Research on the Promotion and Business Model of User-Side Renewable Energy in Outlying Islands

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I. Research Background and Objectives

Due to the effect of greenhouse gases, global warming is faster than expected, and it's an arduous challenge to prevent climate change. Our country has announced the goal of "2050 net zero emissions", and the promotion of energy saving and renewable energy in the energy industry is an important development project. Kinmen area, for example, is an independent power grid with good wind and solar energy conditions, which is very suitable for developing renewable energy. When the proportion of green electricity increases, it will affect the stability of the power grid, and the energy saving at the user end (demand response) becomes more and more important. Therefore, research on promoting renewable energy at the user end in the outlying island area is proposed. This study aims to find a business model to increase the amount of renewable energy to reduce carbon emissions and maintain the stability of the power grid.

II. Research Content

To understand the international development trend, this project studies and analyzes renewable energy development in outlying foreign islands, including Danish Samso Island, French Reunion Island, American Maui Island, and German Pellworm Island, as well as outlying domestic islands Kinmen, Penghu, and Matsu. Taking the Kinmen area as the research object, a questionnaire survey was conducted to collect and summarize residents' opinions and suggestions on energy saving and renewable energy. The survey was carried out through a stratified system, and the chi-square test confirmed the sample's representativeness. With 37 multiple-choice questions (one answer) and 4 multiple-choice questions (more than one answer) in the questionnaire, the characteristics of the interviewees, opinions on renewable energy, surveys on energy-saving measures, surveys on incentive mechanisms for power load characteristics, willingness to participate in citizen power plants and challenges and subsidies for renewable energy were obtained. Through the t-test and Analysis of Variance, the Kinmen people's subjective cognition on the local promotion of green energy was obtained. Then, through the two-way communication of interviews and publicity, the brainstorming method was used to obtain feasible plans to promote energy saving for low-load users and green energy and renewable energy in Kinmen (Figure 1.).

III. Conclusions and Suggestions

In order to collect Kinmen local residents' willingness to participate and issues of concern in energy saving and renewable energy, a questionnaire survey was conducted. The questionnaire survey is carried out through a stratified sampling system, including gender, age, region, education, etc., and interviews with stakeholders, including the government, industry, opinion leaders, experts, scholars, etc. The validity of the questionnaire adopts the expert validity method, which is valid after being drafted by the research team and reviewed by experts and

scholars. The reliability is judged by Cronbach's α coefficient, and its significance is to test the homogeneity, stability, or consistency within the questionnaire. The Cronbach's α of the initial questionnaire test is 0.702, and the reliability of the questionnaire is credible. Next, a formal questionnaire survey was conducted in the five townships of Kinmen, and 333 valid questionnaires were collected. Under a confidence interval of 95%, the sampling error was less than 5%, and Cronbach's α was 0.70, which was similar to the reliability of the initial test and had the same level.

The purpose of the chi-square test is to identify the variable relationship between category variables or order variables, and it is also a test to check the matching degree between the sample sampling and the parent population (Goodness of Fit test). The test results of this study based on the gender ratio, township ratio, age ratio, and education ratio all reject the opposite hypothesis H1 and show that the sample and the parent are consistent in various characteristics, as shown in Table 1. Then, through the t-test and Analysis of Variance, the differences in cognition and willingness of different attributes to related issues were tested. After collating the data, interviews are conducted with stakeholders who promote energy saving and renewable energy in Kinmen, which belongs to the semi-structured in-depth interview method and is one of the data collection methods often used in qualitative research. Through the process and content of the interviews, the interviewees' motivations, beliefs, attitudes, practices, and implementation results can be discovered and analyzed regarding the promotion of energy saving and renewable energy.

Based on feedback from questionnaires and stakeholder interviews, the research team used the brainstorming method to integrate the above information into feasible plans. Suggested feasible plans for promoting energy saving and renewable energy are as follows: (1) Energy-saving plan: increase energy-saving incentives, strengthen the publicity of Time of Use Rates system, and promote power remote control mechanism to induce a reduction of electricity consumption during peak hours, (2) Renewable energy promotion plan: build wind turbines on islands and reefs, increase renewable energy subsidies, strengthen the publicity of Renewable Energy Certification and promote the development of multiple green energy industries to increase the amount of renewable energy construction. (3) Image improvement plan: Strengthen Taipower's image and green energy promotion, deepen green energy education in the Kinmen community, and strengthen industry-government-university cooperation to enhance green energy awareness and action, as shown in Table 2. Although outlying islands have different ecological environments , customs, and cultures, the promotion strategies for energy saving, carbon reduction, and renewable energy are generally the same as those in Kinmen. The plans mentioned above can be used in other outlying islands.

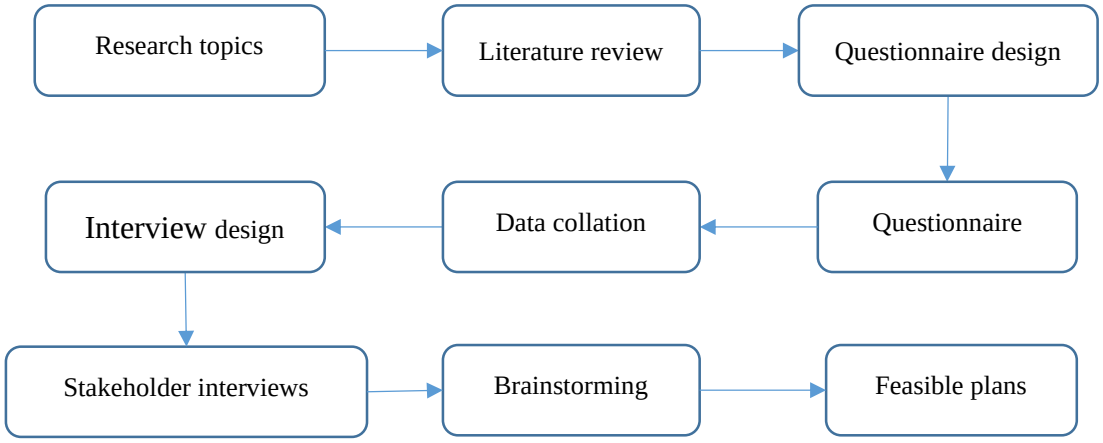

Fig. 1. Research Flow Chart

Table1 Chi-Square Test: Sample and Parent Characteristics

test parameters	chi-square value	degrees of freedom	significant level (α=0.05)	test result
gender ratio	0.46	1	3.84	reject H1
township ratio	3.75	4	9.49	reject H1
age ratio	10.10	6	12.59	reject H1
education ratio	5.34	4	9.49	reject H1

Table 2. Feasible solutions for promoting energy saving and renewable energy in Kinmen

plan	content
energy saving plans	1. increased energy saving incentives 2. strengthen the publicity of time electricity price 3. promote power remote control mechanism
renewable energy promotion plans	1. build wind turbines on islands and reefs 2. increase renewable energy subsidies 3. strengthen the publicity of Renewable Energy Certification 4. promote the development of multiple green energy industries
image improvement plans	1. strengthen Taipower's image and green energy promotion 2. deepen green energy education in Kinmen community 3. strengthen industry-government-university cooperation