuclear energy
- Reinforcing technologies and human resources for nuclear security
- Reinforcing collaboration and cooperation with international organizations and foreign nations

Medium-term: Taking actions for reducing dependency on nuclear power after having nationwide discussions

- Intensifying safety of nuclear energy
- Implementing the reactor-decommissioning process safely and steadily
- Reinforcing technologies and human resources for nuclear security
- Reinforcing collaboration and cooperation with international organizations and foreign nations

Long-term: Making decision on reducing dependency on nuclear energy on the basis of nationwide arguments

- Intensifying safety of nuclear energy
- Implementing the reactor-decommissioning process safely and steadily
- Reinforcing technologies and human resources for nuclear security
- Reinforcing collaboration and cooperation with international organizations and foreign nations

nations

(5) Electric power system: Continuous challenges for stable demand-supply, cost reduction, and risk management of electricity

[Missions]

- Stabilizing electric power demand-supply and reducing costs
- Promoting distributed power sources and consumers' self-sustaining demand control
- Intensifying management of nuclear risks
- Realizing desirable forms of electric power businesses for attaining these three missions upward, including separation of power generation and power distribution

[Priority matters in short-term, medium-term, and long-term strategies]

Short-term: Reforming legacy systems, stabilizing demand-supply through implementing new systems ahead of schedule, and avoiding cost hike

- Establishing flexible electricity fee menus and strengthen consumers' incentives for peak cut (introducing new programs by large-lot consumers in initiative and accelerating the installation of smart meters)
- Rearranging electric power wholesale markets and increasing exchanges through the markets
- Establishing a new framework for acceleration of entry to the electric power market by various sources such as private power generation, renewable energies and etc.(rearranging grid operation rules and etc.)
- Avoiding cost hike through promoting competition and reforming procurement practices and etc.
- Starting to reinforce the functions of power transmission/distribution systems (creating smart grids for power distribution purposes, expanding transmission grids, and strengthening interconnected power systems)
- Improving neutrality and fairness of electric power transmission/distribution systems
- Investigating nuclear operations thoroughly (checking the feasibility of private sector operations under national policy and the way of government's involvement)

Medium-term: Diffusion of distributed new energy systems and coexistence/competition with centralized legacy systems

- Increasing supply capabilities through innovation and competition
(A wide variety of service providers and consumers will tap into the electric power market, leading to full competition, including competition between power utilities.)
- Developing demand control by innovation and price mechanism
(Consumers will participate in demand-supply management through the installation of smarter equipment, storage battery technologies, and smaller private power sources and peak-time fee programs will accelerate a shift to an energy-saving structure)
- Completing to reinforce the functions of power transmission/distribution systems
(Creating smarter power distribution networks, completing the enhancement of

- interconnected power transmission lines, and starting to create next-generation grids)
- Accelerating competition in R&D on renewable energies
 - Rearranging the regulations that distinguish between public utility operations (power transmission/distribution services and nuclear energy operations) and competitive operations (power generating operations and retail operations)
 - Exporting new energy systems overseas

Long-term: Realizing distributed new energy systems

- Establishing new electric power systems that are stable, efficient, environment-friendly, and risk-immune, joined by diversified service suppliers and consumers
- Expanding business operations to rapidly-growing countries' markets in the world

(6) Energy and environment industry: Challenges for realizing stronger industry structure and creating job opportunities

[Missions]

- Fostering human resources working for new energy systems
- Creating new industries with an international competitive edge and new job opportunities

[Priority matters in short-term, medium-term, and long-term strategies]

Short-term: Fostering intersectional total energy service industries, which deal with all energies (electricity, gas, and heat)

- Enhancing the competitive edge of energy industries (accelerating innovation and expanding business operations overseas)
- Fostering and enhancing the competitive edge of renewable energies and energy-saving industries
- Conducting reforms toward new energy systems and fostering energy ventures as the next leading companies

Medium-term: Rising of intersectional (electric power, gas, and heat) comprehensive energy industries

- Progress of intersectional or interregional alliances or market entries of new businesses
- Rising of energy industries with international competitive edge
- Rising of energy venture businesses

Long-term: Creating new industries and job opportunities

- Establishing clusters of new industries that will help new energy systems
- Energy industries playing leading roles in overseas strategies and job creation

6. For realizing innovative strategy for energy and environment

(1) The Energy and Environment Council regards this report as a start point of discussions on embodiment of the best- mix of energy sources and the new energy systems. It will develop discussions cooperating with related ministries and institutions and exchanging opinions with stakeholders.

(2) In short, the Council will make this report more specific in the following steps and set down the basic principles of innovative strategy for energy and environment around the year-end.

-As for the best energy mix, based on this report, first, the Council will set up a subordinate working group to identify what should be evaluated, such as generating costs. Taking account into outcomes from this process, the Energy and Environment Council and related organizations, such as the Advisory Committee for Natural Resources and Energy, will work together and have detailed discussions.

- The Council will examine the technologies for renewable energies, energy-saving, clean use of fossil fuels, and reform of electric power systems, called “green innovation strategies”.

- As for electric power systems, the Council and related organizations, such as the Advisory Committee for Natural Resources and Energy, will work together and discuss to develop the ideas.

- As for nuclear power, the Minister for the Restoration from and Prevention of Nuclear Accident will take specific actions based on this report.

(3) Based on the basic policy principles scheduled to be developed at the year-end, the Energy and Environment Council will draft “innovative strategy for energy and environment”, consisting of “the new best mix” (New Basic Energy Plan), “strategies for energy and environment industries”, and “green innovation strategies” at the appropriate time in the next year.

(Exhibit)

“Cost Estimation and Review Committee”

(tentative name)

(Exhibit) “Cost Estimation and Review Committee” (tentative name)

To push ahead with the “formation of national consensus,” one of the basic philosophies in “Innovative Strategy for Energy and Environment,” it is necessary to “examine strategies on the basis of objective data.”

In this process, power generation costs of nuclear or other power source categories as well as the introducible amount of renewable energies are particularly important matters, but the government has not examined these matters in a uniform manner. In this context, the Energy and Environment Council will set up a “Cost Estimation and Review Committee” (tentative name) to yield specific data and incorporate them in drafting the basic principles of Innovative Strategy for Energy and Environment at year-end.

1. Problem consciousness for cost review

(1) The government has been disclosing the following power generation costs for each power source category (Figure 1). However, it is necessary to closely examine the cost data by paying attention to the following debatable points.

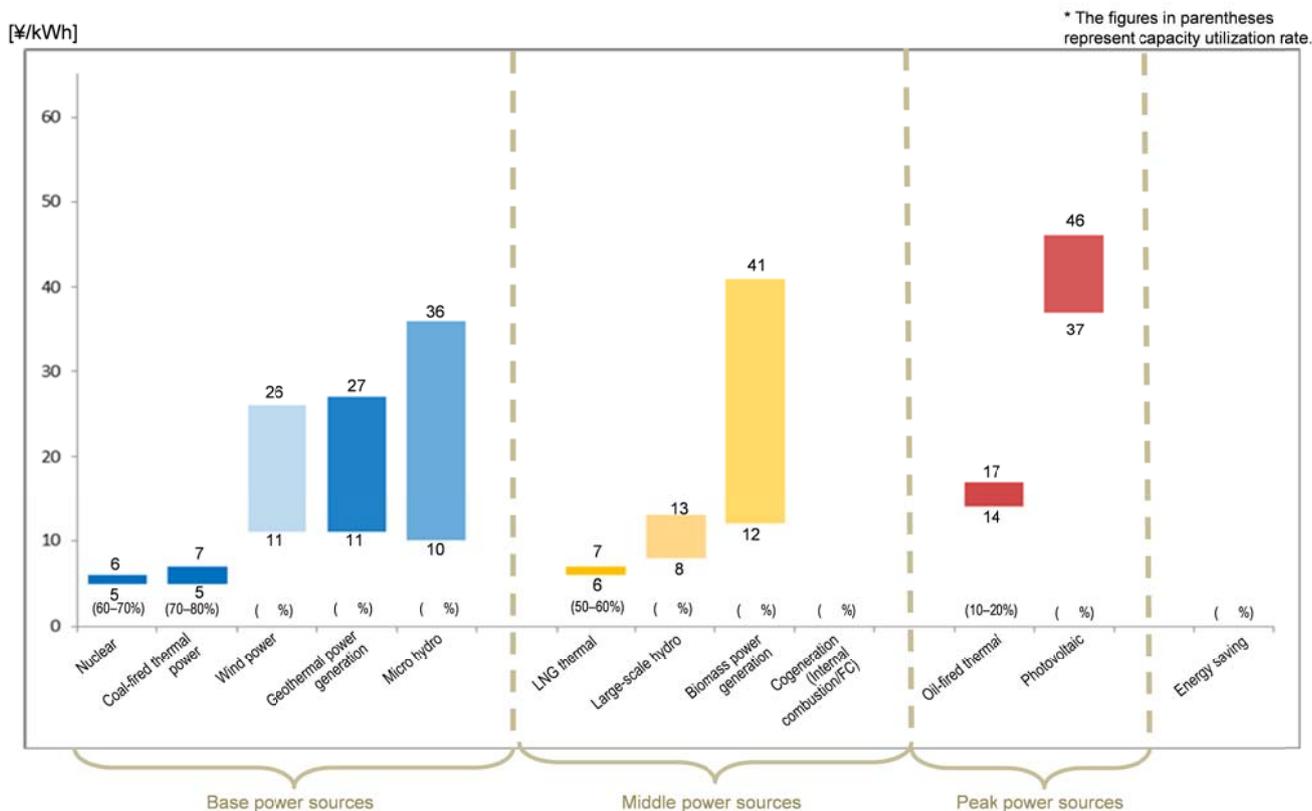
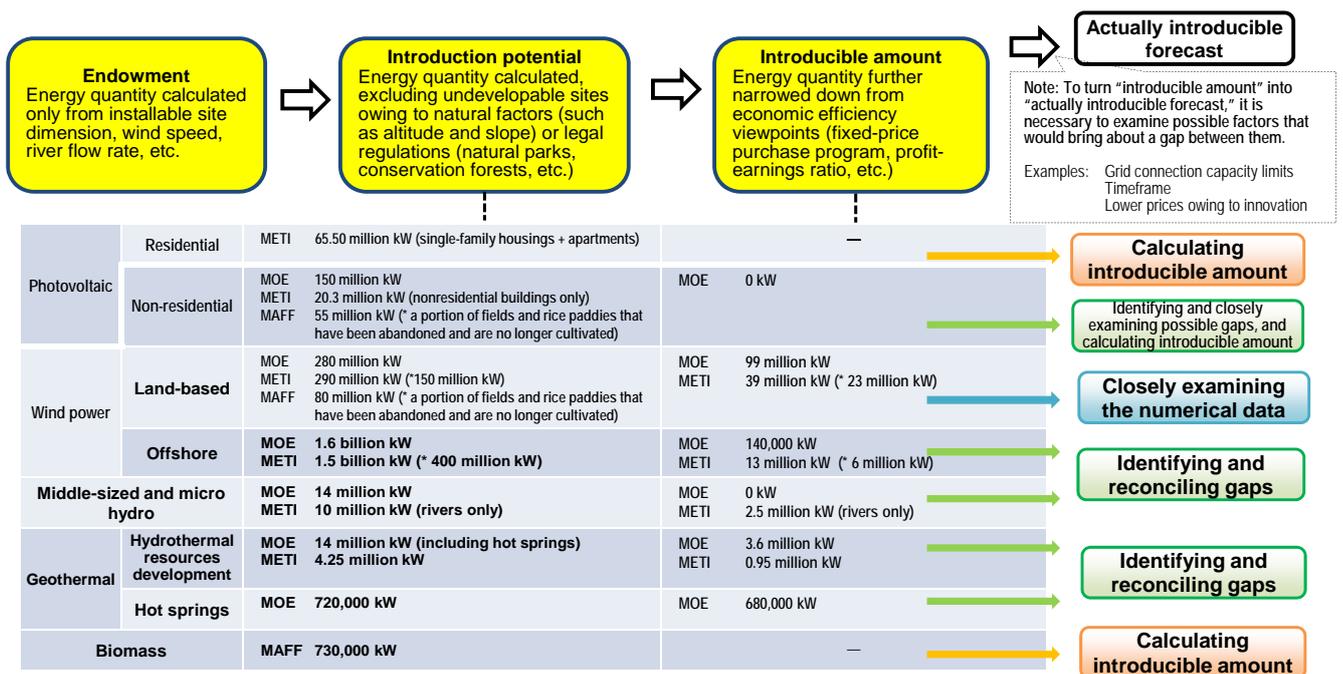


Figure 1: Cost estimate currently disclosed

<Main debatable points>

- 1) Which estimation method is appropriate?
- 2) Are the assumptions set up in an appropriate manner?
- 3) Isn't it necessary to pay attention to policy costs?
- 4) Does each power source category have any important topic that should be considered?
- 5) Is there any other factor that would influence cost estimation?

(2) As each ministry has different perspectives and their own assumptions for estimating the introducible amount of renewable energies, there is a gap in their research outcomes (Figure 2). For this reason, it is necessary to closely examine numerical data from inter-ministerial perspectives.



- Note 1: Since the data in the table above are cited from ministerial surveys with different assumptions, readers should not simply compare the data.
- Note 2: METI is currently preparing for disclosure of survey results on photovoltaic power generation and wind power generation. The land-based data marked with (*) exclude natural park category II, category III special locations, ordinary locations, and national forests. Offshore wind power generation data marked with (*) do not include areas without fisheries rights.
- Note 3: MAFF data marked with (*) represent the calculated data, supposing that, out of the entire fields and rice paddies that have been abandoned and are no longer cultivated, ex-farmland unsuitable for food production will be fully utilized for photovoltaic power generation or wind power generation.
- Note 4: MOE's data on introducible amount only consist of new facility installations, while METI's data also include existing facilities.

Figure 2: Estimates of renewable energies introducible amount, etc. by ministries

⇒ Paying due attention to the aforementioned problem consciousness, the “Cost Estimation and Review Committee” (tentative name) will estimate and verify the data from new perspectives as stated below.

2. Basic principles for review at the “Cost Estimation and Review Committee” (tentative name)

- 1) Ensuring transparency
- 2) Ensuring neutrality
- 3) Discussions based on specific data
- 4) Participation of experts in a wide variety of fields, such as finance, technologies, and systems
- 5) Perspectives of international comparison

3. Considerations for estimation from new perspectives

- (1) Estimation approaches (operating-year power generation approach or securities report-based approach?)
- (2) Assumptions (estimation with wider-range assumptions, such as capacity utilization rate, operating years, or discount rate)
- (3) Policy expenses (new factor)
- (4) Important points requiring special attention (costs of pumped-storage power plants; (for nuclear power generation) advertisement cost, close examination of back-end tasks, accident-related cost, additional safety action cost, higher fuel cost; (for fossil fuels) higher fuel cost; and (for renewable energies) lower prices owing to innovation or volume efficiency)
- (5) Factors on which quantitative evaluation is difficult, but their impacts should be examined
(Economic evaluation of greenhouse effect gases, introducible amount of renewable energies [see 1. (2) above], and economic stimulus effects)

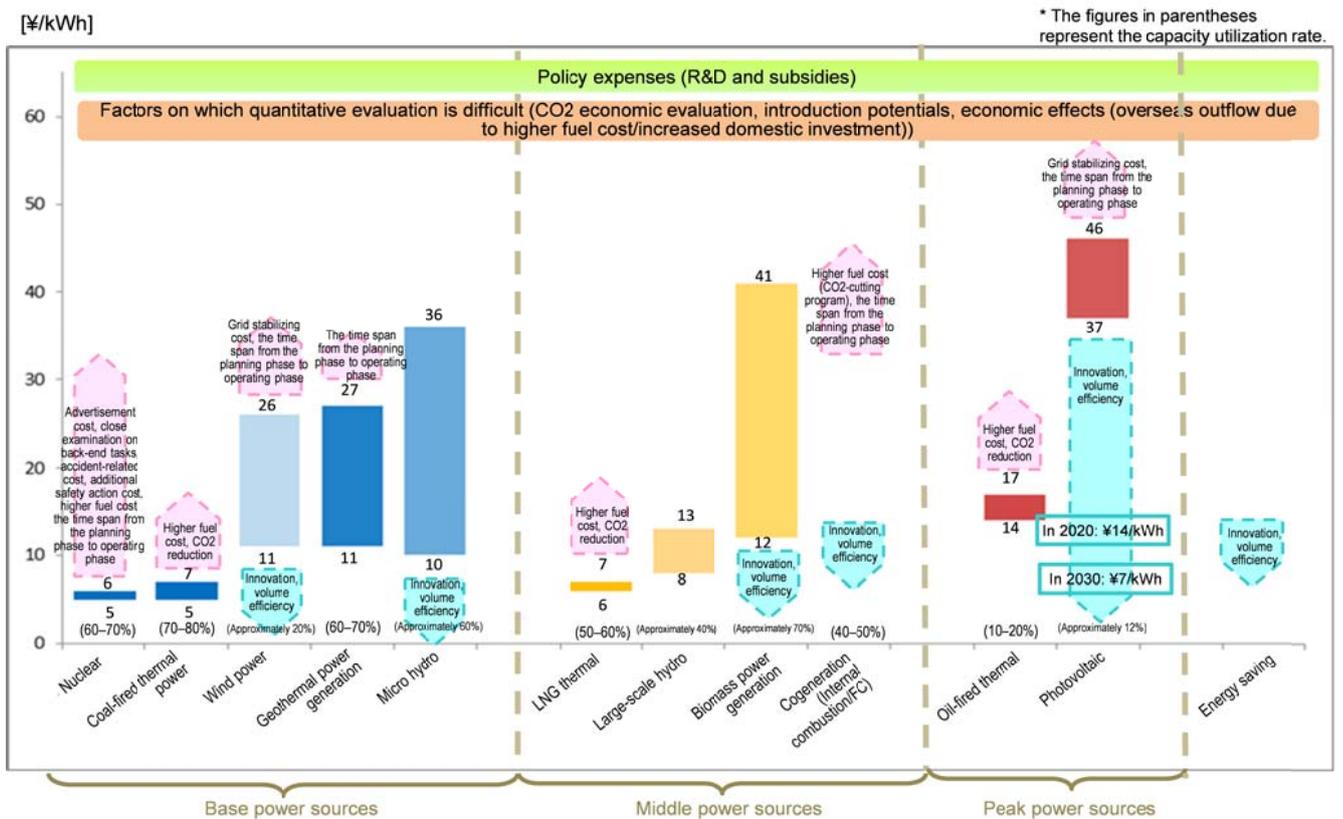


Figure 3: Rough image of impacts of factors requiring considerations

4. Schedule

Around this autumn, the “Cost Estimation and Review Committee” (tentative name) will discuss cost estimation from new perspectives in order to reflect the cost estimates to basic policies of the “Innovative Energy and Environment Council” meeting, which is scheduled to be held at year-end.

Reference materials

1) Japan's energy strategies so far

1) Focusing on volume expansion and stable supply

1950s

Electricity shortage

- 1) Post-war recovery period
 - Priority production
 - Monopoly of nine power utilities for scale economy purposes (in 1951)
 - Electric Power Development Co., Ltd. established to encourage electric power development (in 1952)



1960s

Fuel shift

- 2) High-growth period
 - Shifting from coal to oil (coal industry adjustment started in 1955; liberalization of oil import, in 1962)
 - Starting to develop nuclear energy (the Japan Atomic Power Company established in 1957)



2) Setting the top priority on energy security or environment-friendliness in recent years

1970s

Shifting away from oil

- 3) Oil shocks (in 1973 and 1979)
 - Pushing ahead with nuclear energy (three legislations on power sources in 1974)
 - Pushing ahead with alternative energies (Sunshine Project in 1974, Alternative Energy Act in 1980)
 - Pushing ahead with energy saving (Moonlight Project in 1978, Energy Saving Act in 1979)



1990s

CO2 emission reduction

- 4) Necessity to address global warming (Rio Summit in 1991, Kyoto Protocol in 1997)
 - Shift to nuclear energy
 - Shift to new energies



2000s

Simultaneously addressing stable supply, efficiency, and environment-friendliness

- 5) Focusing on energy security again
 - Energy Policy Basic Act (in 2002)
 - Energy Basic Plan (in 2003), and the first amendment (in 2007)
 - Soaring energy prices (in 2008)
 - The second amendment version of the Energy Basic Plan (in 2010)



In 2011: In addition to stable supply (security), efficiency (cost reduction), and environment-friendliness (global warming solutions), the policy guidelines this time clearly request the government to examine innovative strategies that would meet safety requirements, including risk strategies.

2) International comparison of national energy policies

(Note) The data in 2007. Renewable energies, etc. include waste power generation, heat utilization, etc.

	The United States	France	Germany	South Korea	Japan
Primary energy supply structure	Coal 24% Oil 39% Natural gas 23% Nuclear 9% Renewable energies, etc. 5% (of which, hydro) 1%	Coal 5% Oil 32% Natural gas 15% Nuclear 43% Renewable energies, etc. 5% (of which, hydro) 2% Energy self-sufficiency ratio 51%	Coal 26% Oil 32% Natural gas 23% Nuclear 11% Renewable energies, etc. 8% (of which, hydro) 1%	Coal 25% Oil 43% Natural gas 14% Nuclear 17% Renewable energies, etc. 1% (of which, hydro) 0%	Coal 23% Oil 42% Natural gas 19% Nuclear 10% Renewable energies, etc. 6% (of which, hydro) 3%
	Energy self-sufficiency ratio 71%	Energy self-sufficiency ratio 51%	Energy self-sufficiency ratio 41%	Energy self-sufficiency ratio 19%	Energy self-sufficiency ratio 18%
Breakdown of power generation sources	Coal 49% Oil 2% Natural gas 21% Nuclear 19% Renewable energies, etc. 9% (of which, hydro) 6%	Coal 5% Oil 1% Natural gas 4% Nuclear 78% Renewable energies, etc. 12% (of which, hydro) 10%	Coal 49% Oil 2% Natural gas 12% Nuclear 22% Renewable energies, etc. 15% (of which, hydro) 3%	Coal 40% Oil 6% Natural gas 19% Nuclear 34% Renewable energies, etc. 1% (of which, hydro) 1%	Coal 25% Oil 13% Natural gas 28% Nuclear 26% Renewable energies, etc. 9% (of which, hydro) 8%
All of these nations have common interests in maintaining/improving the energy self-sufficiency ratio					
Current situations	<ul style="list-style-type: none"> The US has abundant natural resources, but it is becoming more dependent on imported oil. 	<ul style="list-style-type: none"> Only poor natural resources are available domestically (dependent on import). Strongly pushing ahead with nuclear power generation to reduce dependence on oil 	<ul style="list-style-type: none"> Germany has abundant coal resources Keeping on using coal from energy security perspectives 	<ul style="list-style-type: none"> Only poor natural resources are available domestically (dependent on import). Pushing ahead with nuclear power generation for natural resources self-sufficiency purposes 	<ul style="list-style-type: none"> Only poor natural resources are available domestically (dependent on import). Diversifying energy sources to natural gas or nuclear energy through the oil substitution promotion policy
Future strategies	<ul style="list-style-type: none"> It is probably planning on "shifting to natural gas" and "pushing ahead with nuclear energy." The government is pushing ahead with two core policies: Reducing heavy dependence on imported oil and guaranteeing US oil firms participation opportunities in international markets. 	<ul style="list-style-type: none"> Fostering national champion firms (EDF, Areva, etc.) to keep a competitive edge at home and abroad 	<ul style="list-style-type: none"> New nuclear power plants prohibited in 2002 Expanding the introduction of renewable energies The cabinet made a decision to aim at the elimination of nuclear power plants in 2022 at latest (June 6) 	<ul style="list-style-type: none"> Focusing on sharply expanding renewable energies and using coal thermal power generation Expanding the supply of natural gas, with state-owned firms playing central roles 	<ul style="list-style-type: none"> Working on fostering four pillars that consist of the traditional two core energies (i.e., nuclear energy and fossil fuels) and emerging two core strategies (renewable energies and energy saving)
Targets after 2020	(Energy-saving target) <ul style="list-style-type: none"> Improving energy efficiency at commercial facilities by 20% from the current level in 2020 at latest 	(Energy-saving target) <ul style="list-style-type: none"> Improving energy efficiency by at least 2.5% a year from 2015 to 2030 	(Energy-saving target) <ul style="list-style-type: none"> Doubling energy productivity from the 1990 level in 2020 at latest 	(Energy-saving target) <ul style="list-style-type: none"> Improving the energy consumption rate per GDP by approximately 26% from 2009 to 2020 	(Energy-saving target) <ul style="list-style-type: none"> Installing smart meters for all consumers in principle as early as possible in the 2020s
	(Clean electric power target) <ul style="list-style-type: none"> Boosting the clean electric power ratio to 80% as a percentage to the entire electric power supply in 2035 at latest by employing the clean use of renewable and nuclear energies as well as fossil fuels (specific breakdown is uncertain) 	(Renewable energy-related target) <ul style="list-style-type: none"> Sending up renewable energies to 23% of final energies in 2020 at latest 	(Renewable energy-based electric power target) <ul style="list-style-type: none"> Sending up renewable energies to 38.6% as a percentage to the entire power generation in 2020 at latest 	(Renewable energy-related target) <ul style="list-style-type: none"> Sending up renewable energies to 6.08% as a percentage to the overall energy supply in 2020 at latest 	(Renewable energy-based electric power target) <ul style="list-style-type: none"> Sending up renewable energy-based power generation to more than 20% as a percentage to overall power generation as early as possible in the 2020s (Prime Minister Kan's speech at the OECD commemorative event)

3)-1 Present Strategic Energy Plan of Japan

Energy mix in 2030, with energy saving incorporated

Installed capacities

[Primary energy supply basis]

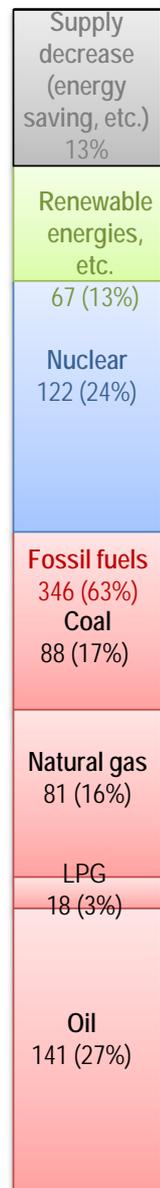
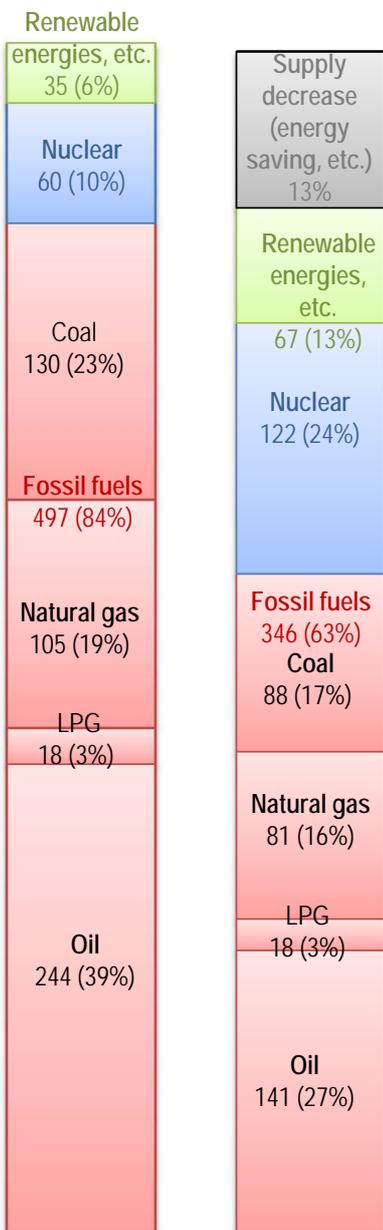
[Power generation volume basis]

[Installed capacity basis]

592 million kl oil equivalent in total
517 million kl oil equivalent in total

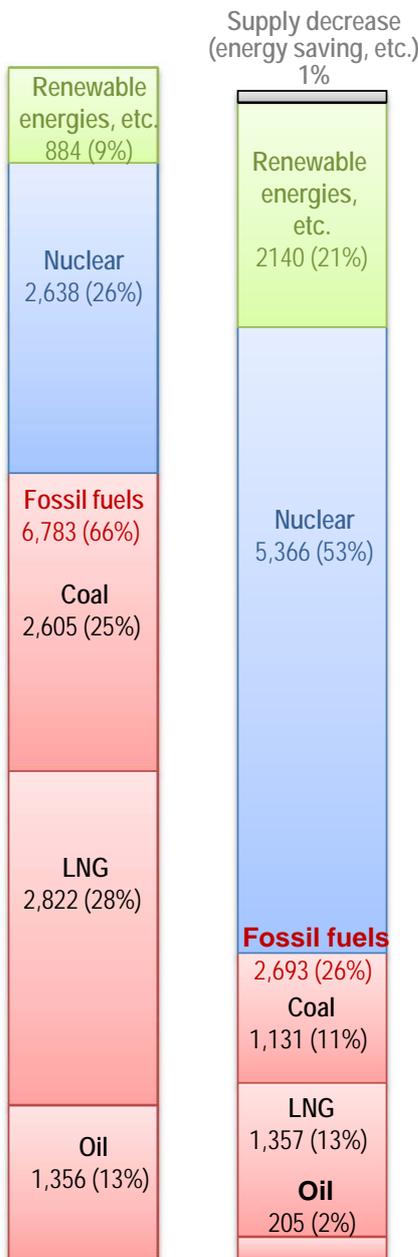
1023.9 billion kWh in total
1020.0 billion kWh in total

241.61 million kW in total
317.98 million kW in total



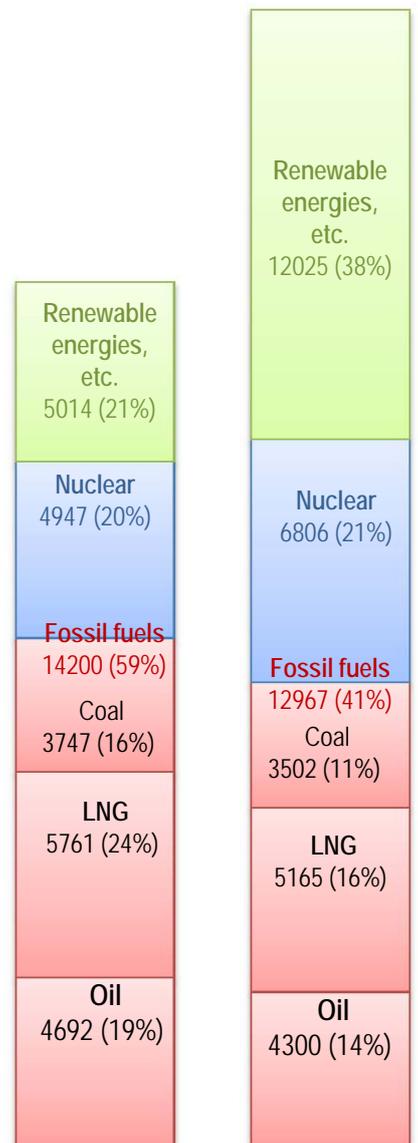
FY 2007 actual data

2030 estimate



FY 2007 actual data

2030 estimate

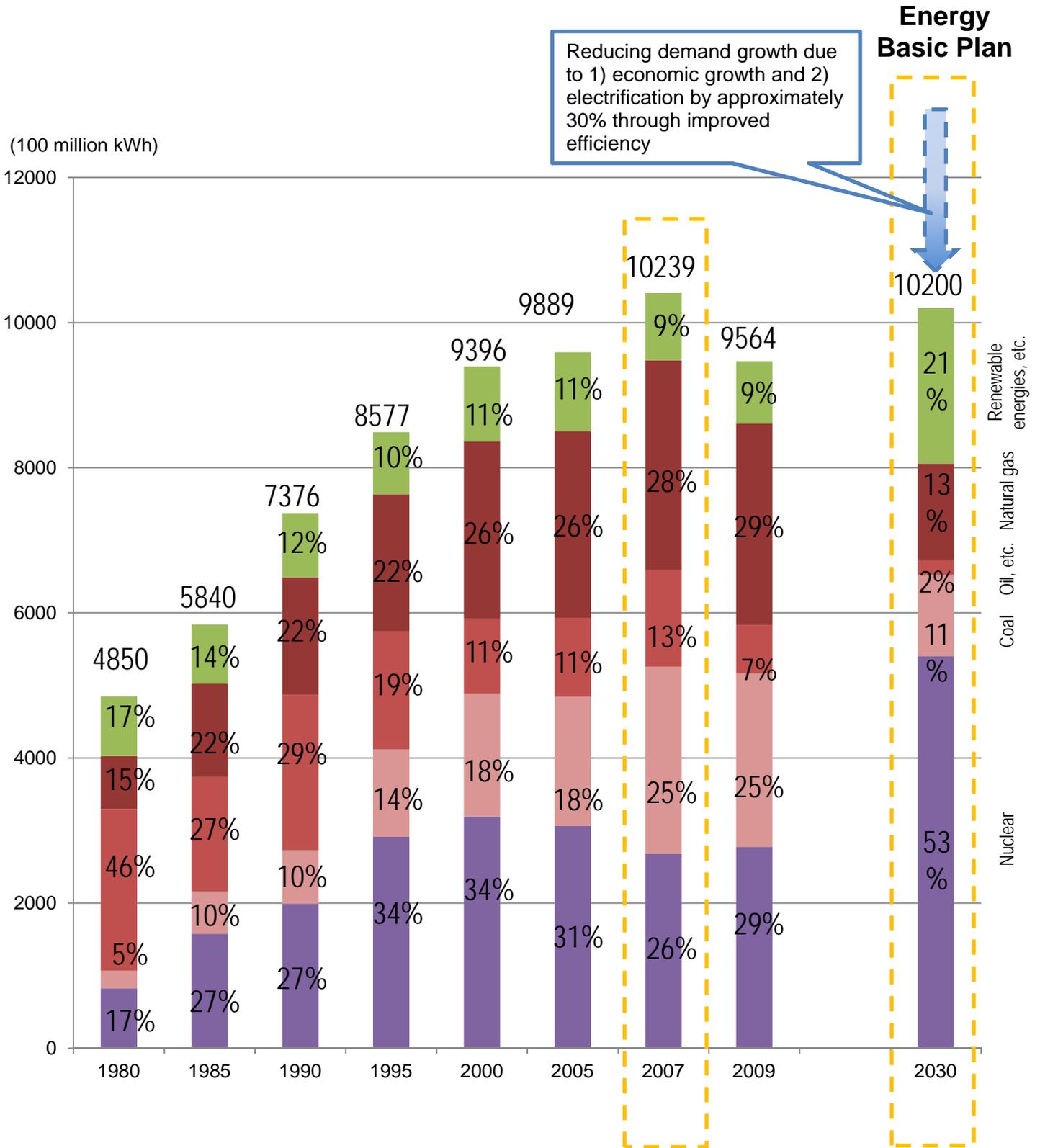


FY 2007 actual data



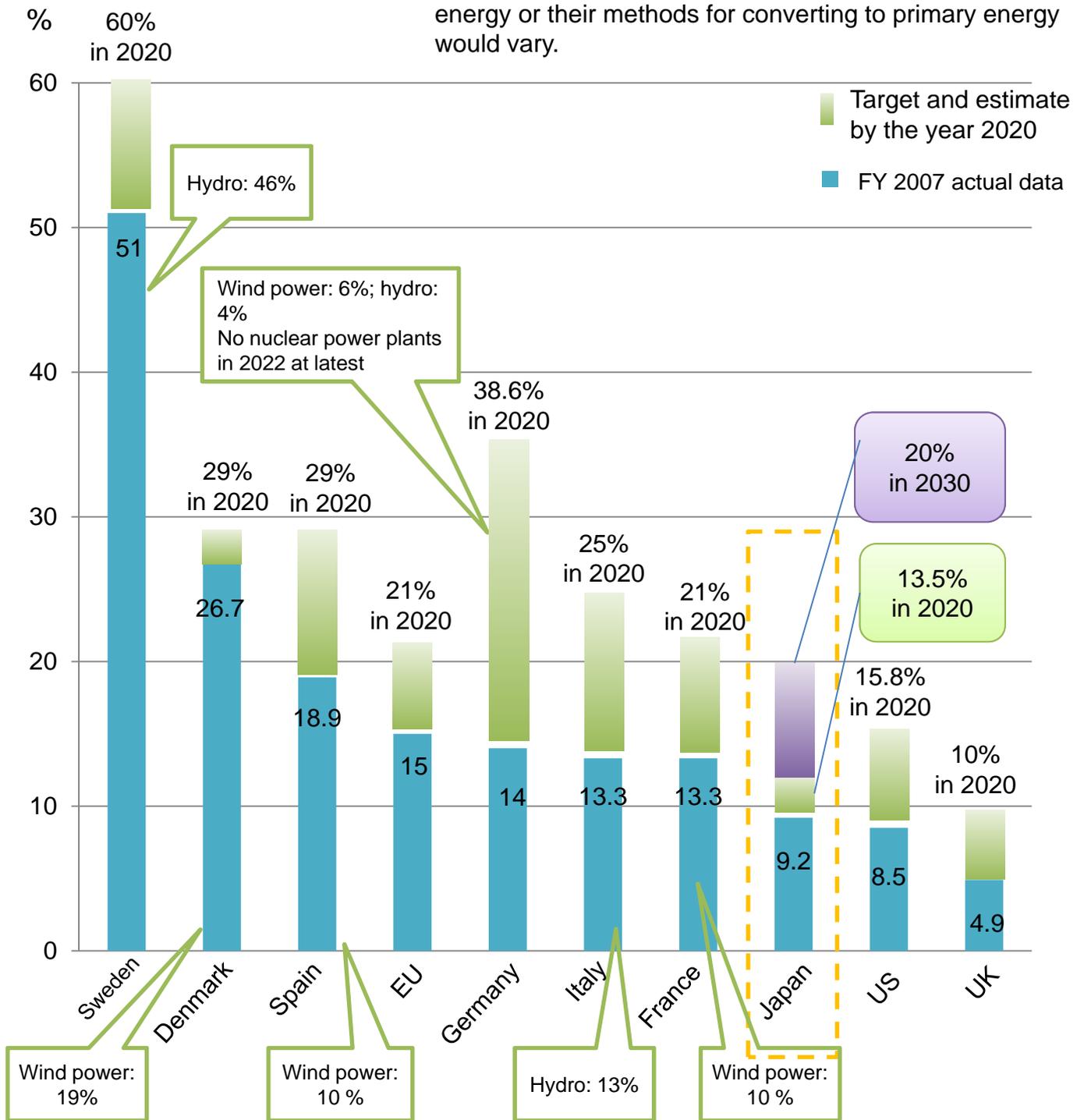
2030 estimate

3)-2 Trend of electric power generated and power source mix



4) Actually installed capacities and target on renewable energy-based power generation

* Readers should not simply compare the data below among nations because their definitions of renewable energy or their methods for converting to primary energy would vary.



Source: The Materials for Energy Supply Working Group, Long/Medium-term Roadmap Study Committee on Global Warming, Ministry of Environment, dated January 13, 2010
http://www.env.go.jp/earth/ondanka/mlt_roadmap/comm/com05-01/mat02_2.pdf

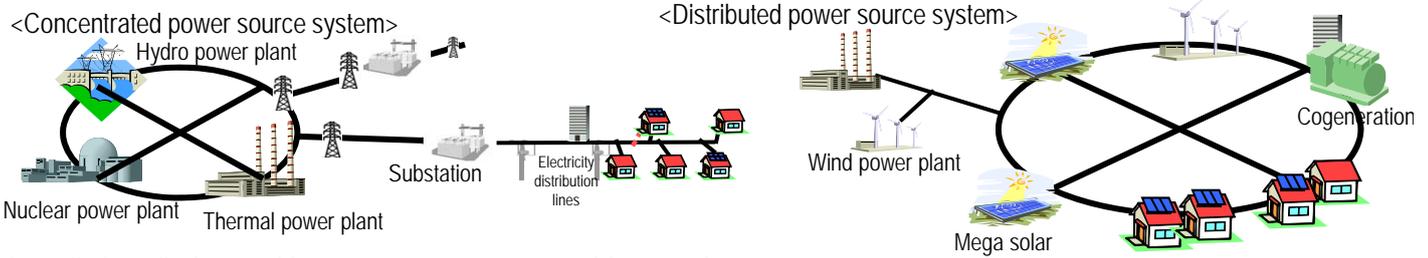
5) Nuclear policies in foreign nations

Note: METI Data

Nation	Number of nuclear power plants	Nuclear energy policies (Statements marked with "●" represent the post-Fukushima accident reactions)
US	104	<ul style="list-style-type: none"> ● The government has set up a task force to evaluate safety regulations on all nuclear power plants in the US. ● On March 30 after the Fukushima nuclear power plant accident, <u>President Obama expressed his view that nuclear power plants are important because they do not emit CO₂.</u>
UK	19	<ul style="list-style-type: none"> ● Energy & Climate Change Minister Huhne gave <u>an instruction to report him about possible impacts of Japan's nuclear power plant accident on existing and new plants in the UK.</u> ● Minister Huhne takes the stance that the UK does not have existing reactors or new plants of the same type as the Fukushima plant and there would be no location possibly affected by tsunami in the UK, but the UK should learn lessons from the Fukushima accident, if any.
France	58	<ul style="list-style-type: none"> ● Prime Minister Fillon instructed the government to examine safety, with focus on loss of power and loss of cooling capabilities, and to disclose the results around the end of this year. ● <u>President Sarkozy stated that nuclear power generation is essential to reduce greenhouse gas.</u>
Germany	17	<ul style="list-style-type: none"> ○ The ruling coalition of the Social Democratic Party and Green Party <u>decided to gradually abolish nuclear power stations in 2022</u> (the amended Atomic Energy Act). ○ In January 2010, the German parliament passed the bill that allows extended operations of existing nuclear power plants. ● <u>After the Fukushima nuclear power plant accident, the German government froze the aforementioned "extended operations of nuclear reactors" for 3 months.</u> ● In addition, <u>Chancellor Merkel, federal ministers and state chancellors agreed to shift away from nuclear power generation as early as possible and make the shift to renewable energies.</u> The cabinet approved the related legislation bills, including the legislation on no nuclear power station and energy shift on June 6, 2011. Federal parliament passed these bills on June 30, and then Bundesrat also approved them on July 8. ● President Kaitel of BDI (Federation of Germany Industries) said that electricity cost will be pushed up because abolishment of nuclear power plants will require additional consumption of coal and natural gas, imposing the necessity to purchase increased CO₂ emission rights on the supply side.
Italy	0	<ul style="list-style-type: none"> ○ In 1987 after the Chernobyl nuclear meltdown, <u>Italy decided to withdraw from nuclear power generation through national referendum.</u> ○ In 2009, lawmakers passed the legislation bill for resuming nuclear power generation. ● After the Fukushima nuclear accident, the cabinet decided to <u>postpone and freeze the resumption of nuclear power generation for one year (i.e., moratorium).</u> ● The cessation court (equivalent to the supreme court) determined that a national referendum should be held in order to approve the indefinite suspension of nuclear power generation. ● Prime Minister Berlusconi expressed his concern, "Without nuclear power generation, electricity bills would be 40% more expensive than in France." ● <u>As a result of the national referendum, Italy decided to scrap the nuclear power generation resumption bill, with 94.15% votes in favor.</u>
Sweden	10	<ul style="list-style-type: none"> ○ Sweden has not closed down or newly set up nuclear reactors, but expressed its intention to replace nuclear reactors in 2009. ● Prime Minister Reinfeldt stated that <u>he would not change the aforementioned stance even if considering the situations in Japan.</u> Environment Minister Carlgren also <u>expressed his view that the 2009 government consensus that approved the replacement of existing nuclear reactors would not change.</u>
Switzerland	5	<ul style="list-style-type: none"> ○ In 2003, <u>Swiss people disapproved the "Anti-nuclear Initiative," which called for the elimination of nuclear power generation, through national referendum.</u> ○ The present Atomic Power Act does not prohibit new nuclear reactor construction projects. ● Doris Leuthard, the Head of the Federal Department of the Environment, Transport, Energy, and Communications, decided to temporarily suspend the review of nuclear reactor replacement applications currently in the review process. ● The government <u>conducted safety inspections on existing nuclear reactors ahead of initial schedule</u> under the initiative of the Federal Atomic Safety Inspectorate. ● The government publicly announced its intention to gradually abolish existing five nuclear power stations and also decided not to newly construct any nuclear power plants.
China	11	<ul style="list-style-type: none"> ● Premier Wen Jiabao gave instructions to temporarily suspend the review of new construction projects, <u>to start up safety inspections on all nuclear power plants in China, and to enhance safety management on nuclear facilities currently operating.</u> ● Hong Lei, Foreign Ministry Vice Spokesman, made his remarks on the Italian national referendum, <u>saying that nuclear power generation is still one of important choices for many countries in order to address energy shortage or global warming.</u>
South Korea	20	<ul style="list-style-type: none"> ● Korea Institute of Nuclear Safety expressed its intention to start inspections on nuclear power plants in South Korea. ● <u>Choi Joong-Kyung, Knowledge Economy Minister, expresses the ministry's policy not to abandon the Atomic Program (boosting nuclear power generation to 59% as percentage to overall power generation in 2030 at latest).</u>

6) Foreign nations' actions to set up distributed power source systems

- Unlike concentrated power source systems consisting of nuclear, large-scale hydro, and thermal power plants located far away from electricity consumption districts, distributed power source systems will use electricity generated from renewable energies, cogeneration, or fuel cells located in electricity consumption districts.



<Actually installed capacities or supports on renewable energies>

(Note) Renewable energy power generation has two types: a distributed type, which generates electricity for local consumption; and a centralized type, which extensively generates electricity and sends it to distant areas.

Nation	Actually installed capacities ¹ (2009) (in 10,000 kW)	Target of installed capacities (2020) (in 10,000 kW)	FIT ³ /RPS ⁴	Subsidies ⁵	Tax breaks ⁵	Priority rules ⁶
Japan	Photovoltaic: 263 Wind power: 206	Photovoltaic: 2,800 Wind power: 500	RPS and FIT (a standard household's cost burden on photovoltaic power generation per month: ¥3-¥21/month in FY 2010) * The government already submitted to the Diet a legislation bill on FIT (fixed-price purchase programs) for other renewable energies.	○ (Residential-use PV)	○	Priority rules are scheduled to be introduced (the government has already submitted to the Diet the legislation bill on the FIT program)
US	Photovoltaic: 164 Wind power: 3,509	Photovoltaic: - Wind power: -	RPS (implemented in 37 states) FIT (California)	○	○	None
UK	Photovoltaic: 3 Wind power: 405	Photovoltaic: 268 Wind power: 2,788	RPS and FIT (started for small-sized facilities in April 2010)	○	○	None
France	Photovoltaic: 43 Wind power: 449	Photovoltaic: 540 Wind power: 2,500	FIT (a standard household's cost burden on photovoltaic power generation per month: Approximately ¥36/month in FY 2009 (estimate))	○	○	None
Germany	Photovoltaic: 985 Wind power: 2,578	Photovoltaic: 5,175 Wind power: 4,575	FIT (a standard household's cost burden on photovoltaic power generation per month: Approximately ¥460/month in FY 2009) ⁷	○	○	Priority access (the grid operator is not required to enhance its grid if priority access is economically irrational) and priority power feeding (output restriction is the least likely)
Denmark	Photovoltaic: 0.5 Wind power: 348	Photovoltaic: 0.6 Wind power: 396	FIT (a standard household's cost burden on photovoltaic power generation per month: Approximately ¥190/month in FY 2010 (estimate))	○	○	Priority access (renewable energies and waste power generation) and priority power feeding (output restriction is the least likely)

*1: Source: IEA implementing agreements

*2: Source: Renewable Energy Promotion Directive

*3: RPS (Renewables Portfolio Standard): A program that requires electric power suppliers to actually use a certain amount of renewable energies

*4: FIT (Feed-in tariff: fixed price purchase program): A program in which electric power suppliers will purchase renewable energies for a certain time span at the fixed price

*5: Source: Renewables 2010 Global Status Report, REN21

*6: In accordance with the EU Renewable Energy Use Promotion Directive, EU member nations are required to introduce "priority access," which provides renewables with certain preferential treatment in grid connection, and "priority power feeding," which provides renewable energy suppliers with preferential power feeding (however, priority access is not mandatory).

*7: Some analysts estimate that the cost burden would stand at ¥700/month in FY 2010 and ¥1,200/month in FY 2011.

<Actually installed capacities or supports on cogeneration>

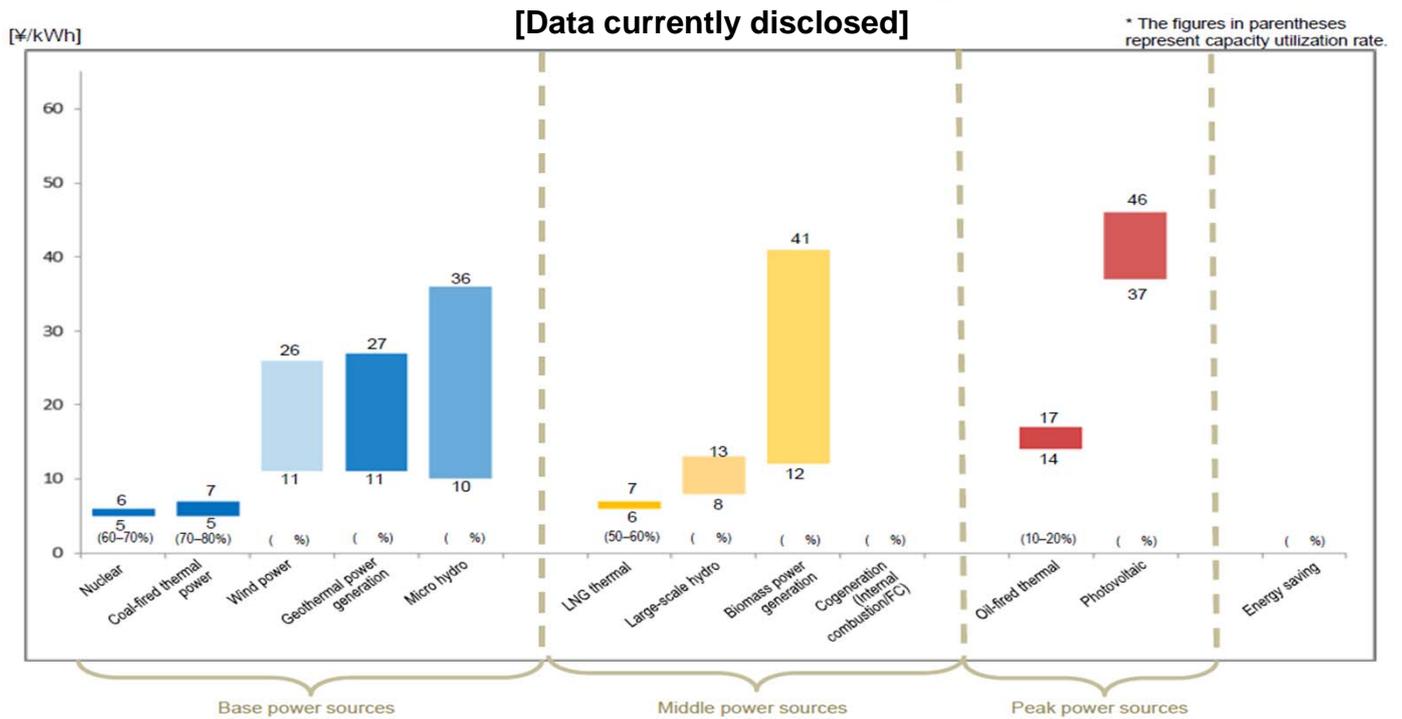
Nation	Cogeneration ratio (2008)	Target of actually installed capacities	Subsidies	Purchase program	Tax breaks	Remarks
Japan	3.5%	Getting doubled in 2030 at latest	○	×	△ (Investment-promoting taxation)	-
US	7.3%	Getting doubled in 2010 at latest	○ (Depends on state)	○ (FIT + net metering: Depends on state)	△ (Investment-promoting taxation)	- Evaluating CO2 emission-cutting effects on the basis of the marginal emission coefficient
UK	6.4%	Getting doubled in 2010 at latest	○	○ (FIT)	○ (Enterprise tax and climate change tax exempted)	- Instructing municipalities to examine the feasibility of incorporating cogeneration in their city planning - Evaluating CO2 emission-cutting effects on the basis of the marginal emission coefficient
France	3.1%	-	×	○ (FIT)	○ (Energy tax and enterprise tax exempted)	-
Germany	12.5%	Increasing by 25% in 2020 at latest	○	○ (Market price + premium)	○ (Energy tax exempted)	- Lawmakers passed the Cogeneration Act in 2000. - The government has required the installation of cogeneration at newly-constructed buildings
Denmark	46.1%	-	○	○ (FIT)	○ (Energy tax exempted)	- The government continues long-term supportive measures to diffuse cogeneration since the 1980s, taking an opportunity afforded by oil shocks. - Applicable law requires local governments to examine the feasibility of district heat utilization programs.

* "Cogeneration ratio" means cogeneration as a percentage to the overall generated electric output.

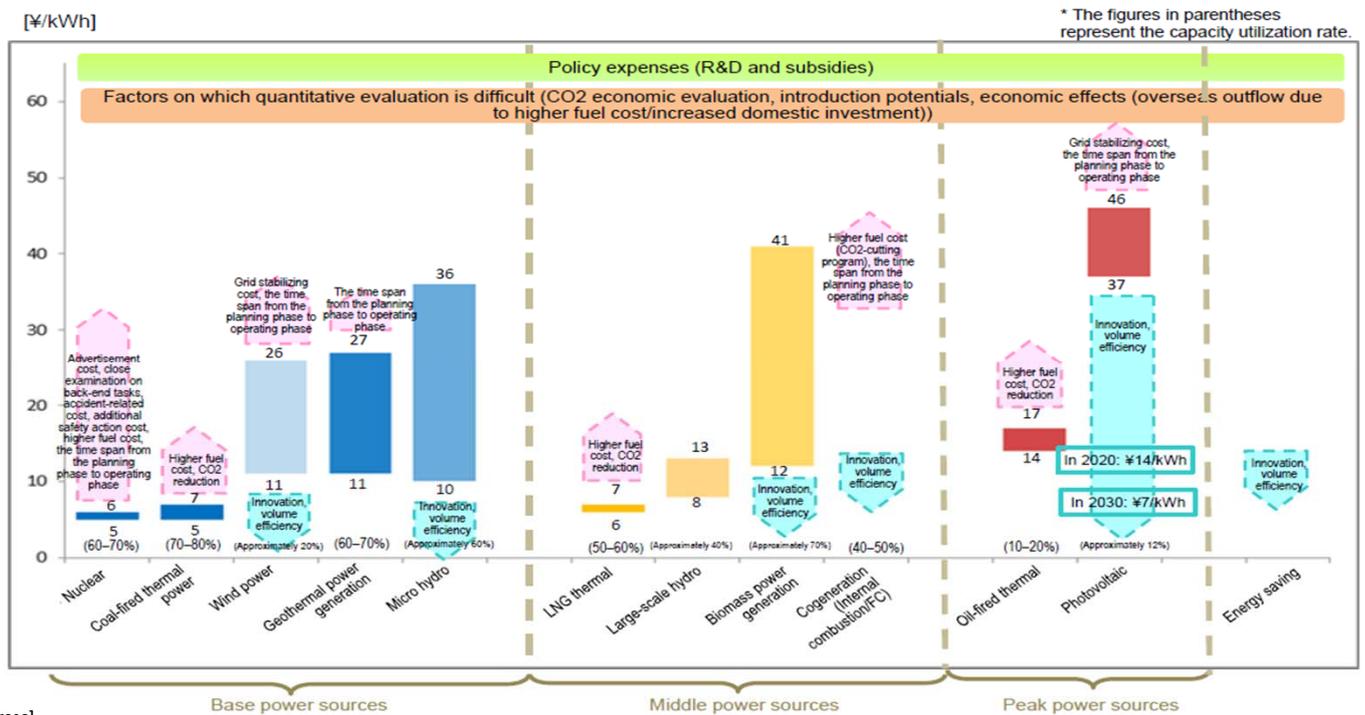
* In the EU, member nations have been pushing ahead with introducing cogeneration in accordance with the 2004 Cogeneration Directive (legislation).

Source: Report of Working Group on Fuel Shift and Advanced Use of Natural Gas (METI)

7) Comparison of estimated power generation costs



[Cost comparison incorporating important factors for cost estimation]



[Sources]

- Large-scale hydro power generation, oil-fired thermal power generation, LNG-fired thermal power generation, coal-fired thermal power generation, and nuclear power generation: Data on unit prices and the capacity utilization rate come from the Cost Review Committee, Electricity Industry Sectional Committee, and Advisory Committee for Natural Resources and Energy (January 2004).
 - Geothermal: Data on unit prices come from the Study Group on Geothermal Power Generation (June 2009).
 - Wind power: The authors calculated unit prices on the basis of certain assumptions and actual data in "Subsidies for Accelerating Introduction of New Energies (FY 2009)."
 - Micro hydro: The authors calculated unit prices on the basis of certain assumptions and actual data in "Subsidies for Accelerating Introduction of New Energies (FY 2009)."
 - Biomass: The authors calculated unit prices from the NEDO Biomass Energy Introduction Support Database. Data on the capacity utilization rate come from the unit price estimation assumptions available from the Agency for Natural Resources and Energy.
 - Photovoltaic: The authors calculated unit prices on the basis of certain assumptions and actual data in "Subsidies for Supporting Installation of Residential-use Photovoltaic Power Generation (FY 2009)."
- Unit prices in 2020 and 2030 are calculated from the NEDO "Photovoltaic Power Generation Roadmap (PV2030+)" dated June 2009.
- (These data draw on "Present Situations and Problems surrounding Power Generation Costs," a document material (prepared by the Electricity and Gas Department, Agency for Natural Resources and Energy) for the 1st meeting of the Power Generation Cost Estimation Working Group, Electricity Industry Sectional Committee, Advisory Committee for Natural Resources and Energy, dated March 10, 2011).