

Factors Affecting Willingness to Pay for Renewable Energy

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Background : Contingent Valuation Method considering spatial factor

Tragedy of the commons: In game theory, the equilibrium solution is different from the cooperative solution (Hardin, 1968). Important differences may exist between local communities and the general (e.g., the country as a whole) (Batley et al., 2001). Thus, it is not enough to consider social acceptance at the national level, but it is necessary to consider social acceptance at a smaller level – residents' perspectives with higher resolution.

A major approach used is to estimate the WTP(Willingness to Pay) of residents toward each RE source as an index of social acceptance using the contingent valuation method (CVM) and clarifying components of residents' preference(Zarnikau, 2003). Most of the studies solely rely on questionnaire-based data and lacks analysis taking spatial information into account.

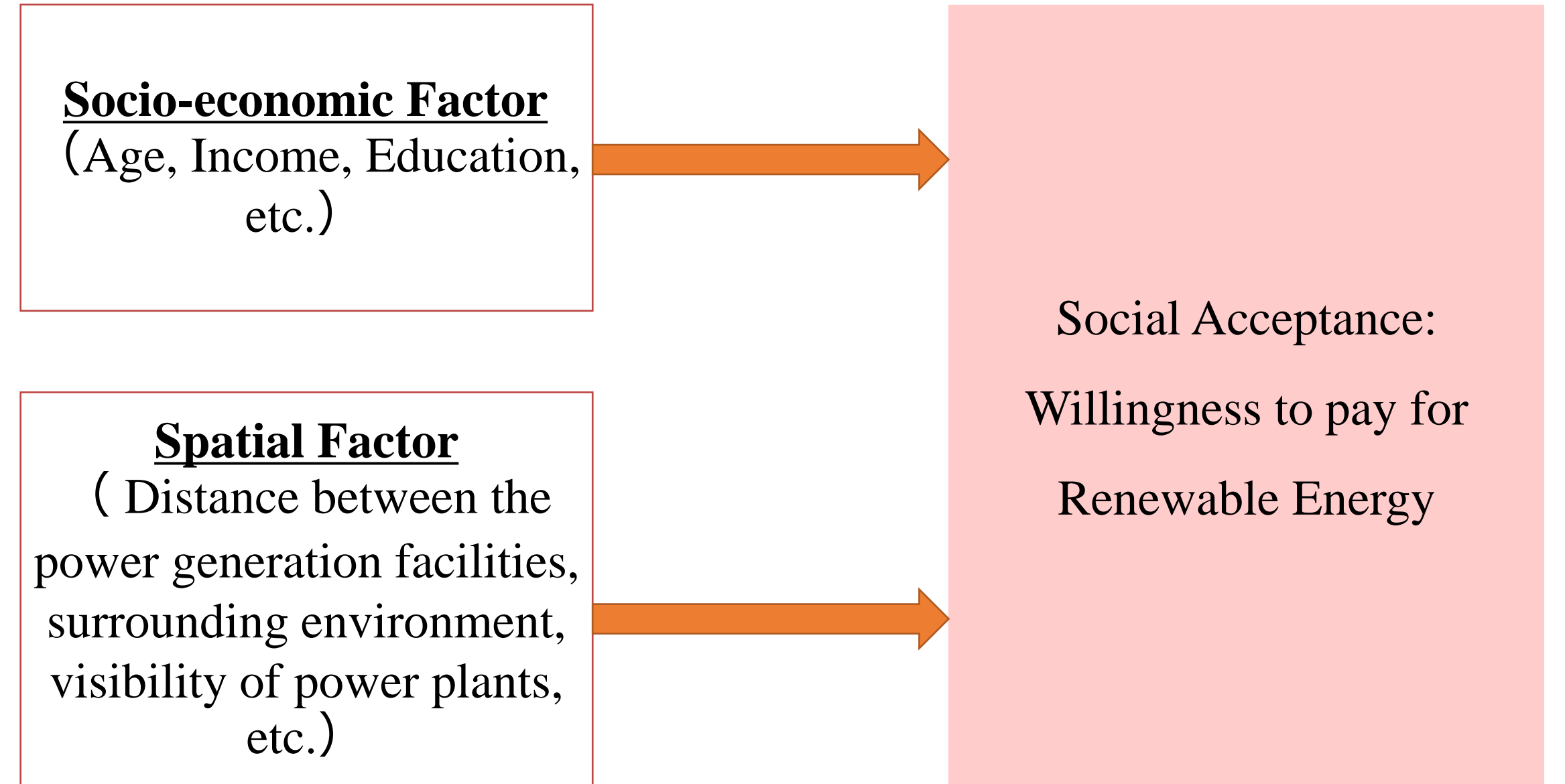


Figure 1 Factors Affecting Willingness to Pay for Renewable Energy

Research Questions:

1. What are the major determinants of social acceptance toward Renewable Energy in Japan
2. How does visibility of power plants influence social acceptance

Research Objectives:

Addressing the above questions through:

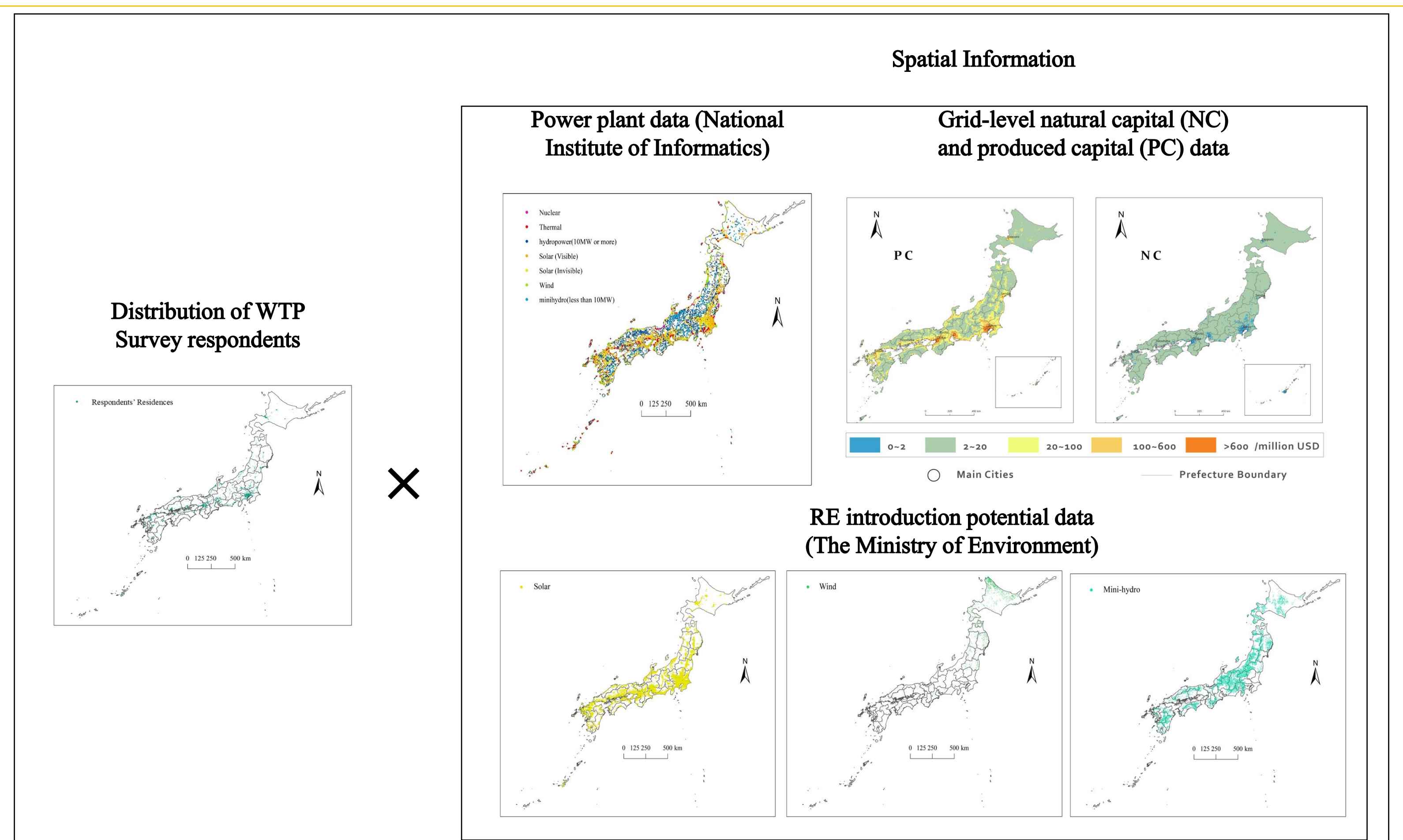
- I. The analysis of determinants of social acceptance toward renewable energy in Japan
- II. The analysis of the impact of visibility of power plants on social acceptance toward solar PV

Method : Contingent Valuation Method

$$y_{wtpj} = \beta x_j' + u_{1j}$$

- Dependent variable(y_{wtpj}): Willingness to pay for each Renewable Energy
- Explanatory variable(x_j)
 - ✓ Socio-economic variable: Household income, Education year, Age, Sex, Subjective Well-being
 - ✓ Spatial variable: Distance between the power generation facilities, the surrounding artificial and natural environment, visibility of power plants, Existence of renewable energy introduction potential

The above equation identifies the factors that affect WTP. Spatial information is incorporated into the Contingent Valuation analysis by merging spatial information with the respondent's place of residence.



Results and Discussion

| Variables | Analysis I | | Analysis II |
|--|------------------------|------------------------|-----------------------|
| | Wind | Mini-Hydro | Solar |
| Subjective well-being (highest=5, lowest=1) | 149.97*** (41.83) | 171.47*** (42.36) | 203.94*** (43.85) |
| HC of the respondents (Million \$) | 181.59*** (26.82) | 191.27*** (27.25) | 153.59*** (28.21) |
| Existence of nuclear power plants within 10km | 1441.20*** (464.93) | 1225.12*** (470.78) | 1014.80** (484.94) |
| Existence of nuclear power plants within 10km~30km | 626.08*** (236.62) | 700.48*** (239.17) | 781.16*** (245.88) |
| Proximity to Visible power plants | 92.82 (223.10) | 76.42 (105.16) | -166.05* (92.71) |
| Proximity to Invisible Solar PV power plants | | | -22.99 (105.69) |
| Log likelihood | -15060.7 | -15045.4 | -15271.5 |

Factors shaded in orange are those that have an impact on WTP. Factors shaded in blue are those that did not show a statistically significant effect. Note: Standard error is shown in parenthesis. ***p<0.01, **p<0.05 *p<0.1 Note: Variables not explained in this presentation are not shown.

NIMBY(Not In My Back Yard) phenomenon

- The existence of solar PV power plants with capacity of 1 MW or higher located nearby (within 3 km) residents' locations influences social acceptance toward solar PV negatively and significantly.
 - No significant impact observed in the case of wind and mini-hydro energy
- **Existence of NIMBY phenomenon for solar PV in Japan**

The Value of Invisibility

- The existence of solar PV power plants that are less visible (e.g. placed on roofs of buildings and public facilities) than usual ground mounted solar PV power plants didn't influence the social acceptance of solar PV, while more visible power plants influenced the social acceptance strongly and negatively
- **The importance of visibility**

Nuclear power vs. renewable energy

- Residents within 30 km of nuclear power plants showed statistically significant increase in WTP for RE.
- The presence of a nuclear power plant near their residence may make them aware of the disaster risks associated with proximity to a nuclear power plant and make them want to promote renewable energy, which is attracting attention as an alternative energy source to nuclear power.

Human capital (HC) matters

- HC of the respondents (incl. knowledge, aptitude, education, and skills) had positive and significant impact on WTP for RE.
- WTP for renewables increases the younger the age, the larger the number of years of education, and the higher the annual income. The results are in line with the preceding studies (Damigos and Kaliampakos, 2003; and Li et al., 2009).