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VERIFICATION OF RENEWABLE ENERGY POTENTIAL SYSTEM (REPOS) FOR THE PROMOTION OF SMALL HYDROPOWER GENERATION

Abstract

The purpose of this study is to clarify whether the Renewable Energy Potential System (REPOS) provided by the Ministry of the Environment can replace actual field surveys in the selection of suitable sites, which is the first step in small hydroelectric power generation. And we will show the improvement method and create a small new hydropower introduction potential map. Comparing the actual project plan with REPOS analysis, it was shown that the discrepancy in the available water volume was the main reason for unreliable power generation and construction costs. In addition, in the field survey of power plant candidate sites, IRR values were calculated individually assuming that a new power plant will be built on each river in Toyama Prefecture. We then investigated the three sites with the highest IRR values. As a result, it became clear that there was a lack of information on the existence of national parks and existing hydroelectric power plants. Based on the above issues, we compared the available volume of existing hydroelectric power plants and the available water volume on REPOS and made corrections. Then, at the same time as excluding places where it is difficult to construct new power plants, we displayed on the map the impediments to introduction.

Introduction

Since most of the small hydropower plants in operation in Japan are less than 1000 kW, this study defines a small hydropower plant as a hydropower plant that generates less than 1000 kW [1]. The Ministry of the Environment provides a service called Renewable Energy Potential System (REPOS) to promote the spread of renewable energy. REPOS, as shown in Fig. 1, can display on a map the amount of electricity generated by a virtual power plant and points to consider when constructing a power plant. REPOS can display the amount of electricity generated by a virtual power plant and points to consider when constructing the plant on a map. The "Small and Medium Hydro Analysis Tool" can also be used to analyze the installed potential (power output), available water volume, effective head, pipe length, installed capacity, total estimated construction cost, and unit cost of construction at any point on the river. However, according to the Small and Medium Hydro Analysis Tool Setup Manual, it is pointed out that the project cost (estimated construction cost) calculated by the Small and Medium Hydro Analysis Tool deviates from the actual project cost by about ±20-30% [2].

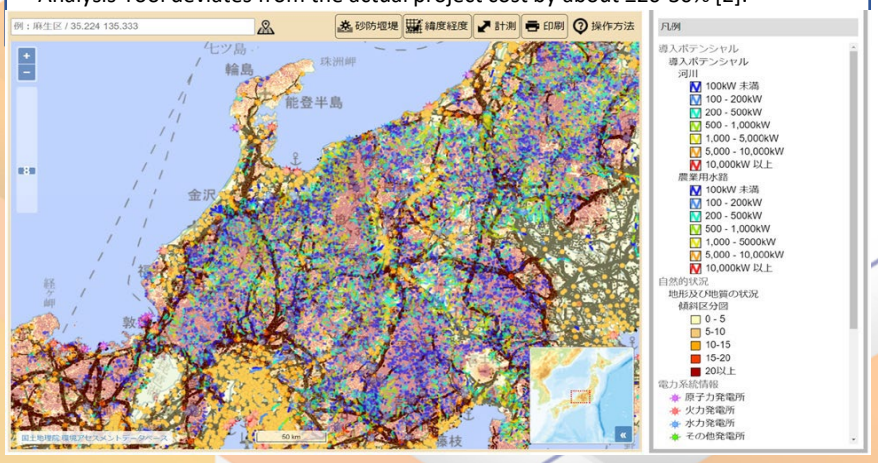


Fig. 1. Introduction potential map

Methods and Materials

As for the survey method, in order to pick up issues, we conducted a field survey of two locations with the highest IRR values in the virtual power plant on REPOS in Toyama Prefecture. In calculating the IRR value, analysis was performed using a small- and medium-sized hydropower analysis tool with reference to the Agency for Natural Resources and Energy's Small and Medium-sized Hydroelectric Power Station Introduction Guide[3]. As a result, it was found that there was a lack of information on factors inhibiting introduction, so this was reflected in the newly created introduction potential map.

In addition, we received business plans for three sites currently under construction from hydroelectric power producers and compared them with the analysis results of small and medium-sized hydropower analysis tools.

Results

The field survey revealed that there is a lack of information on national parks and hydroelectric power plants available in REPOS. Information on national parks is not available by category, and there is no information on ordinary areas. For existing hydroelectric power plants, only information on the location of large pumped storage hydroelectric power plants is available.

Comparison of the actual power plant plans and the results of the small and medium hydropower analysis tool for the same location is shown in Table 1. It was found that the plant capacity, construction cost, construction unit cost, and IRR were off due to the usable water volume. Therefore, it is necessary to correct for the usable water volume.

In order to correct for usable water volume, we studied the usable water volume of existing small hydropower plants that could be analyzed throughout Japan. The results showed that REPOS over-estimated usable water volume by an average of 1.72 times for the 32 sites. Therefore, the inverse of this number was multiplied by the usable water volume to correct the usable water volume, resulting in a revised IRR value. The information on national parks and existing hydroelectric power plants was added. Fig. 2 shows a map of the installed potential with corrected IRR values after adding information on national parks and existing hydropower plants.

Table 1. Comparison of actual power plant specifications and REPOS analysis results

			Usable water volume (㎥/s)	Water head(m)	Length of water supply canal(m)	Plant capacity (kW)	Construction cost (1,000 Yen)	Construction unit cost (1,000 Yen/kW)	IRR(%)
SITE1	REPOS	(A)	1.1	70.9	550.2	571.8	510,311	892.5	23.0
	Actual power plant specifications	(B)	0.3	70	520	151.0	303,000	2006.6	0.8
	Ratio	(A)/(B)	3.8	1.0	1.1	3.8	1.7	0.4	28.8
SITE2	REPOS	(A)	0.9	45.9	553	285.7	402,366	1,408.6	12.1
	Actual power plant specifications	(B)	0.6	42.1	530	190.0	429,000	2257.9	4.0
	Ratio	(A)/(B)	1.5	1.1	1.0	1.5	0.9	0.6	3.0
SITE3	REPOS	(A)	2.4	44.9	554.5	752.8	771,162	1,024.5	19.6
	Actual power plant specifications	(B)	1.8	43	550	650.0	915,000	1407.7	5.2
	Ratio	(A)/(B)	1.3	1.0	1.0	1.2	0.8	0.7	3.8

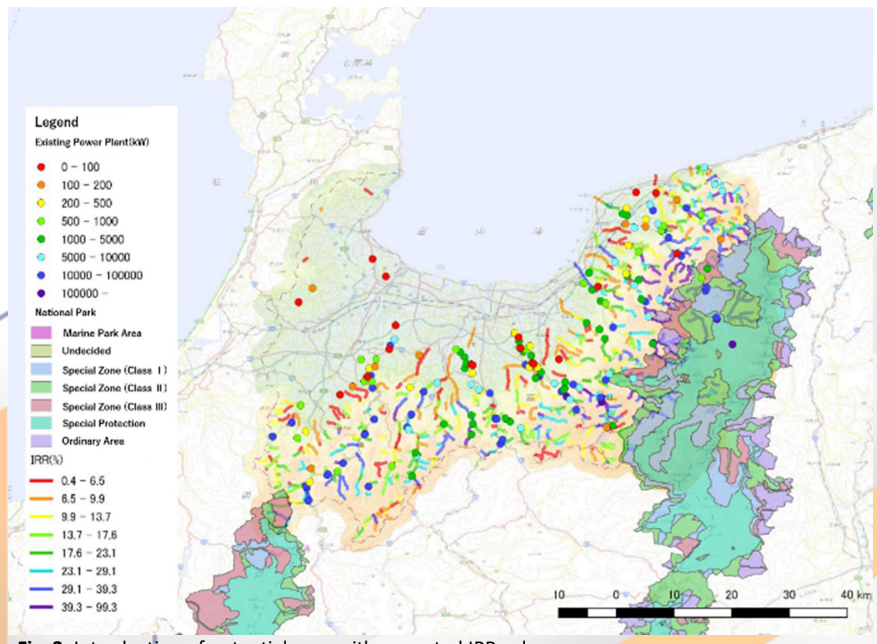
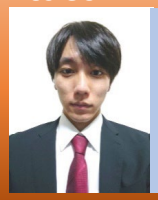


Fig. 2. Introduction of potential map with corrected IRR values

Conclusions

This study verified that REPOS could replace field surveys to find better suitable sites for new small hydropower plants, and made recommendations for improvement. The missing information on national parks and existing hydropower plants was given and the usable water volume was corrected. The IRR value was calculated using the corrected usable water volume, and an introduction potential map was created to identify the factors that inhibit introduction with higher accuracy.

Contact



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