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Quantifying Public Preferences for Community-Based Renewable Energy Projects in South Korea

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Abstract: Under the new climate regime, renewable energy (RE) has received particular attention for mitigating the discharge of greenhouse gas. According to the third energy master plan in South Korea, by 2040, 30–35% of the energy demand must met with RE sources. To ensure relevant policy design to achieve this goal, it is crucial to analyze the public's willingness to accept community-based RE projects. This study conducted a nationwide survey to understand the opinion of the public and also that of local inhabitants living near a RE project. A choice experiment was employed to measure public preferences toward RE projects. The analysis reveals that the type of energy source, distance to a residential area, and annual percentage incentives could affect acceptance levels. Additionally, investment levels were a factor in local inhabitants' acceptance of energy-related projects. This study presents the relevant policy implications in accordance with the analysis results.

Keywords: choice experiment; renewable energy; willingness to accept; multinomial logit models

1. Introduction

Recently, many nations started orienting their energy policy initiatives to "the new climate regime" for mitigating the discharge of greenhouse gases. The United Nations asked many nations around the world to replace their traditional energy source with a more sustainable alternative. Each nation was required to hand in nationally decided contributions and formulate decrease goals quinquennially [1]. In this context, the South Korean government started to follow the global trend by replacing conventional energy sources such as coal with a renewable energy (RE) gradually.

The government has set an ambitious target that by 2040, 30–35% of the energy demand should be met using RE sources [2]. To meet this target, the level of social acceptance regarding RE needs to improve. Social acceptance of RE can be classified into the public acceptance and the local acceptance of inhabitants living near an RE farm. Acceptance is associated with the usual recognition caught by the greater part of people; it presents a challenge given that it is difficult to address in the short term [3]. For example, in South Korea, 37.5% of photovoltaic (PV) power and wind farms admitted in 2016 were canceled or postponed because of opposed local inhabitants [4]. One of the significant causes for local inhabitants' opposition to constructing RE projects is that RE projects provide no benefit to residents [5]. To address this issue, the South Korean government needs comprehensive information on public preferences for community-based RE projects. Such data allows the government to customize future RE incentives and policies in line with people's preferences.

The current study intends to determine the preferences toward RE projects in South Korea employing a choice experiment (CE) method. We consider five major attributes of RE projects: RE types, distance to residential areas, investment types, investment level, and annual percentage incentives. The marginal willingness to accept (MWTA) estimates can provide policymakers with the necessary information to stimulate social acceptance. This study is predominantly concerned with the marginal effect of the economic influence regarding community-based RE projects, covering three RE sources: wind, PV, and biomass. The economic impact is in the form of incentives that are needed for the public to accept RE plant projects. Finding the public's MWTA will be one of the goals of this study, differentiating it from other studies, which mainly focused on the public's marginal willingness to pay (MWTP) [6–9]. Several studies, such as that by Woo et al. [4] and Botelho et al. [10], also estimated the willingness to accept (WTA) for wind, solar, biomass, and hydropower power plants, but they used the contingent valuation method (CVM) for analysis.

The main questions addressed by this study are: what are factors that will affect the public's acceptance of RE projects and what are the financial implications in terms of the final product's value? Thus, both the general public's and local residents' MWTA for RE projects needs to be determined. The results will be useful for creating more appropriate community-based RE projects in South Korea. To do this, first, data on the standard of acceptance of both the public and local inhabitants is gathered and analyzed using a CE approach to determine the relationship between each observed alternative and the value of the goods [11]. Unlike the commonly used CVM, the CE approach is able to analyze the relationship between each factor and alternative in a one-step process. In choosing the best option for an RE source, respondents typically consider multiple aspects, causing a significant trade-off between choices. As a result, policymakers will be able to customize different aspects of their policy to favor everyone involved.

The rest of this study is structured as follows. Section 2 reviews the literature regarding the evaluation of public preferences for RE projects. In Section 3, we explain the CE approach to evaluate public preferences and the survey data. Section 4 depicts the empirical results, followed by a relevant discussion. Conclusions are made in the last section.

2. Literature Review

Public acceptance of RE projects can differ according to several determinants such as environmental factors, the location of the projects, and other socio-economic factors. For example, supporters and opponents of wind energy turbines tend to base their claims on the local and global environmental and economic factors [3]. Understanding of effects of wind turbines on health, environment, and community wellbeing will lead to RE project siting decision. The "Not In My Back Yard" (NIMBY) syndrome has been affecting different opinions and public acceptance rates of RE projects [12,13]. For RE projects, the most significant factor for acceptance is associated with the perceived qualities of the location [14]. Some studies on the improvement of the South Korean policy to fit the RE initiative provided detailed information regarding how to implement the government's goal in real life using the available RE technology [15,16]. However, those studies do not include public opinion and focus more on the technological aspect of the policy.

The Korean government has been concerned with the increase in the production of RE without considering the impacts or problems that might surface because of the lack of coordination and planning. Until now, the RE policy in South Korea has been a top-down scheme, and is effective as a temporary solution [17]; however, in the long run, bottom-up schemes with public/private involvement are needed [18–20]. Lack of coordination between the government, public, and private sectors has caused confusion during the investment and participation process. To ensure consistent programs that can be accepted by the public, collaboration between all stakeholders is important. Camarinha-Matos et al. [20] mentioned a smart energy grid in which customers are treated as partners, with shared obligations and benefits. Thus, each local community can be self-sufficient by generating its own energy. There have been many studies on energy self-sufficient communities or villages, especially in the United Kingdom (UK), as it was considered the solution to RE project local opposition [21–23].

As mentioned before, public participation is important to decrease any possibility of retaliation. Usually, there can be a gap between how the public and local inhabitants perceive an RE project. The general public's opinion usually depends only on the outcome of RE projects, without weighing the process through which that outcome was achieved. Local residents, by contrast, directly witness the process and face the consequences of their choices, leading them to often oppose RE projects [24,25]. To ensure local acceptance, Germany and the UK tried to implement a locally owned small-scale RE project policy that would benefit local residents [17,26,27].

Specifically, Salm et al. [28] in Germany and Masini and Menichetti [29] for the European Union, conducted a survey on the willingness to accept RE projects. These studies indicated the period of investment return plays an important role in respondents' willingness to accept. There are several RE project case studies in Finland [30], the UK [31], Greece [25], and Spain [7]. Kosenius and Ollikainen [30] estimated the willingness to pay (WTP) for RE sources and considered effects of energy production as biodiversity, jobs, CO_2 emissions, and electricity bills. Scarpa and Willis [31] investigated public WTP for RE projects in UK using a CE approach. Dimitropoulos and Kontoleon [25] conducted a CE method to estimate preferences regarding wind farm projects in Greece. Moreover, Álvarez-Farizo and Hanley [7] tried to measure preferences for the environmental effects of wind plants in Spain using a CE method. According to their findings, social costs of environmental effects will relate to wind plant projects.

Most previous community-based RE project studies are from Europe and currently, the amount of research in Asia regarding this topic is little to non-existent. To the best of the authors' awareness, there have been few applications of a CE method to evaluate the willingness of local residents to accept for community-based RE projects in South Korea. Unlike other studies, this study attempts to compare public and local residents' preference for RE projects. Moreover, it is difficult to discover previous studies for quantitative analysis regarding policy impacts of financial incentives for RE projects. Therefore, this paper will give insightful information regarding community-based RE projects in Asian countries.

3. Methodology and Data

3.1. CE Survey

We gathered data regarding South Korean people's stated preferences for new RE power plant projects (solar PV, wind, and biomass power plants) employing a CE survey. The reason for using a CE survey is mainly to understand the respondent's attitude that causes them to favor specific alternatives [32]; the analysis result can inform policy design. This approach can identify the economic value of each attribute that makes up the alternatives and the total value of the alternatives [11]. This approach can provide insights for policymakers to customize their policies and ensure they are more suited to public preferences [33,34].

To design an appropriate CE for South Korean people's preferences for new RE power plant projects, we need to check the major attributes of RE power plant projects and assign relevant levels. It demands respondents to select the preferable alternative out of an assumed set of projects made from major attributes stated at some standards [35]. Table 1 depicts the attributes which can affect South Korean people's preferences for RE projects. It is assumed that other latent attributes are the same through all alternatives.

Specifically, we assumed that five attributes could describe RE projects. First, we included three technology options such as solar PV, wind, and biomass power plants. The reason for choosing these three levels is to analyze differences in preferences by various RE technologies. As of the time of the survey, in 2017 in South Korea, the RE sources for power generation are solar photovoltaic (7056 GWh/year produced in 2017), wind power (2169 GWh), hydro power (2819 GWh), ocean (489 GWh), bio (7467 GWh), and waste (23,867 GWh) [36]. Therefore, the three power sources included in the CE survey account for a substantial share of renewable power generation in South Korea. Moreover, the government designs to decrease the portion of waste energy in the long term [37], and hydro power is not very suitable to be promoted as a community-based project due to its big size and long gestation period. Ocean energy cannot be developed for private use, for which the application of community-based project is not suitable.

Second, the distance between the respondent's residential area and the renewable power plant was considered to be one of the key characteristics of the RE project. We assumed that the possible distance ranges from 100 to 1000 m. Those levels reflect the regulations on separation distance (i.e., setback distance) of RE power plants in several countries including South Korea. As of June 2018, 94 of the 228 local governments in South Korea enforced the separation distance regulation on photovoltaic power facilities, and most of them span 100 to 1000 m [38]. In terms of wind power, there are no statutory regulations in South Korea yet, but in general, it is suggested that a distance of 500 to 1500 m from residential area is negotiable with local residents [39]. Regulations and recommendation regarding the separation distance between the wind turbine and residential areas in other countries such as Germany, Canada, and the UK also extends around 300 and 1000 m [40].

Third, how respondents participate (invest) in the project determines the characteristics of the RE projects. Bond investment is a form of investment in an energy project, and a certain amount of interest is guaranteed each month, based on the amount of the investment. On the other hand, equity investment is when the investor share in both the profit and risk by owning a portion of the RE project as a shareholder. These two levels are representative methods of resident participation that are actually used in the community-based RE project in South Korea [4]. In addition, when promoting a community-based RE project, the South Korean government is planning to diversify the residents' participation method from existing equity participation to bonds, funds, etc. [41].

Fourth, the levels of respondents' participation can make a difference among RE projects. Recent literature highlighted that high level of public participation and engagement is a key factor in raising the acceptance toward local RE projects [42–45]. In particular, as the main purpose of a community-based RE project is to increase local acceptance by securing high levels of public participation and the level of engagement of residents can be different [21,46], it is important to examine people's preferences for this attribute. We assumed that there are two levels of respondents' participation. When the level of participation of respondents is low, respondents will only participate in procedures such as consent for construction and operation according to administrative requirements. However, when the level of respondents' participation is high, respondents participate directly in the operation and management of the RE project.

Lastly, the expected rate of return can vary according to the forms of RE projects. This attribute serves as a payment vehicle, and corresponds to the price attribute of the typical CE questionnaire. It is also the basis for WTA calculation. In an ongoing community-based RE project, local residents would receive a share of the benefit. Therefore, how much profit is shared is a crucial determinant of the acceptance of the RE project. Previous studies also confirmed that the financial incentives such as benefit sharing influenced people's attitude toward RE projects [47,48]. In addition, when using the stated preference techniques, it is significant to use a payment vehicle that is similar to the real world decision, which is the case for this attribute [49]. Based on previous RE projects in South Korea, the expected rate of return for each participant was assumed to range between 2%/year and 6%/year [50,51]. It was also considered that the rate of return on 3-year to 10-year government bonds ranged from 1.8% to 2.28% in 2017.

Table 1. Attributes of Renewable Energy (RE) projects for the choice experiment.

Attribute	Attribute Level
RE technology	(1) Solar photovoltaic (2) Wind (3) Biomass
Distance from residence	(1) 100 m (2) 500 m (3) 1000 m
Participation form	(1) Bond investment (2) Equity investment
Participation level	(1) Low (2) High
Expected rate of return	(1) 2%/year (2) 4%/year (3) 6%/year

We derived the 108 possible combinations from attributes and their levels in Table 1. Through Statistical Package for the Social Sciences (SPSS) 19.0.1, however, we selected only 18 orthogonal alternatives adopting a fractional factorial design to ensure the orthogonality of each attribute. Such alternatives are separated into six choice sets consisting of three alternatives and one status quo option. To save time needed for the respondents to respond, the respondents were classified into two groups, with each group demanding to answer three different sets. Then, the respondents are permitted to select the most preferred alternative from three alternatives and one status quo option in each choice set (see Table 2).

Table 2. A sample choice set.

	A	B	C	D
RE technology	Wind	Solar Photovoltaic	Biomass	No interest to participate (Status quo)
Distance from residence	500 m	1000 m (1 km)	100 m	
Participation form	Equity investment	Equity investment	Bond investment	
Participation level	Low	Low	High	
Expected rate of return	4%/year	6%/year	2%/year	
Most preferable option		V		

This study attempts to compare public acceptance with the local acceptance of the inhabitants currently living near the RE power plant. Thus, we conducted two separate CE surveys: (1) one for the South Korean nationwide public and (2) another for local inhabitants who reside within 1 km proximity of a RE power plant. The features of the survey design are represented in Table 3. Table 4 condenses the features of the 508 respondents in the public survey and 306 respondents in the local resident survey. The considerable difference in education level between the two samples needs to be addressed. It is probably due to the difference between the sampling method and survey method for the two samples, as shown in Table 4. This is a limitation of this survey and needs to be corrected in subsequent studies.

Table 3. Summary of survey design.

Type	(1) Survey for General Public	(2) Survey for Local Residents
Population	Head of household (and spouse), aged 20 to 65, nationwide	Head of household (and spouse), aged 20 to 65, living in administrative areas within 1 km of RE power plant grounds
Sample size	508 persons	306 persons
Sampling method	Sampled at random from proportional quotas based on age and region	Purposive quota sampling method
Method	Web survey	Face-to-face interview
Period	May 22 to May 29, 2017	May 19 to May 30, 2017
Survey firm	Hankook Research	

Table 4. Descriptive statistics of the respondents.

Type	Definition	(1) Survey for General Public	(2) Survey for Local Residents
		No. Respondents (%)	
Total		508 (100%)	306 (100%)
Gender	Male	244 (52%)	155 (50.7%)
	Female	264 (8.5%)	151 (49.3%)
Age	19–29	43 (8.5%)	12 (3.9%)
	30–39	103 (20.3%)	48 (15.7%)
	40–49	147 (28.9%)	80 (26.1%)
	50–59	151 (29.7%)	107 (35.0%)
	≥60	64 (12.6%)	59 (19.3%)
Education level	Less than high school	88 (17.3%)	220 (71.9%)
	More than college	420 (82.7%)	86 (28.1%)
Type of RE power plant	Wind power		101 (33.0%)
	PV		103 (33.7%)
	Biomass		102 (33.3%)

3.2. Model

We employed multinomial logit models to explore the South Korean public and local inhabitants' preferences for new RE power plant projects. The multinomial logit model is constructed based on random utility theory. The multinomial logit model is the most widely used discrete choice model. Its popularity is caused by the fact that the equation for the choice probabilities has a closed shape [32]. Although its IIA property is inappropriate in some choice situations, the power and applicability of logit models to represent choice behavior has been demonstrated in several studies in the field of energy [52,53]. The utility of an individual n by selecting alternative j in choice condition t U_{njt} is specified as Equation (1) [32,54].

$$U_{njt} = V_{njt} + \varepsilon_{njt} = \beta' x_{jt} + \varepsilon_{njt}, \quad (1)$$

The utility can be separated into the deterministic portion V_{njt} and the stochastic portion ε_{njt}. x_{jt} indicates the observable attributes for alternative j's attribute value in choice condition t, and β is the parameter for the equivalent attribute. Specifically, in this study, we defined the deterministic part of the utility function as Equation (2):

$$V = \beta_1 d_{wind} + \beta_2 d_{solar} + \beta_3 d_{biomass} + \beta_4 x_{distance} + \beta_5 d_{equity-invest} + \beta_6 d_{low-participant} + \beta_7 x_{return}, \quad (2)$$

where d_{wind}, d_{solar}, and $d_{biomass}$ are dummy variables representing wind, solar PV, and biomass energy technologies, respectively. Looking at the RE technology attribute in a sample choice set (Table 2), alternative A is wind power, B is solar photovoltaic, C is biomass, and alternative D is no-choice (opt-out) option. Our CE is designed so that this order was always fixed in all choice sets. For this reason, the alternative specific constant was not involved in the model. In addition, according to this, the base for estimation of the RE technology dummy variable were set to status quo, which means that dummy represents the difference between choosing alternative D. $x_{distance}$ represents the distance between the respondent's residential area and the renewable power plant. $d_{equity-invest}$ is a dummy variable representing equity investment, and $d_{low-participant}$ is a dummy variable representing a low level of respondent participation. Finally, x_{return} represents the expected rate of return.

Depending on the assumption that respondent selects an alternative from each choice situation to maximize their utility, the choice probability that respondent n selects alternative j in a choice condition t is defined as Equation (3).

$$P_{njt} = \Pr\left(U_{njt} > U_{nkt}, \forall k \neq j\right) = \Pr(\varepsilon_{nkt} - \varepsilon_{njt} < V_{njt} - V_{nkt}, \forall k \neq j), \tag{3}$$

If ε_{njt} follows an independent and identically distributed type I extreme value distribution, the choice probability that a respondent n will select alternative j in choice condition t can be expressed as Equation (4) [54].

$$P_{njt} = \frac{e^{V_{njt}}}{\sum_k e^{V_{nkt}}}, j = 1, \ldots, J, \tag{4}$$

The model can be solved easily by employing the maximum likelihood estimation, and the log-likelihood function for the estimation is specified as Equation (5).

$$LL = \sum_{n=1}^{N} \prod_{t=1}^{T} P_{njt}, \tag{5}$$

The MWTA can be calculated on the basis of the estimation results of β. The MWTP means how much a respondent is willing to accept for a unit change in the level of an attribute. The value can be computed by dividing each attribute's parameter estimate by the return attribute parameter estimate as Equation (4) [32].

$$MWTA_a = -\frac{\partial U/\partial x_a}{\partial U/\partial x_{return}} = -\frac{\hat{\beta}_a}{\hat{\beta}_6}, \tag{6}$$

$\hat{\beta}_a$ and x_a represent the mean estimated parameters and attribute values of the attributes, excluding the rate of return attribute. $\hat{\beta}_6$ and x_{return} indicate the estimated parameter and the attribute level for the rate of return attribute, respectively.

4. Results and Discussion

As noted before, this study divided the sample into two groups of respondents to analyze the preference gap between the public and the local residents for the community-based RE project. The multinomial logit models for both samples were analyzed using the NLOGIT 4.0 software, and the analysis results are shown in Table 5. For the estimation of the model without covariates, we used Equation (2) to analyze the data. As mentioned in Section 3.2, the MWTA for each attribute was calculated using Equation (4), and are also presented in Table 5. Discussion on the MWTA suggested below is only focused on the results that are statistically meaningful at either the 5% or 1% confidence level.

Table 5. Estimation results of multinomial logit models.

Variable		General Public		Local Residents	
		Coefficient (Standard Error)	MWTA (%)	Coefficient (Standard Error)	MWTA (%)
Renewable energy technology	Wind	−1.2211 ** (−0.1856)	10.3197	−2.9697 ** (0.2475)	15.3282
	Solar	0.4214 * (0.1695)	−3.5618	−1.8350 ** (0.2236)	9.4717
	Biomass	−0.9040 ** (0.1808)	7.6395	−2.8115 ** (0.2313)	14.5115
Distance from residence		0.0005 ** (0.9519)	−0.0042	0.0006 ** (0.0002)	−0.0031
Participation form (Equity)		−0.0680 (0.0964)	0.5750	−0.0694 (0.1274)	0.3580
Participation level (Low)		0.0454 (0.0808)	−0.3837	−0.2588 * (0.1180)	1.3360
Expected rate of return		0.1183 ** (0.0287)		0.1937 ** (0.0373)	
		N = 1524; Pseudo R^2 = 0.01 LL = −1750.080		N = 918; Pseudo R^2 = 0.022 LL = −970.149	

*: Statistical significance at 5% level; **: Statistical significance at 1% level; the pseudo R^2 merely has meaning when compared to another pseudo R-squared of the same type, on the same data, predicting the same outcome [55].

On the basis of the results of Table 5, more specifically, the sign of the estimated coefficients and the calculated MWTA, the differences in preferences between the two groups for the community-based RE project are discussed below. First, looking at the preference for RE technology attributes, all three coefficients of technology attributes are highly significant for both local residents and the general public with negative (−) signs, except for the solar PV power plant in the nationwide survey. The solar PV coefficient in the national survey shows a positive (+) sign with a 5% significance level. When estimating the dummy variable as the base level, the RE plant is not in the vicinity. The negative (−) sign basically means that people do not prefer renewable facilities around their residence. However, the general public shows a preference for solar PV power plants around their residence, even if there is no incentive, showing a favorable attitude toward solar PV technology. The relative preferences for the three RE technologies are solar PV, biomass, and wind power in both groups. In particular, the findings indicate that the preference gap between solar power and the other two RE sources was considerable. The differences in people's preferences (and willingness to pay) for different RE sources were already suggested in several studies, and this study reaffirms the existence of such differences. In particular, many existing studies found that people prefer solar PV technology over other RE alternatives [56–58], and this study supports it. In addition, in previous studies, the relative preference between wind power and biomass showed somewhat different results depending on the region and other factors (e.g., Kosenius and Ollikainen [30]). In this study, it was found that the South Korean people (both general public and local residents) prefer biomass to wind power, but this is not a big difference. The finding that solar PV is the preferred RE source of the South Korean people is consistent with previous studies [4,59].

Next, we discuss each group's MWTA for the RE technology attribute. First, we present the general public's MWTA. For the renewable technology type, the data indicates the public is willing to accept wind farm projects if they were given a 10% level of the annual expected rate of return and biomass plant if they were given 7.6%. However, for solar PV power plants, the general public appears to have an opinion that the project can be promoted even if the expected return is negative (−). However, it is impossible to establish a solar PV power plant at an investment loss for the public. Therefore, it can be assumed that the general public has a strong preference for solar PV technology.

Next, we will look at the local residents' MWTA estimations. The MWTA for all technology types is statistically significant at the 1% confidence level, showing local residents accept wind farms at a 15% expected rate of return, while solar PV and biomass plants show a lower annual rate of return (9.5% and 14.5%). When comparing the MWTAs between the two groups, the local residents had a higher MWTA for all three technologies. This means that a higher expected rate of return must be provided to ensure local residents' acceptance of RE projects, i.e., the local acceptance of community-based RE projects is lower than that of the general public. This finding confirm previous studies that identified various reasons for the low acceptance, such as NIMBY, social gap, and the difference in public versus private preferences [60,61]. Such a relatively lower acceptance of local residents compared to the general public is consistent with the results of Lee et al. [59], who analyzed the South Korean case. Therefore, projects need to consider these preferences when promoting community-based RE projects in South Korea. Thus, it will be necessary to focus more on planning and design from the perspective of local residents.

The interpretation of the distance attribute is as follows. For the distance, the general public's and local residents' opinions show a positive (+) sign and are meaningful at the 1% level. This indicates that it is preferred that the RE power plant is located further away from the respondents' residential area. The distance, which is also statistically meaningful at the 1% level, shows the public's MWTA of −0.0042%. From this result, we can assume that the public is willing to receive 0.0042% less annual expected rate of return for every 1 m the plant is located further away from their residential area. Additionally, local residents are willing to accept 0.0031% less for their annual rate of return if the plant is located 1 m further. In sum, even for a community-based RE project, the plant should be as far away from the densely populated area as possible, which leads to a positive response with a lower rate of returns.

Contrary to our expectation, the participation survey for the community-based RE project showed no significant impact on the preferences of both groups. Meanwhile, with regard to the expected rate of return attribute, we can examine that the results are statistically significant at the 1% level with the positive (+) sign. This coefficient, used in Equation (4), counts the respondents' MWTA. Considering that the sign of the expected rate of return is positive (+) and significant, it seems that the South Korean people are indifferent to investment methods such as stocks and bonds (which is related to the degree of investment risk and voting rights) while focusing mainly on return on investment.

Finally, with regard to the participation level attribute, there are various types of public participation in RE projects [42,43]. In this study, it is necessary to clarify that the participation level attribute refers to procedural participation. This is because financial participation is already reflected in the form of the expected rate of return attributes. First, in the case of the general public, it was found that the estimated coefficient of participation level attribute was not statistically significant. In contrast to the general public's result, the local residents' participation level has a negative coefficient and is statistically meaningful at the 5% confidence level with an MWTA of 1.3%. This means that the local residents will require a 1.3% higher annual rate of return for a low participation level. Recent studies reported the positive role of public participation on improving public acceptance of RE projects [43–45]. As community-based RE projects in South Korea are likely to involve local residents, it is necessary to increase the participation level of local residents to promote a successful community-based RE project. As the relatively high participation level showed to have a moderate impact on the MWTA (1.33%), significant financial savings can also be achieved.

In summary, the results indicate that the RE technology types, distance, and expected rate of return could affect the public acceptance of community-based RE projects, while the local residents' acceptance level could be affected by the similar attributes in addition to participation level. In addition, four main policy implications can be suggested from the analysis results. Firstly, in South Korea, the local acceptance of community-based RE projects is lower than that of the general public, so it is necessary to always keep in mind the acceptance gap between the two groups when working on new community-based RE projects in the future. Secondly, because the South Korean people prefer solar

PV above to the other two technologies and the preference gap is significant, it is recommended to disseminate community-based RE projects mainly focusing on solar PV power plants. With solar PV plants, it is expected that effective and smooth dissemination of community-based RE projects can be achieved with less financial input. The findings indicate the largest influence on the expected rate of return (WTA) was the selection of the renewable power source (for example, in the case of local acceptance, if the wind power or biomass technology is chosen rather than solar PV, an additional rate of return of approximately 5% to 6% should be provided to offset the potential resistance from local residents). Thirdly, the range between the plant and the residence remains an important attribute. In other words, although the community-based RE project is more resident-friendly than a conventional RE project, it is wise to deviate from the densely populated area as much as possible when selecting a site. Lastly, it was confirmed that procedural participation is as important as financial participation. It is recommended that similar studies, such as Langer et al. [42], Koch and Christ [62], and Liu et al. [63], should be conducted to determine the most effective local residents' participation plans for South Korea.

5. Conclusions

Greenhouse gas emissions rapidly increased since the first industrial revolution, resulting in a significant rise in global temperatures. The United Nations asked countries around the world to replace their conventional energy sources with a more sustainable option. Accordingly, the South Korean government has set a goal that by 2040, 30–35% of the domestic energy demand will be met with RE sources. To achieve this goal, social acceptance, including public acceptance and local acceptance as well as technological development, is crucial. Public opinion must be considered in order to develop RE policies. One way to understand public opinion and apply it to the policy frameworks is through a survey. The data collected in this survey can then be analyzed using several methods to understand the factors that affect public acceptance of RE. This study conducted a conjoint analysis CE to determine public acceptance of RE projects in South Korea.

We use the multinomial logit model to explore the survey data. The results show that the energy source type, distance, and annual percentage incentives significantly affect social acceptance. In addition, it was confirmed that public acceptance of RE was higher than local acceptance. These results are presumed to be due to the NIMBY syndrome. The result also shows that there is an investment level that only has an effect on local residents' acceptance but is not statistically significant in the general public's opinion. Local residents preferred solar power over both wind, which generates noise, and biomass power plants, which emit pollutants.

The government has the ability to create a better world by using policy instruments to convince the public and create a beneficial symbiosis to find solutions to both national and global challenges. These instruments can be in the form of economic support, which can be broadly divided into price discount (subsidies) or investment returns. In this study, we found that an appropriate investment return level is required to secure public acceptance and local acceptance. Local residents prefer a higher investment return than national residents do. Therefore, the government can create a policy program based on the distance between the project and the residential areas. As indicated in this study, the closer the distance, the greater is the investment return required.

However, there are other possible policy programs that can be created by customizing them to include every statistically significant attribute that would increase public and local acceptance. We could not sufficiently stress the importance of the public's participation and active promotional/educational programs to enhance the reputation of RE plants, which will help boost the acceptance rate of RE projects all over the country. Because countries differ in culture, mindset, and renewable technology levels, a careful approach is required to apply the results of this study to other countries. We expect that the general public and local resident's preference for RE will vary from country to country. Similar studies can be applied to other countries to conduct a comparative analysis.

This study hypothesized that the difference in acceptance for RE between general public and local residents is caused by living around RE plants. However, national and local residents may show different results depending on their gender, income and education levels. This study did not take into consideration these socio-economic attributes, leaving this issue for future study such as cross effects analysis with the demographic variables or latent class analysis. By including the socio-economic background of the respondents, it is possible to comprehend the general attitude of the respondents. The abovementioned recommendation will be beneficial to reduce public resistance.

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