

A Proposal of a Renewable Energy Promotion Policy for Achieving a Low-carbon Society

February 10, 2009

Conference on Renewable Energy Promotion Policy
for Achieving a Low-carbon Society

1. Significance of the promotion of renewable energy

The promotion of renewable energy contributes to global climate change measures.
Japan's current targets are the lowest level.

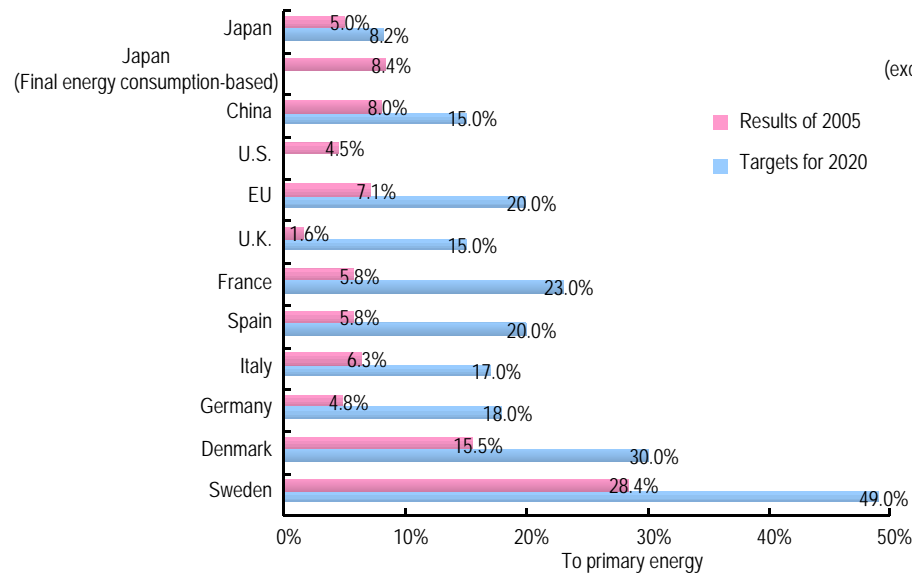
○ Significance of the promotion of renewable energy

- Contributing to building a low-carbon Society in Japan
- Contributing to the promotion of low-carbon power systems of the world including developing countries
- Ensuring energy security
- Creating employment, expanding domestic demand, and improving international competitiveness of industries
- Providing good-quality social capital to be succeeded to the next generations

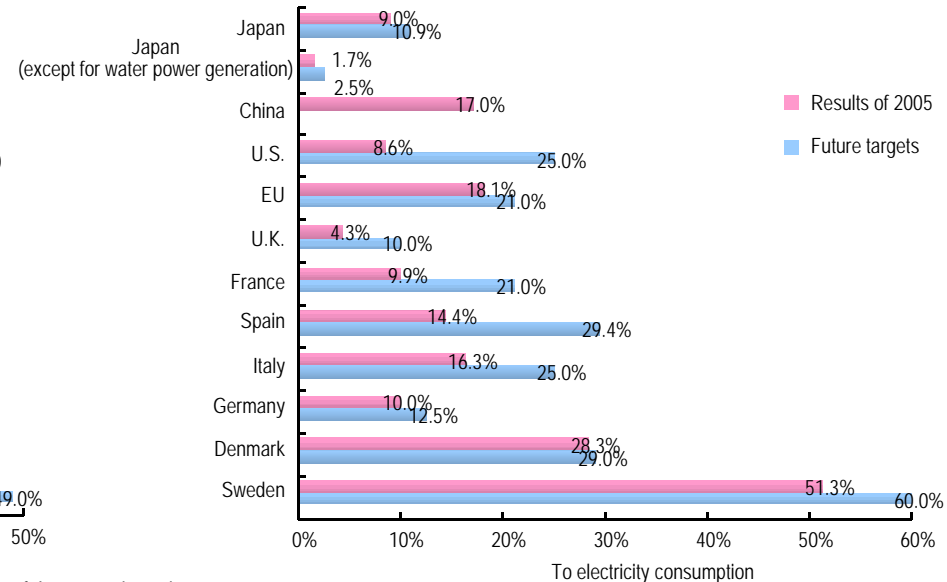
○ Japan lagging behind major countries in the world and its goals

- Renewable energy output in Japan has remained at low levels since 1990 (2005: about 5% of annual primary energy supply (about 2% if large-scale water power is excluded); about 9% of annual electricity output (2% in the condition above))
- Compared to western countries which achieve high performance of production and set ambitious goals, Japan's targets are **the lowest level in the world**.

The proportion of renewable energy to total primary energy supply (results and targets)



The proportion of renewable energy-based electricity to total electricity of all power sources (results and targets)



- The values of the year 2005 are based on the prime energy supply given by IEA. (The values of Japan are based on the Long-term Prospect of Supply and Demand of Energy, and an urgent proposal by the New and Renewable Energy Subcommittee, etc. The value of China is based on the year 2006.)
- The targets for the year 2020 of EU nations are based on final energy consumption. The values of Japan are based on the supply of primary energy in the maximum case of the Long-term Prospect of Supply and Demand of Energy. The value of China is based on the primary energy supply given by IEA.

- *1) The values of the year 2005 are based on electricity output given by IEA. The total electricity output includes home-generated and -consumed energy. (The values of Japan are based on the Long-term Prospect of Supply and Demand of Energy. The value of China is based on the year 2006)
- *2) Future target years of EU nations, Japan and China, and the U.S. (President Obama's pledge) are 2010, 2020, and 2025, respectively.

High production targets should be set up for the promotion of renewable energy.

- Estimating technologically and economically feasible output, production targets of **double** output in 2020 can be set up. (About 10 to 11% (about 6-7% excluding large-scale water power) of annual primary supply and about 16-18% (9-10%) of annual electricity output)

2. Promotion policies of renewable energy

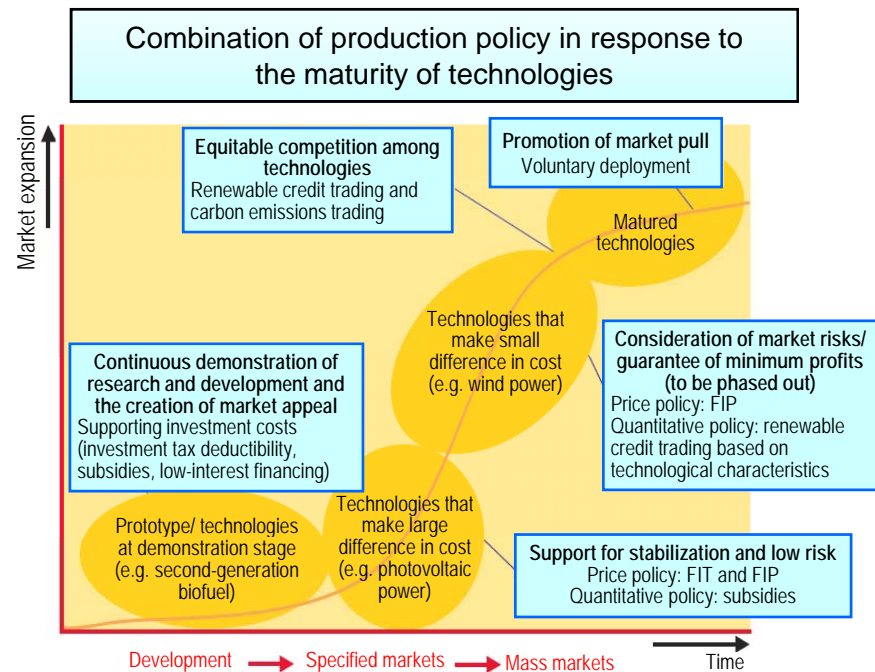
Appropriate production support policies are needed to achieve goals.

O Policies for renewable energy-based electricity

- We need to combine appropriate support policies, such as a subsidy program, the RPS, feed-in tariffs, depending on technological levels and market phases.
(For example, Italy has adopted an FIT program for photovoltaic power generation, in addition to the RPS.)
- The target level of the current RPS is low (1.6% by 2014). We need to raise the target level.
- Detailed analysis made by the EC Commission and the IEA based on actual cases of renewable power production in a number of countries shows that the FIT is highly effective in introducing technologies.

O Policies for renewable energy heat and fuel

- As a heat policy, the utilization of solar heat to cover hot-water supply and heating in housing and buildings is obliged, and as a fuel policy, the use of E10 (10% ethanol and 90% gasoline) is promoted.

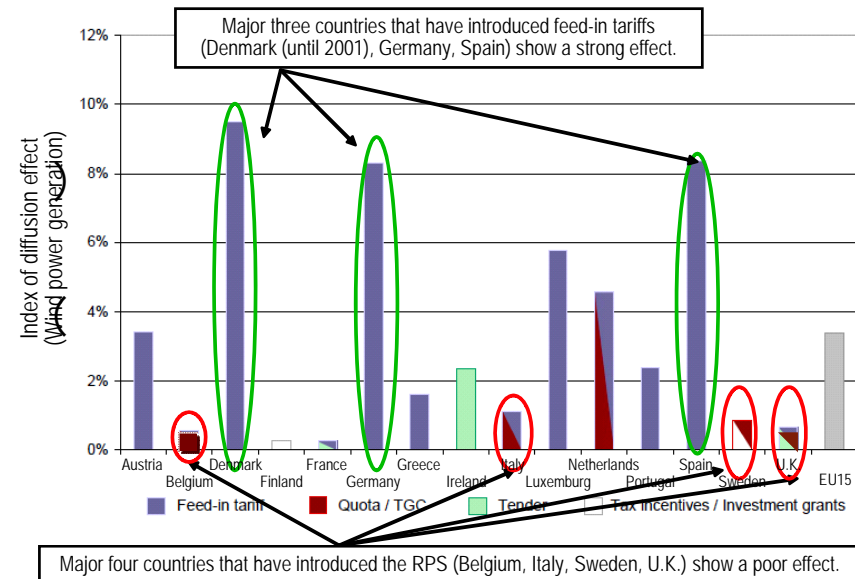


Source) IEA "Deploying Renewable." 2008

* FIT (Feed-in Tariff) : Electricity buyback at fixed prices

* FIP (Feed-in Premium) : Buyback at electricity charges at market prices with fixed premiums (bonuses) added

Positive research on EU nations concerning renewable electricity promotion policies



(Note) Quota: Fixed quantity system (RPS mechanism)

TGC: Tradable Green Certificates

Tender: Tendering system

Source) EC, "The support of electricity from renewable energy sources," December, 2005.

3. Significance of the promotion of photovoltaic power generation and cost targets

Photovoltaic energy is important renewable energy in Japan.

○ Photovoltaic power generation

Photovoltaic energy is important renewable energy in Japan for the following reasons: (a) Japan has technological advantages and maintains its international competitiveness in this area; (b) power generation costs may be reduced thanks to economies of scale; (c) photovoltaic power generation can be accepted widely because solar sources are available all over the world, and power production is available in business and household sectors. In addition, photovoltaic energy may be used in storage batteries for plug-in hybrid and electric vehicles, in which Japan has technological advantages.

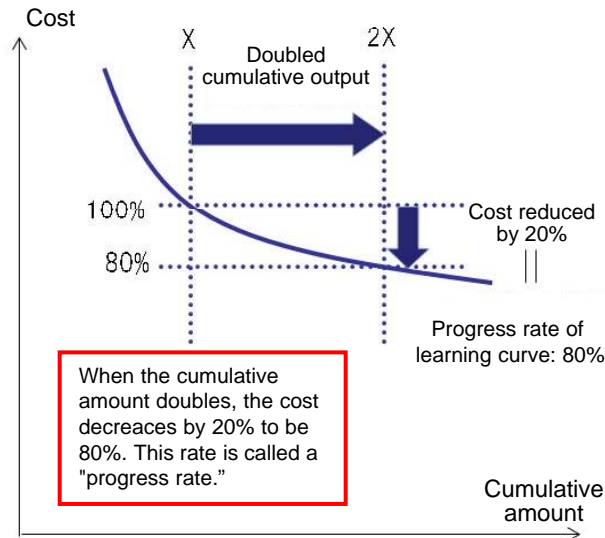
○ Target for photovoltaic electricity production and policies

- Target for the cost of photovoltaic power generation reduced to the level of retail electricity prices → 2020:14 yen/kWh, 2030: 7 yen/kWh
- Production target for photovoltaic power to achieve the cost target
→ 2020: 37 million kW (**25 times** the present level), 2030: 79 million kW (**55 times** the present level)
- The target will be achieved by the public sector's initiative in installing solar systems, a policy to recover investments in 10 years, and technological development.
- In particular, the FIT is a crucial policy to recover investments in 10 years.
- Japanese businesses' share in the global market will be **more than 30%** in 2020.

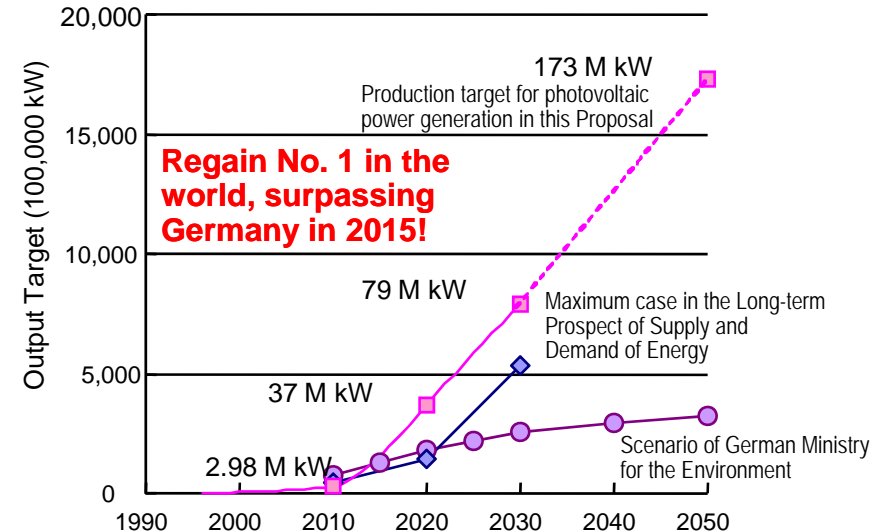
Learning curve

The facility costs of photovoltaic power generation are said to decline to 77% to 83% as cumulative output doubles on the "learning curve". This rate is called a "progress rate." The photovoltaic power production target is estimated at 80%, and construction costs are assumed to decline at the same progress rate.

(Reference) Progress rate of photovoltaic power generation facility costs in reports	
IPCC Fourth Assessment Report (2007)	77%
EPIA (European Photovoltaic Industry Association) "EPIA ROADMAP" (2004)	80%
IEA "Energy Technology Perspectives 2008"(2008)	83%



Comparison among output targets



	2020	2030
Production target for photovoltaic power generation in this Proposal	37 M kW	79 M kW
Maximum case in the Long-term Prospect of Supply and Demand of Energy	14 M kW	53 M kW
Scenario of German Ministry for the Environment (reduced by 80% by 2050)	18 M kW	25 M kW

4. Policies for achieving photovoltaic power production targets

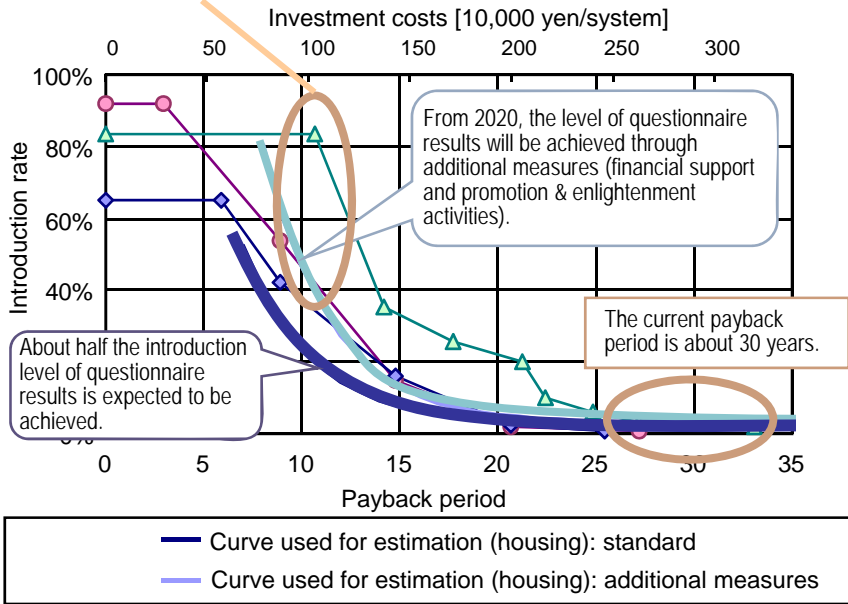
The target will be achieved by combining five measures appropriately.

- The 2030 production target (79 million kW) will be achieved by combining the following measures appropriately: (i) **the public sector's initiative in introducing photovoltaic electricity**, (ii) **FIT to recover investments in 10 years**, (iii) **dissemination of innovative technologies through encouragement of technological development**, (iv) **financial support (including interest subsidies and low-interest loans)**, and (v) **educational activities on photovoltaic power generation and its economic benefits**.
- If the public sector takes the initiative in introducing photovoltaic electricity and a support policy for the demand side to recover investments in 10 years, the photovoltaic electricity penetration rate is projected to be **14%** for new single houses and **14%** (about 4.2 million units) for all single houses in 2020 (from about 0.32 million units in 2005 to **about 4.2 million units in 2020 (one out of seven)**, and to **about 9.1 million units (one out of three)**), because the penetration will spread to existing housing.

Relationship between payback period and penetration rate (housing)

In various questionnaires, there is a significant increase in the number of people who want to introduce photovoltaic power generation if the investment cost is one million yen (the payback period is 10 years). The 10 years is a manufacturer's warranty period.

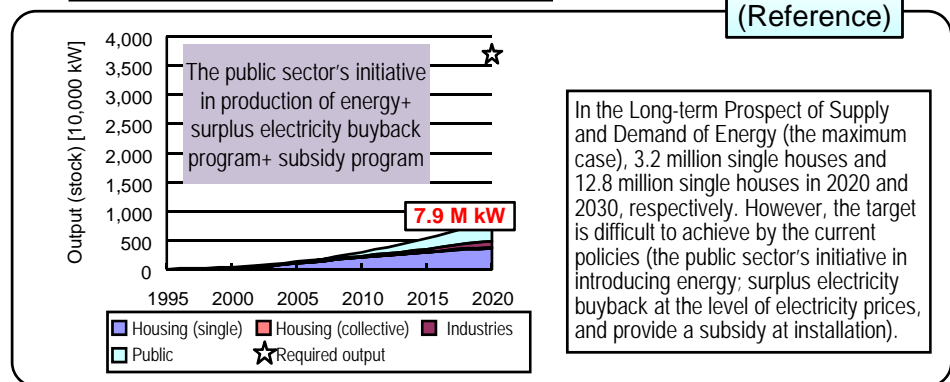
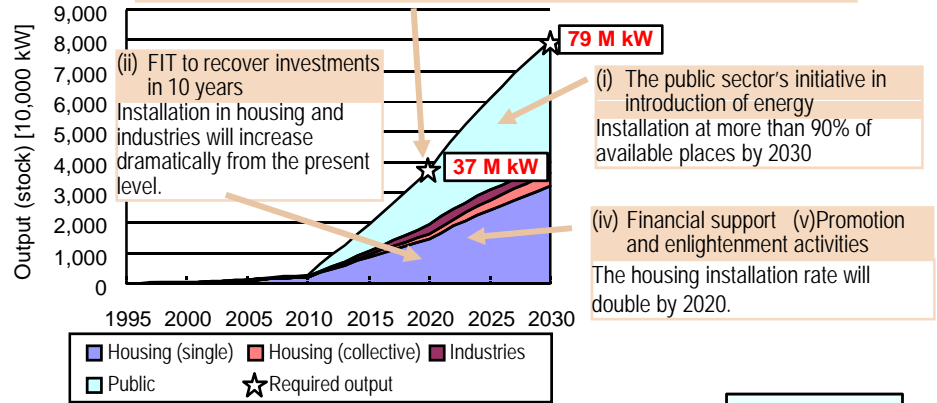
Measures should be taken to shorten the payback period by supporting burden reduction and lead the people's strong awareness of photovoltaic power generation to actual production.



* If the payback period is 10 years, the production rate of housing photovoltaic power generation is about 24% in the graph above. However, only about 60% of houses meet sun illumination conditions. Therefore, feasible output is expected to be about 14%, considering the 60%.

Estimated output through the public sector's initiative in production of energy + support policy for the demand side to recover investments in 10 years

(iii) Promotion of innovative technologies by accelerating development efforts
The progress rate of the learning curve, which is 80% until 2020, will be around 75% through the promotion of innovative technologies by continuous technological development.



In the Long-term Prospect of Supply and Demand of Energy (the maximum case), 3.2 million single houses and 12.8 million single houses in 2020 and 2030, respectively. However, the target is difficult to achieve by the current policies (the public sector's initiative in introducing energy; surplus electricity buyback at the level of electricity prices, and provide a subsidy at installation).

5. Costs and effects of renewable energy production

Overcoming barriers and enjoying merits

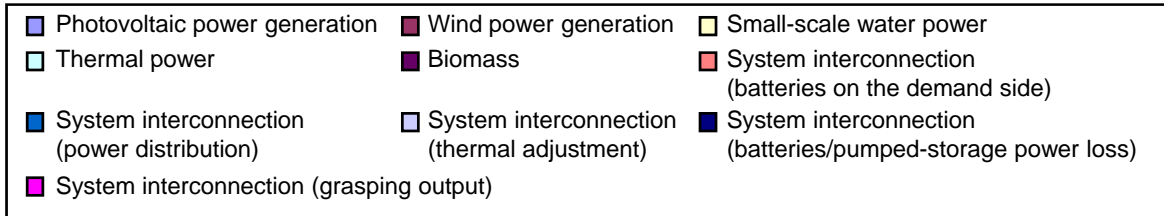
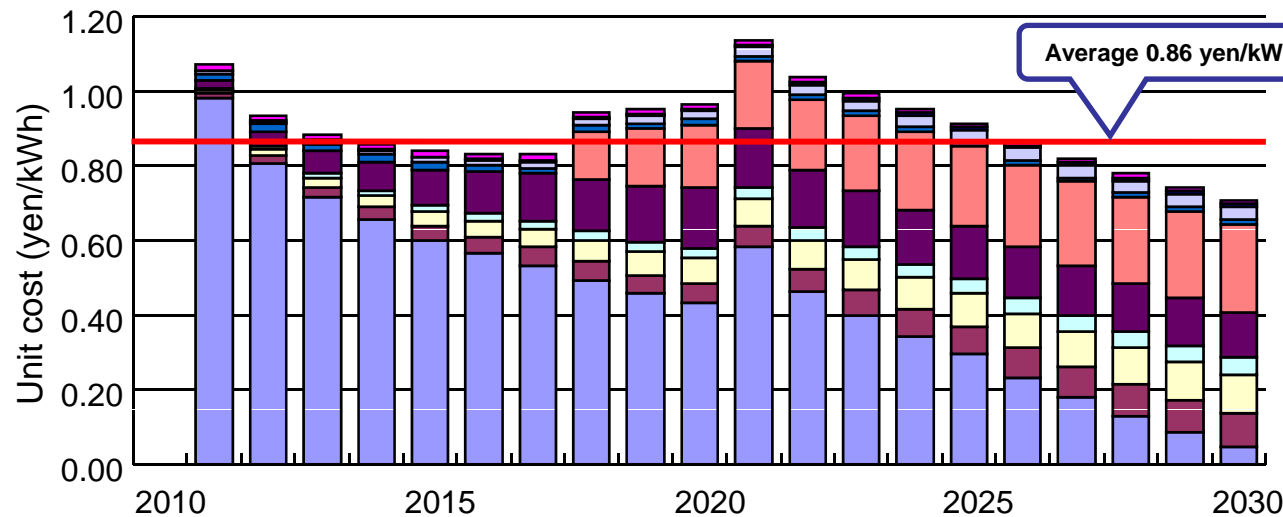
○ Barriers (increases in voltage, frequency fluctuations, loss of supply-and-demand balance, and introduction costs) may be overcome.

- Using IT and the systems (smart grids) to adjust electricity supply and demand by controlling power lines, which consists of large-scale power sources, dispersed power sources, and storage batteries enables promotion without depending excessively on introducing storage batteries.
- The costs should be allocated widely and evenly to people by way of taxes and electricity charges.
- If the costs are shouldered by electricity charges, standard households will bear about 260 yen per month on average. (No extra charges for the minimum required consumption for daily life (the first stage: about 120 kWh/month) should be added, and reduced taxes should be considered for electricity-intensive industries.)
- The costs for increased production are 25 trillion yen by 2030.

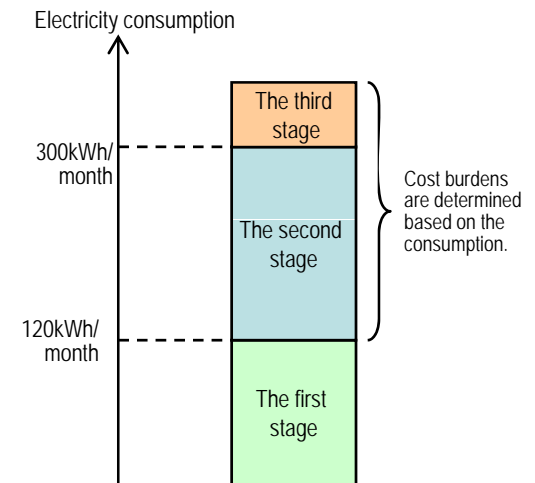
○ Enjoying considerable merits

- Economic effects by 2020: **over 29-30 trillion yen**
by 2030: **over 58-64 trillion yen**
- **CO2 reduction of about 50 Mt** in 2020 (about **4%** from the base year)
CO2 reduction of about 100 Mt in 2030 (about **8%** from the base year)
- Effect on employment creation in 2020: **about 600,000 people**
In 2030: **about 700,000 people**

Costs shouldered by the society for renewable energy production



Three-stage rating system



Three-stage rating system is a system that sets different unit prices according to electricity consumption, adopted in June 1974, for the purpose of promoting energy consumption. The first stage makes relatively small charges, based on the idea of a national minimum (the minimum living standard that the nation should guarantee).