Chapter 3

Methodology: Survey Design

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1. Survey Overview

Following last year's analysis, a series of household surveys were conducted in three cities in two countries to explore the willingness to pay (WTP) for renewables in the Association of Southeast Asian Nations (ASEAN) countries. A discrete choice experiment (DCE) was conducted in Jakarta (Indonesia) and Kuala Terengganu and Kuala Nerus (Malaysia).

Local researchers, in collaboration with the author, conducted each survey. Table 3.1 describes the survey period for each city. The survey instrument for Malaysia is presented in the Appendix as an illustration. The survey was influenced by the COVID-19 pandemic.

Table 3.1. Survey Period

City	Period
Jakarta	March to May 2022
Kuala Terengganu and Kuala Nerus	April to June 2022

Source: Authors.

Our basic approach is similar to that of the last report, except for the survey experiments that were conducted in Malaysia. To support our readers, however, the following gives a brief description of the method used.

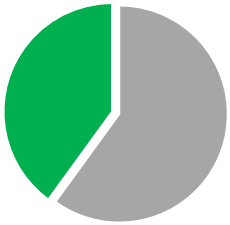
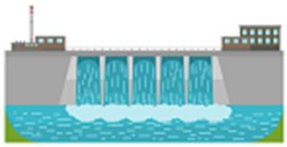
2. Discrete Choice Experiment

2.1. Theoretical background

DCE is a stated preference methodology to measure the WTP of respondents. The stated preference method is appropriate for a hypothetical choice scenario with a smaller number of samples. Please see more details of the theoretical background in the previous report (Yoshikawa, 2021).

The DCE asks respondents to choose from choice sets to elicit preferences. There are three alternatives (scenarios) in each choice set, and each set has a collection of attributes with defined levels (Table 3.2). Respondents are requested to select the most preferred alternatives amongstst the choice set.

Table 3.2. Sample Question from the DCE Survey

Choice Set 1	Alternative A	Alternative B	Alternative C (Status Quo)
Renewable Energy (%)	30 % Renewable Energy 	40 % Renewable Energy 	17 % Renewable Energy 
Main Type of Renewable Energy	 Biomass	 Solar	 Hydropower
% Increase in Monthly Electricity Bill	Your monthly electricity bill will **increase** by **25%**	Your monthly electricity bill will **increase** by **2%**	Unchanged

DCE = discrete choice experiment.

Source: Authors.

2.2. Attributes and levels

Two common characteristics regarding renewable energy (RE) policy were selected for the experiment: the RE share of future total generation capacity and the RE type with a higher share. For easier understanding of survey respondents, only one of these renewable sources will increase its own share, even if the current share is collective. These attributes were designed at three to four levels depending on the circumstances of each country.

The price attribute was defined as the percentage increase in residents' monthly electricity bills. The increase in the monthly electricity tariff levels was determined, in part based on the results from the last phase (Yoshikawa, 2021) and in consultation with local collaborators. Table 3.3 displays the three attributes along with their corresponding levels.

Table 3.3. Attributes and Their Levels by Country

	Future Share of RE*	Type of RE	Increase in Monthly Electricity Tariff	Status
Indonesia	15%/35%/45%/50% in 2030	Solar/wind/biomass/ geothermal	2%/10%/15%/25 %	11%** by large-scale hydropower
Malaysia	25%/30%/35%/40% in 2035	Solar/biomass/mini hydro	2%/5%/10%/15% /25%	current 17% by large-scale hydropower

RE = renewable energy.

* The target year of each country was set according to each government's plan, as explained below.

Source: Authors.

** The 2020 RE rate is 17% according to the IEA, but the previous survey used the RE share in primary energy of 11% in 2015.

Indonesia

Renewable share levels in Indonesia were set at 15%, 35%, 45%, and 50%, given that the share of RE in 2015 was calculated as 11% of the total of hydropower, geothermal, biofuels, solar, wind, and waste. Based on the Indonesia Electric Power Supply Business Plan 2021–2030 (RUPTL 2021–2030) (PLN, 2021), the target share of RE generation capacity in 2030 is projected as 51.6%. An RE share of 29.6% in 2028 was the goal of the 2019 plan. However, the target share of RE generation capacity was significantly increased to meet the goal of achieving net zero emissions (zero net greenhouse gas emissions) by 2060 in line with the Paris Agreement.

Malaysia

In 2020, the Ministry of Energy and Natural Resources of Malaysia (KeTSA) set a target to increase the share of RE in the national installed capacity mix to 31% in 2025 and 40% in 2035

(Sustainable Energy Development Authority (SEDA) Malaysia, 2021). Thus, we set the maximum level of share of RE in 2035 to 40%.

Blocks and Choice Sets

We produced the necessary combinations of choice sets using the numerical analysis software MATLAB. We set seven to eight choice sets per respondent, as response quality degrades when eight to 16 comparisons are made (Pearmain and Kroes, 1990). Choice sets assigned to each respondent comprise a block. A block is configured such that the number of occurrences of alternatives is equal. Table 3.4 shows the number of alternatives, choice sets, and blocks.

Table 3.4. Number of Choice Sets and Blocks for Each Country

	Blocks	Choice Sets
Indonesia	11	88
Malaysia	11	88

Source: Authors.

Sample size

A certain number of samples are needed to evaluate WTP in DCEs. (Kuriyama et al., 2013) reported that 200 samples are sufficient for statistical analysis in DCEs. We followed the formula (3–1) provided by (de Bekker-Grob et al., 2015).

$$\frac{nta}{c} > \mathbf{500}, \qquad (\mathbf{3}-\mathbf{1})$$

where *n* is the number of respondents, *t* is the number of tasks, *a* is the number of alternatives, and *c* is the largest number of attribute levels.

For our design, *c* = 5 (maximum), *t* = 8 (maximum), and *a* = 2 because the status quo alternative should not be counted. Therefore, we determined that the number of respondents should be *n* > 156, and we collected > 300 samples for each type of information material.

3. Survey Experiment

It is well established that public perceptions of unfamiliar technologies are shaped by the framing of the information given to the respondents. Our previous research (Yoshikawa, 2021) demonstrated that citizens do not possess sufficient understanding of renewable energy, and it is crucial to understand the impact of framing on impressions of renewable energy and on WTP. Moreover, this is crucial for CDR, which is new even to policymakers.

To understand possible framing impacts, a survey experiment was conducted in which participants were randomly divided into three informational groups, each receiving different info about RE (Table 3.5) and CDR (Table 3.6).

RE comes with a number of benefits such as improved energy security but also with additional costs including the costs to system integration to deal with intermittencies. We therefore created one type that emphasises the benefits of RE and another one that discusses the additional costs.

Table 3.5. Three Informational Descriptions about RE

Choice explanation 1. (neutral)	Choice explanation 2. (add positive)	Choice explanation 3. (add negative)
Though coal-, crude-oil-, and gas-fired thermal power plants contribute more than 80% of the gross electricity production in Malaysia, the electricity generation by these fossil fuels produces a large amount of greenhouse gases, which contribute considerably to the process of global warming. Switching fossil fuels to renewable energy sources (e.g., solar, wind, biomass, and small-scale or mini hydro) is considered to be an important measure of global warming mitigation, because greenhouse gases emission from the production of renewable energy is much lower than that from coal and gas thermal power.		
(blank)	In addition, they do not incur fuel costs (with the exception of biomass power generation) and are based in the domestic territory, leading to greater energy self-sufficiency and less energy imports from foreign countries. They are renewable by definition, and there is no need to worry about depletion.	However, because the energy source of renewable energy is of natural origin, it is subject to environmental factors such as weather and continuously fluctuates, and may require energy storage such as batteries for a back-up. Some energy sources, such as geothermal and wind, are concentrated in limited areas, and long-distance transmission may be required to send electricity to urban areas.
The installation of renewable energy sources might increase the cost of electricity production. As a result, the retail price of electricity may have to increase. We would like to know your WTP for the increased renewable energy production.		

For CDR, the previous research has shown the importance of 'naturalness' in affecting people's attitudes (Corner and Pidgeon, 2015). In particular, planting trees (afforestation/reforestation) is often favoured by the publics. To assess the difference in perception by technology or storage medium, we have prepared three types of information with three different storage locations: plants, rocks, and the ocean.

Table 3.6. Three Informational Materials about CDR

Choice explanation 1. (plant)	Choice explanation 2. (rock)	Choice explanation 3. (ocean)
Carbon dioxide removal or 'CDR' is a group of strategies that might be able to slow or reverse climate change. These strategies remove excess carbon dioxide (CO_2) from the atmosphere through various biological, chemical, or physical processes.		
The carbon dioxide would be stored in plant matter, such as in trees and soils, so that it cannot contribute to an increase in the Earth's temperature. This method has the potential to store CO_2 for around 20–100 years.	The carbon dioxide would be stored deep underground, for example in rock formations, so that it cannot contribute to an increase in the Earth's temperature. This method has the potential to store CO_2 for thousands of years.	The carbon dioxide would be stored in ocean waters or under the ocean floor, so that it cannot contribute to an increase in the Earth's temperature. This method has the potential to store CO_2 for hundreds or possibly thousands of years.