

## Study of Basic Zoning Information Concerning Renewable Energies (FY2011)

The introduction of renewable energies is important not only as a countermeasure for global warming but also from such viewpoints as establishing energy security, developing an autonomous and scattered energy system and creating new industries and jobs. For this reason, the Ministry of the Environment (MoE) conducted the Study on the Potential for the Introduction of Renewable Energies (hereinafter referred to as the “Potential Study”) in FY 2009 and FY 2010 to estimate the abundance as well as introduction potential of various types of renewable energies (non-residential use of PV power, wind power, small and medium-scale hydropower and geothermal power) and their possible introduction amount by different scenarios with a view to developing basic data for the examination of viable measures to introduce and spread the use of renewable energies in the coming years.

The present work involved the refinement of the findings of the Potential Study in the preceding two years, re-estimation of the data and renewal of the potential maps. It also consolidated and made available basic zoning information concerning renewable energies based on the outcomes of the Potential Study and other relevant information. Furthermore, the potential to use PV power was estimated focusing on individual buildings, etc.

1. Examination to Improve the Estimation Accuracy of the Possible Introduction Amount by Scenario
  - (1) Examination to Improve the Estimation Accuracy Concerning PV Power Generation for Non-Residential Use

Sensitivity analysis based on the current cost level as well as various levels of the assumed FIT (Feed-in Tariff) purchase price was conducted after considering demobilization cost, using the results of the Potential Study conducted in FY 2010 for the purpose of reviewing the scenarios and re-estimating the possible introduction amount by scenario. The results of this analysis indicate that when the solar cell system cost is ¥350,000/kW, the possible introduction amount is 26 million kW based on a FIT purchase price of ¥38/kWh or 44 million kW based on a FIT purchase price of ¥44/kWh

for areas other than abandoned farmland. In the case of abandoned farmland, while the commercial viability of development is lower because of the rent and transmission line construction cost, the possible introduction amount is still approximately 36 million kW based on a FIT purchase price of some ¥44/kWh. The estimation results are summarised in Fig. 1.

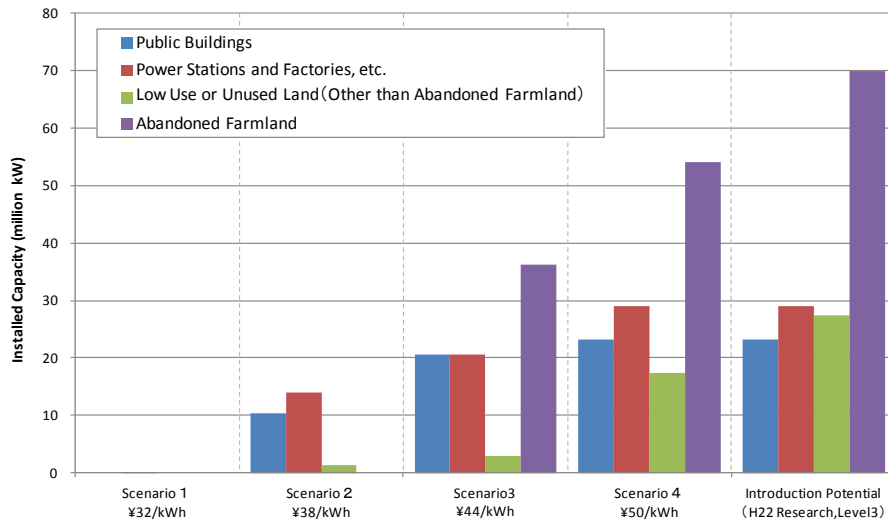


Fig. 1 Potential Introduction Amount by Scenario for PV Power Generation for Non-Residential Use

(2) Examination to Improve the Estimation Accuracy Concerning Wind Power Generation

In regard to the FY 2010 Potential Study results, the width of the access road was revised (from 3.0 m to 5.5 m) for onshore wind power generation and the exclusion of islands where no system connection is possible and other revisions were made for offshore wind power generation after considering demobilization cost. As a result, the possible introduction amount for onshore wind power generation is found to be approximately 18 million kW based on a FIT purchase price of ¥15/kWh for a period of 15 years and approximately 133 million kW based on a FIT purchase price of ¥20/kWh for a period of 20 years. In the case of offshore wind power generation (bedded type), hardly any possible introduction amount can be expected when the FIT purchase price is ¥20/kWh. However, when the FIT purchase price is increased to ¥25/kWh, there is a possible introduction amount of approximately 19 million kW for a period of 15 years and 62 million kW for a period of 20 years. For floating type offshore wind power generation, introduction becomes possible at a FIT purchase price of around ¥22.5/kWh. At a FIT purchase price of ¥30/kWh, the possible introduction amount is as large as 136

million kW for a period of 15 years and 300 million kW for a period of 20 years. The estimation results are summarised in Table 1. It must be noted that no environmental impacts, etc. are taken into consideration when calculating the figures in Table 1.

Table 1 Possible Introduction Amount by Scenario for Wind Power Generation

Evaluation Period	FIT Purchase Price	Onshore Wind Power (million kW)	Offshore Wind Power Bedded Type (million kW)	Offshore Wind Power Floating Type (million kW)
15 Years	¥15.0/kWh	17.68	not calculated	not calculated
	¥17.5/kWh	53.60	not calculated	not calculated
	¥20.0/kWh	86.07	0.13	0
	¥22.5/kWh	133.41	2.63	0
	¥25.0/kWh	179.14	19.02	12.45
	¥27.5/kWh	202.41	49.34	42.50
	¥30.0/kWh	207.56	92.21	135.77
	¥32.5/kWh	not calculated	137.56	300.46
	¥35.0/kWh	not calculated	178.62	300.46
Reference: Introduction Potential in FY2010 Potential Study		282.94	1,572.62	

### (3) Examination to Improve the Estimation Accuracy Concerning Small and Medium-Scale Hydropower Generation

The exclusion of the installed capacity of existing hydropower plans after considering demobilization cost from the FY 2010 Potential Study results led to a substantial reduction of the introduction potential for 1,000 kW or higher capacity plants. The estimated possible introduction amount is 0.39 million kW based on a FIT purchase price of ¥15/kWh for a period of 15 years and 1.3 million kW based on a FIT purchase price of ¥20/kWh for a period of 20 years. The estimation results are summarised in Table 2.

Table 2 Outline of Examination Results Concerning Small and Medium-Scale Hydropower Generation in FY 2011

Evaluation Period	FIT Purchase Price	Rivers		Reference: Possible Introduction Amount (for Rivers) by Scenario in the Potential Study in FY 2010	
		Installed Capacity (million kW)	Number of Sites	Installed Capacity (million kW)	Number of Sites
15 Years	¥15.0/kWh	0.39	83	0.90	139
	¥17.5/kWh	0.63	167	—	—
	¥20.0/kWh	0.97	325	2.13	492
	¥22.5/kWh	1.30	503	—	—
	¥25.0/kWh	1.62	732	—	—
	¥27.5/kWh	1.93	1,012	—	—
	¥30.0/kWh	2.30	1,389	—	—
Reference: Introduction Potential in FY 2010 Potential Study (excluding existing facilities)		13.98	21,703	—	—

(4) Examination to Improve the Estimation Accuracy Concerning Geothermal Power Generation

In regard to the FY 2010 Potential Study results, the width of the access road was revised (from 3 m to 5.5 m) among other revisions after considering demobilization cost. As a result, the possible introduction amount for geothermal power generation using flash steam of 150°C or higher is 0.38 million kW based on a FIT purchase price of ¥15/kWh for a period of 15 years or 5.3 million kW based on a FIT purchase price of ¥20/kWh for a period of 20 years. In the case of binary power generation with a temperature of 120 ~ 150°C, the commercial viability is slim when the FIT purchase price is less than ¥40/kWh. The possible introduction amount is still very small at 40,000 kW even if a FIT purchase price of ¥50/kWh is maintained for a period of 20 years. The estimation results are summarised in Fig. 2.

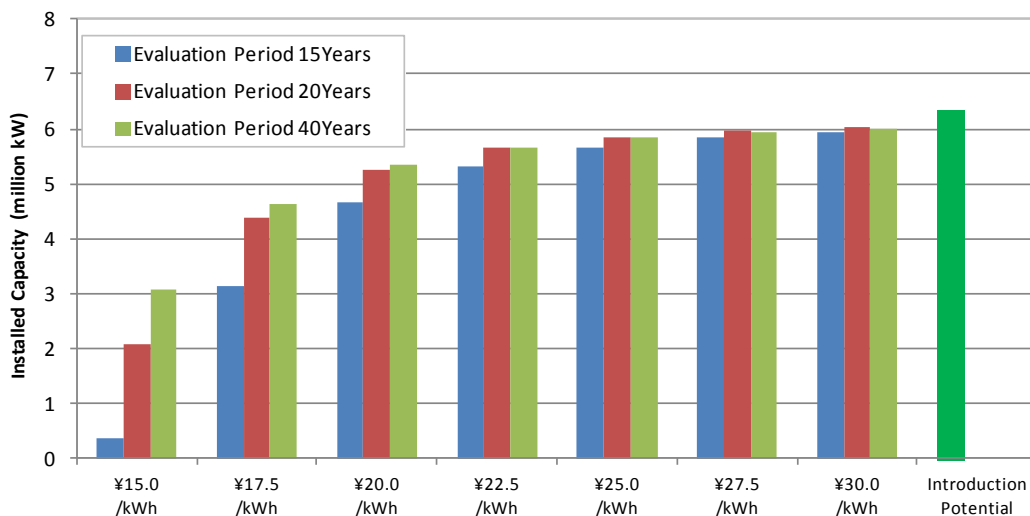


Fig. 2 Possible Introduction Amount by Scenario for Geothermal Power Generation ( $\geq 150^{\circ}\text{C}$ )

## 2. Examination Concerning the Development and Transmission of Basic Zoning Information

The permission to disclose on the Internet was obtained regarding the conditions which make prospective development impossible as these conditions affect the nationwide abundance of wind power, small and medium-scale hydropower and geothermal power and the introduction potential maps. Such basic zoning information was produced in PDF file format using 1 to 200,000 scale topographical maps (with a primary mesh size of approximately 80 km by 80 km). The sample images are shown in Fig. 3.

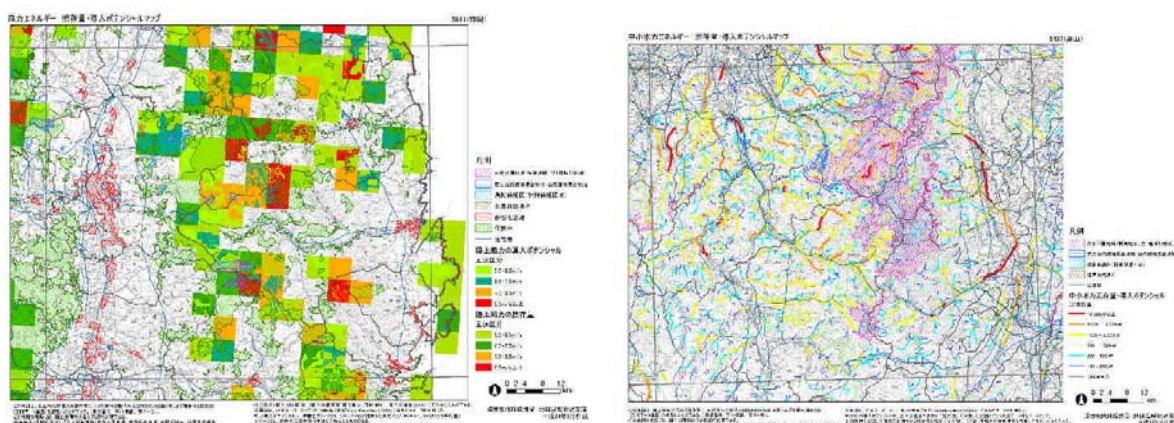


Fig. 3 Sample PDF Images for Basic Zoning Information  
(Left: Wind Power; Right: Small and Medium-Scale Hydropower)

### 3. Introduction Potential Study for PV power generation Focusing on Individual Buildings, etc.

Forty-six million polygons featuring individual buildings were extracted from housing maps and were analysed using 500 m x 500 m meshes to estimate the introduction potential for PV power generation. In addition, the possible introduction amounts under various scenarios of PV power generation were estimated. The distribution of the possible introduction amount by scenario of PV power generation (Scenario 2) is shown in Fig. 4 as an example.

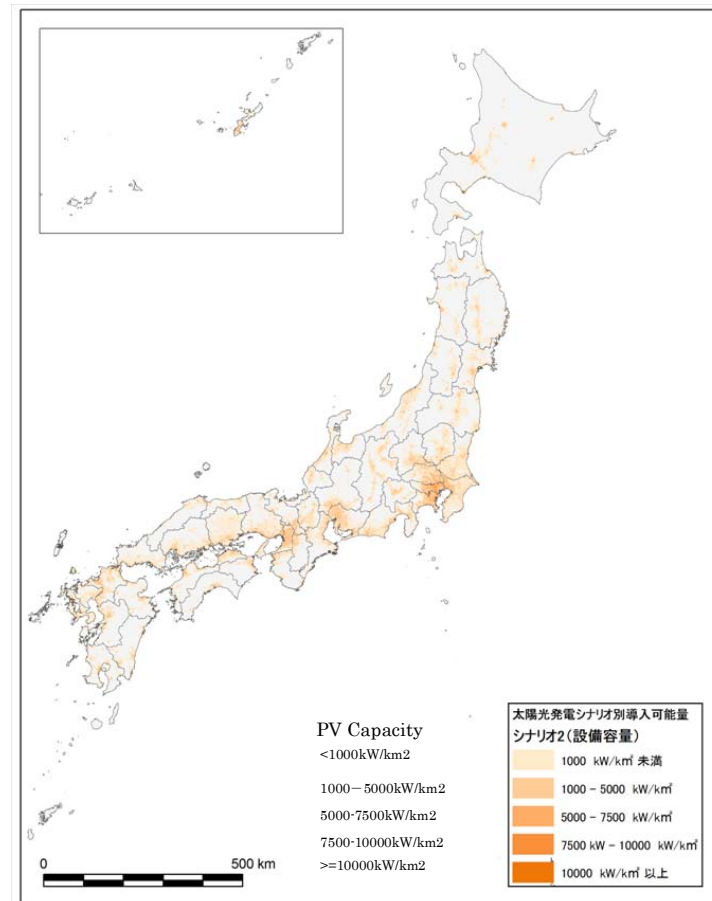


Fig. 4 Distribution of Possible Introduction Amount by Scenario of PV Power Generation (Scenario 2)