Energy Research & Social Science 125 (2025) 104072

Contents lists available at ScienceDirect

Energy Research & Social Science

journal homepage: www.elsevier.com/locate/erss

Original research article

How do we want to buy and sell electricity? Contrasting preferences from the United Kingdom and South Korea

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ARTICLE INFO

Dataset link: OSF Storage

Keywords:
Prosumers
Preferences
Retail electricity markets
Discrete choice experiments
UK
Korea

ABSTRACT

Electricity end-users play a crucial role in the energy transition. Their preferences shape the adoption of new electricity supply models, such as local energy markets and aggregator models. Whilst previous studies have explored end-user preferences, most have been conducted in liberalised electricity markets, and research on prosumer-specific preferences remains limited. To address these gaps, this study compares preferences of prosumers and consumers in two contrasting electricity market contexts: the liberalised United Kingdom (UK) and centralised South Korea (Korea). With a total sample of 536 respondents from the UK and 392 from Korea, discrete choice experiments were conducted to examine preferences for: (1) consumers buying electricity; (2) prosumers buying electricity; and (3) prosumers selling electricity. Findings indicate that end-user preferences in the UK and Korea differ, reflecting their distinct market structures. Korean end-users strongly prefer national and local governments as electricity generators or providers, whilst UK end-users favour non-profit organisations over private companies. Price emerged as the most important factor for buying and selling electricity, especially in the UK. Interestingly, when selling electricity, Korean prosumers preferred lower prices, suggesting avenues for further research into altruistic or collective motivations. Location factors, such as locally generated electricity, had minimal importance in both countries. Moreover, compared to the fixed-price option, end-users in both countries have yet to embrace alternative attributes, such as direct load control and peer-to-peer trading. Our study highlights the importance of socio-technical contexts in understanding end-user preferences for shaping energy transition policies.

1. Introduction

The climate crisis is driving a radical restructuring of our energy system. Distributed renewable energy resources are changing the way people relate to energy and how the electricity system operates. One important change is the emergence of prosumers who both consume and produce energy. With the increasing number of prosumers, a range of new business models are emerging to engage them in electricity markets [1].

One example is local energy market models, often exemplified by peer-to-peer (P2P) energy trading. P2P energy trading provides a platform where prosumers and consumers can trade electricity with one another [2]. This model can be implemented within a relatively small area as a local energy market or across a large geographical region via virtual trading [3].

Another new approach is aggregator models, which involve grouping prosumers, consumers, or producers to act as a single entity when trading flexibility in electricity markets [4,5]. Aggregators can optimise the use of consumers' electric appliances and prosumers' energy assets in real-time [6]. Alternatively, instead of controlling consumers' assets, they can offer time-varying tariffs that incentivise consumers to shift their electricity consumption [7]. These models and P2P energy trading are not mutually exclusive and can be combined to capture the benefits of both [2].

These new types of electricity supply models present the potential to increase end-user (prosumer and consumer) participation in energy transitions, address grid management challenges, and contribute to climate change mitigation [2,5,8,9]. However, transitions in the electricity sector involve not only technological changes but also system-level shifts in economic, environmental, and social elements, as well as regulatory regimes. Studying how these different contextual factors interact with actors, particularly end-users, is critical for enabling these benefits and facilitating energy transitions that deliver environmentally and socially beneficial outcomes.

In this context, this research investigates how electricity end-user preferences are formed in different electricity market regimes. For a comparative analysis, we examine the United Kingdom (UK), with

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https://doi.org/10.1016/j.erss.2025.104072
Received 8 September 2024; Received in revised form 26 March 2025; Accepted 4 April 2025
Available online 26 April 2025

Table 1
A comparison between the UK and Korea.

	UK	Korea
Population	69,138,192/Rank: 21	51,717,590/Rank: 29
GDP (PPP) per capita (USD)	58,906/Rank: 25	54,033/Rank: 33
Global Innovation Index	Rank: 4	Rank: 10
Climate target	Net zero by 2050	Net zero by 2050
Retail electricity transaction	Competitive with multiple retailers	Monopolised by a public enterprise

Sources: Worldometer(2024); WorldBank(2024); WIPO(2023); ClimateActionTracker(2023).

its liberalised market, and South Korea (Korea), with its centralised market. Both the UK and Korea are high-income countries with similar population sizes, high technological capability, and a shared 'Net Zero by 2050' target (Table 1). However, in Korea, electricity transactions are monopolised by a public enterprise, making it the only country with a monopoly among the so-called advanced nations [10]. Meanwhile, the UK has been one of the early adopters of energy market liberalisation, and its retail electricity market is competitive and vertically disaggregated.

Interestingly, despite their contrasting regimes, both are witnessing innovative trials in the electricity markets whilst undergoing transitions to achieve the same climate target. We can also gain insights that may be extrapolated to other countries with similar economic and technological profiles but with market structures ranging from monopolised to competitive. We expect this study to contribute to the broader discourse on global electricity system transitions whilst addressing specific national contexts.

This study aims to develop a quantitative understanding of prosumer and consumer preferences for new electricity supply models in the UK and Korea. The rest of the paper is organised as follows: Section 2 provides an overview of retail electricity markets in the two countries, reviews the role of users in socio-technical transitions, and examines relevant literature on user preferences for electricity supply models. Section 3 details the research design, describing discrete choice experiments (DCEs) as the main method. Section 4 presents and discusses the results from the two stages of surveys. Finally, Section 5 concludes by discussing the implications of the findings.

2. Background and literature review

2.1. Retail electricity markets in the UK and Korea

As an early pioneer of electricity market deregulation, the UK has undergone significant reforms since the late 1980s [11]. The current UK retail electricity market is essentially a liberalised system in which multiple suppliers purchase energy in the wholesale market, pay transmission and distribution charges, and fulfil regulatory requirements [12]. These suppliers act as the primary interface between consumers and the energy system, and each consumer can have only one supplier at a time [13,14].

This 'supplier hub' model has been challenged in recent years, as it can prevent potential new entrants with niche business models from entering the market [13]. Addressing this concern, in 2019, aggregators were allowed to participate in the Balancing Mechanism without a supplier licence [15,16]. Although most of them have focused on larger industrial or commercial customers, some are developing domestic aggregator business models [17].

In the recent UK retail electricity market, innovative supply models are emerging that decrease carbon emissions whilst reducing electricity bills for consumers. One notable case is National Grid ESO's Demand Flexibility Service, introduced in 2022 [18]. This initiative incentivised households and businesses to participate in a flexibility market through energy suppliers and aggregators by voluntarily adjusting their demand, particularly during peak winter days [19].

The UK has also been at the forefront of early trials of P2P electricity trading. For example, Piclo, the UK's first online P2P trading platform, was trialed in 2015 [20]. In 2019, a pilot project called 'CommUNITY' was implemented for social housing tenants in Brixton, London [21]. However, P2P trading is not permitted under current UK regulations and remains confined to experimental settings within regulatory sandboxes [22].

In Korea, on the other hand, Korea Electric Power Corporation (KEPCO) has a monopoly in retail electricity transactions [23]. Although multiple generation companies produce electricity, KEPCO transports it through the transmission and distribution network and sells it to customers. KEPCO's monopolistic position has been considered providing an essential public good and has led to intense debates in the process of electricity market reforms [24].

Despite this centralised market structure in Korea, recent government initiatives are encouraging the innovation of business models and involvement of other actors. For instance, a collaboration between Gridwiz, a Korean aggregator, and Electron, a UK-based energy technology firm, demonstrated a 'flexible energy trading blockchain platform'. This initiative was jointly supported by the governments of both countries. [25].

A few pilot projects of P2P electricity trading have also been tested or are underway in Korea. In 2017, KEPCO and the Ministry of Science and ICT trialed a blockchain-based P2P energy trading system in two apartment buildings in Seoul and nine buildings within KEPCO's facilities [26]. In 2021, the Ministry of Land, Infrastructure and Transport approved the 'Smart City Regulatory Sandbox' in Jeju Island. This four-year trial will test energy trading services that enable neighbours to trade renewable electricity among themselves [27].

More recently, in 2023, the Special Act on Promotion of Distributed Energy was enacted to address the limitations of the centralised electricity system and to lay the foundation for promoting distributed energy and balancing electricity supply and demand [28]. The Act establishes a legal basis for virtual power plants (VPPs) and the creation of distributed energy specialised regions [29]. Jeju is pursuing to become Korea's first specialised region by experimenting with new business models, such as trading surplus electricity through VPPs and implementing flexible real-time tariff systems [30].

Against this backdrop of existing market structures and emerging innovations in the two countries, this study investigates end-user preferences for new retail electricity supply models.

2.2. The role of users in socio-technical transitions

Moving towards a low-carbon electricity system is a fundamental long-term shift to a more sustainable mode of production and consumption, which can be conceptualised as a 'sustainability transition [31].' A transition from one socio-technical system to another is a co-evolutionary process involving not only technological changes but also other elements such as economic, social, cultural, and regulatory factors. [32]. The Multi-Level Perspective (MLP) on transitions [33–35] offers a useful framework to examine the alignment of processes within and among three levels: (1) the micro-level of niche innovations; (2) the meso-level of socio-technical regimes; and (3) the macro-level of the socio-technical landscape [34].

Here, users play a critical role in shaping transition processes. Based on evolutionary economics as one of their theoretical roots, MLP researchers further widened the concept of regimes to include not only firms but also other social groups, such as users from the demand side and policymakers from public authorities [33,36]. The dynamic relationships between these actors and regimes reproduce socio-technical systems [32]. Niches, on the other hand, act as incubation rooms for innovations, providing space for learning processes and building the social networks that can support innovations [36]. As the new innovation steadily improves, users interact with and incorporate it into their practices, articulating their preferences [32].

When this framework is applied to retail electricity markets, climate change acts as a broader exogenous factor driving the need for low-carbon transitions. In response to this landscape pressure, new electricity supply models are emerging as niche innovations. Users — both traditional electricity consumers and newly emerging prosumers — play a critical role in either supporting the widespread adoption of these niche models or reinforcing existing systems. Their preferences and subsequent decision-making are influenced by other elements within the regime, such as electricity providers, policy frameworks, and social influences. In the UK, the regime operates within a liberalised market, whereas in Korea, it is centralised.

Despite the importance of users, the study of human behaviour in consumption and everyday life remains an underdeveloped area in sustainability transitions [37]. Understanding how end-user preferences are constructed is a crucial first step in identifying the types of niche innovations likely to drive transitions. This understanding can help inform policies that shape the future pathways of electricity market transitions.

2.3. User preferences for new electricity supply models

Several studies have identified factors influencing end-users' motivation for new electricity supply models, including local energy markets [38–40], P2P electricity trading [40–46], and direct load control demand response provided by aggregators [47]. Whilst most of them have been conducted in European countries or liberalised retail electricity markets, their findings can still provide useful insights for this comparative research between the UK and Korea. The key factors identified from the literature are categorised into five domains: (1) economic, (2) environmental, (3) spatial, (4) social, and (5) technical.[1] These broad categories served as the basis for identifying key attributes of new electricity supply models for this study.

Focusing on the literature from the UK and Korea, several key factors influencing end-user motivations were reviewed. In the UK, Steadman [45] found that UK consumers' decisions are less influenced by monetary incentives compared to those in Spain and Italy. Similarly, Watson et al. [40] found that there are other attributes, besides cost, that are similarly or more important to UK consumers in the context of local energy and P2P trading. However, it may be necessary to revisit economic factors, given the recent energy crisis impacting household energy bills. Regarding spatial aspects, Fell et al. [41] investigated demand for blockchain-enabled P2P energy trading and found that UK consumers preferred schemes operating at the city or regional level. The results might differ in Korea, where the electricity sector is highly centralised and led by the national government.

In Korea, previous studies [46,48] have consistently found that cost considerations are important in end-user decision-making related to electricity. Li et al. [46] analysed consumer preferences for different types of P2P trading platforms. However, their research mainly focused on economic and technical aspects and did not consider environmental or spatial attributes.

Adams et al. [9]'s systematic review suggests that relatively few studies have quantified general willingness to participate in decentralised energy business models. To fill this gap, this study aims to quantitatively assess end-user preferences across various attributes.

[1] See Appendix A.1.

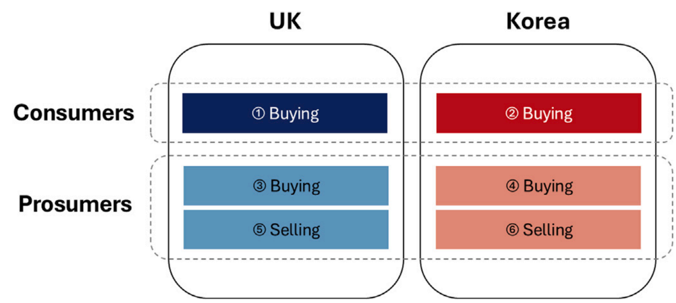

Fig. 1. Six types of end-user preferences.

This approach would also provide a foundation for future research utilising modelling methods.

Moreover, most previous studies have assumed a single type of electricity supply model, such as P2P trading, and identified factors influencing end-user motivations within that particular setting. Therefore, it remains unanswered which types of electricity supply models, among many possible options, will potentially be preferred by end-users.

Additionally, there is limited literature on whether prosumer preferences change when selling and buying electricity. This is an important research gap considering the dual role that prosumers can play in both demand and supply sides. Although Hahnel and Fell [49] found that prosumers' buying and selling prices vary depending on the involved trading actors, their study focused on pricing decisions in P2P communities rather than their overall preference structure for different types of supply models.

Addressing these research gaps, this study collected primary data on both consumer and prosumer choices in the UK and Korea to answer the following research questions:

First, in the MLP, regimes maintain stable socio-technical systems shaped by various social groups, including users. Given the contrasting retail electricity market regimes in the UK and Korea, user preferences may differ. This study tests this hypothesis:

- **RQ1: (UK vs. Korea)** Do current prosumer and consumer preferences differ between the two countries? If so, how do they differ?

Prosumers' decisions to generate their own electricity may reflect different interests, such as environmental concerns or financial incentives, suggesting they may have unique priorities compared to consumers:

- **RQ2: (Consumers vs. Prosumers)** Do prosumer preferences differ from consumer preferences? If so, how do they differ?

In the retail electricity market, prosumers play a dual role: selling excess electricity and buying when their generation is insufficient. This study explores their preferences for different electricity supply models in these roles:

- **RQ3: (Buying vs. Selling)** Do prosumer preferences change when buying and selling electricity? If so, how do they change?

Fig. 1 summarises the six types of end-user preferences that will be elicited to answer the above questions.

3. Methods and data

This section first outlines the two stages of the surveys: the screening surveys and the main surveys. The structure of the main method, DCEs, and the mixed logit analysis (MIXL) are described in detail. This section and the subsequent results section are reported following the relevant CONSORT guidelines [50].

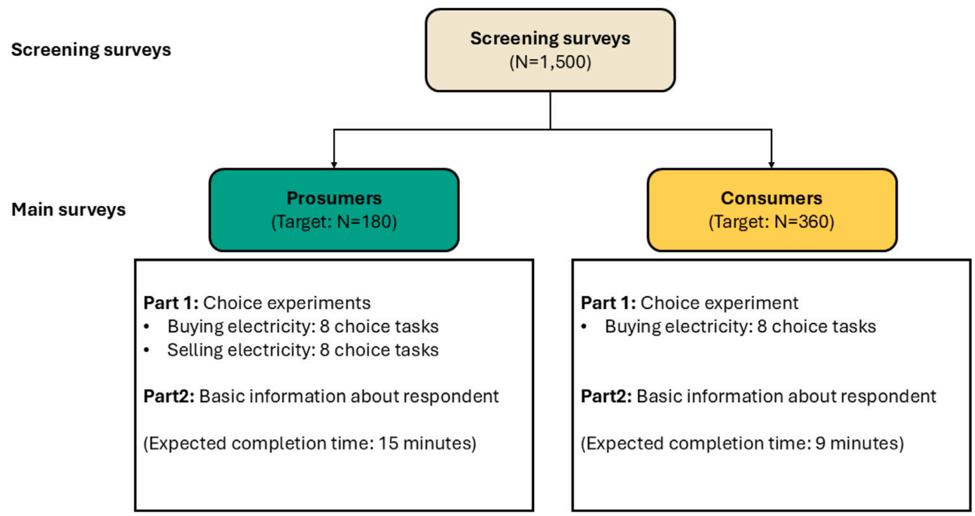

Fig. 2. Research design: two stages of surveys.

3.1. Research design: Two stages of surveys

Primary data was collected through online surveys,[2] and participants were recruited via reputable survey platforms: Prolific in the UK and Embrain in Korea. The survey process involved two stages: a screening survey to identify past, current, or prospective prosumers, and main surveys aimed at eliciting prosumer and consumer preferences using a choice experiment method (Fig. 2). A pre-analysis plan (PAP) was registered before collecting data.

The primary goal of the screening survey was to screen a gender-balanced sample (N = 1500 in each country) using the following question and recruit participants for the main surveys. The screening survey was also expected to provide insights into the current population ratio at different stages of residential solar adoption, since no previous studies, to our knowledge, have examined this in the two countries.

[Q] Which of the following best describes your current situation regarding solar panel installation for generating electricity?

(a) I have solar panels installed at my home.
(b) I have signed a contract to install solar panels at my home, but they haven't been installed yet.
(c) I am actively researching solar panel options (researching on websites, obtaining quotes, etc.) but haven't installed them yet.
(d) I do not currently have solar panels, but I have had them within the past 5 years.
(e) I am interested in installing solar panels but haven't taken any steps yet.
(f) I am not interested in, or unable to, install solar panels at my home.

By calculating back from the minimum required sample size for each sub-group in the main survey (refer to Section 3.2), the sample size for the screening survey was determined by applying the following assumptions: (1) 18% of respondents in the screening survey will be categorised as prosumers[3]; and (2) 70% of respondents in the screening survey will also participate in the main survey.[4] The screening survey was conducted in Korea between 21/11/2023 and 28/11/2023, and in the UK on 04/12/2023.

The main survey comprised two parts: (1) conducting DCEs and (2) collecting basic information about respondents, such as socio-demographic details and attitudes towards technology. At the end of the survey, respondents were given the opportunity to share their thoughts about the survey content in an optional free text box. This text data could supplement the quantitative DCE results by providing additional qualitative insights where relevant. The data were collected during the same period in both countries: between 19/12/2023 and 02/01/2024 in Korea, and between 20/12/2023 and 03/01/2024 in the UK.

3.2. Discrete choice experiments

DCEs are a stated preference method that involves the generation and analysis of choice data, typically implemented in survey form [51]. DCEs elicit preferences indirectly from respondents' repeated choices and separately identify the value of individual attributes [52].

Since there is limited availability of actual behaviour data for niche electricity supply models, DCEs were utilised to create hypothetical markets that are currently not available. Whilst DCEs have advantages over other stated preference methods, such as providing a richer description of preferences and giving the researcher greater control over the experiment [53], they can be cognitively demanding for respondents [54]. Following Lancsar and Louviere [55]'s guide, the DCE design carefully balanced the trade-off between minimising respondents' cognitive fatigue and ensuring statistical efficiency.

Respondents were presented with a series of hypothetical choice tasks (8 for consumers and 16 for prosumers) and asked to select their preferred option between paired alternatives. Each choice task was unlabelled to encourage respondents to focus on trading off attribute levels [56]. Since all respondents must consume electricity in reality, an opt-out ("do nothing") alternative was not included.

The attributes and levels were established by building on the literature review (Appendix A.1.) and considering the contexts of the UK and Korea. This study includes six attributes for choice tasks related to buying electricity and five attributes for tasks related to selling electricity, with two to five levels per attribute (Table 2).

Various electricity supply models are assumed to be offered by an 'electricity provider'[5] who mediates transactions between electricity

[2] The surveys are available in Appendix C.
[3] This is based on the results of a small-scale pre-test conducted with 100 participants in the UK.
[4] This assumption is drawn from information provided by a market research company, based on their previous experience.
[5] To differentiate these actors offering new electricity supply models from conventional energy suppliers, we introduced the term 'electricity provider'.

Table 2
Attributes and levels.

When buying electricity	
Attributes	**Levels**
(1) Electricity bill per month	20% lower (−) than your current bill 10% lower (−) than your current bill The same as your current bill 10% higher (+) than your current bill 20% higher (+) than your current bill
(2) Percentage of renewable electricity sources	25% 50% 75% 100%
(3) Location of electricity generation	In your local community Within [country of survey]
(4) Electricity generator	Private company National government Local government Non-profit organisation Households with small-scale generators (e.g. solar panels)
(5) Electricity provider	Private company National government Local government Non-profit organisation
(6) Added benefit	You can always use electricity at a fixed price You can save money by letting the provider adjust when certain appliances, like your dishwasher, run. You can choose when to use electricity, depending on the varying prices throughout the day. You can additionally choose your preferred generators using an app on your phone
When selling electricity	
Attributes	**Levels**
(1) Selling price	20% lower (−) than the average retail electricity price 10% lower (−) than the average retail electricity price The average retail price 10% higher (+) than the average retail electricity price 20% higher (+) than the average retail electricity price
(2) Location of final consumers	In your local community Within [country of survey]
(3) Final consumers	Family or friends Households in fuel poverty Public facilities (schools, hospitals, etc.) Not-specified
(4) Electricity provider	Private company National government Local government Non-profit organisation
(5) Added benefit	Your excess electricity is automatically sold at a fixed price. You can earn extra money by letting the provider adjust when your electricity is sold. You can choose when to sell your electricity, depending on the varying prices throughout the day. You can additionally choose your preferred final consumers using an app on your phone.

generators and end-users, as well as between prosumers and final electricity consumers. We introduced the attributes of who the electricity provider and generator are, as these have not been extensively considered in most previous studies conducted in liberalised markets.

The added benefit attribute is based on the characteristics of: (1) the incumbent model, (2) the aggregator model with direct control over end-users' electricity usage timing, (3) the aggregator model with end-user control through time-of-use (ToU) tariffs, and (4) P2P electricity trading.

For prosumers selling electricity, the 'final consumers' attribute was included to explore whether specific consumer groups, such as 'households in fuel poverty,' would be preferred compared to a 'not-specified' option. Prosumers might positively perceive trading electricity with fuel-poor households as an altruistic or socially responsible act, potentially supporting broader community benefits and social equity [44,57]. Conversely, prosumers may also view this option negatively, particularly if it conflicts with their own financial interests.

Four questionnaire templates were developed: one each for UK consumers and prosumers in English, and one each for Korean consumers and prosumers in Korean. At the beginning of the survey, essential information was provided, and informed consent to participate was obtained. Background information about the electricity market structure and the context of the choice tasks were presented using simplified diagrams to aid respondents' understanding.

Given the number of attributes and their levels, a fractional factorial design was used by selecting a subset of possible combinations. Each respondent was randomly assigned to one of 150 pre-generated choice task designs. This controlled random design[6] helps ensure a nearly orthogonal and balanced design for each respondent, whilst mitigating potential biases caused by anchoring and learning effects. The consumer group was presented with eight choice tasks for buying electricity, whilst the prosumer group received 16 tasks: eight for buying and eight for selling electricity.

Iterative pilot testing was conducted to improve the questionnaires. 15 individuals in the UK and 12 in Korea, including both non-energy and energy experts, participated in the pilot testing. Their feedback

[6] See Appendix A.1 for details.

helped re-examine the wording of the instructions, the order of attributes in the choice tasks, and the length of the experiments.

Currently, there is no one-size-fits-all approach to determining the minimum sample size for a DCE (See Appendix A.2 for details). Traditional sampling theories do not address the minimum sample size needed to ensure the statistical power of hypothesis tests on estimated coefficients [58], which is the focus of this research. Although researchers often aim to maximise the sample size within budget constraints [59], overpowering was not a viable option for this research, as the ratio of potential prosumers was expected to be limited in both countries.

As a practical solution, this study applied a widely used rule of thumb suggested by Johnson and Orme [60],[7] which is based on the number of levels, alternatives, and choice tasks. Using 500 as a multiplier ($m = 500$), the minimum sample size was calculated to be 180. With a larger multiplier ($m = 1,000$) [61], the minimum was 360. Given the challenge in recruiting prosumers, a sample size of 180 was applied to the prosumer group and 360 to the consumer group.[8]

3.3. Analysis: Mixed logit

MIXL, or random-parameters logit, is a flexible model that allows the parameters associated with each observed variable to vary randomly across individuals [62,63]. This study used MIXL for econometric analysis to accounts for preference heterogeneity [55] and to allow for efficient estimation even when respondents make repeated choices [62].

Preferences can be measured in the form of utility functions. The utility function of respondent 'n' choosing alternative 'j' in choice set 't' is described as follows:

$$U_{njt} = \beta_n X_{njt} + \epsilon_{njt} \tag{1}$$

where β_n is a vector of coefficients that vary over respondents with density $f(\beta|\theta)$, X_{njt} is a vector of attributes, and ϵ_{njt} is an error term. θ refers collectively to the parameters of the density distribution. In this study, the estimation results of θ are presented with the means and standard deviations (SDs) of β_n, assuming that $f(\beta|\theta)$ follows a normal distribution.

In MIXL, maximum 'simulated' likelihood is estimated through simulation, as direct calculation is not feasible [64]. Using the 'mlogit' package in R, this study applied Halton sequences with 1500 draws for simulation (See Appendix A.3 for details).

The relative importance of attributes helps to determine which attributes are more or less important when respondents make decisions. The importance score can be calculated by the ratio of the utility range — the difference between the highest and lowest utility values — of a particular attribute to the sum of all utility ranges of all attributes [65,66]. For a group, it is best to compute importance scores for individual respondents and then average them [65]. Based on the estimated means and SDs of β_n, individual-specific coefficients were computed, and importance scores were calculated and normalised.

4. Results and discussion

This section presents the sample descriptions and results from the screening surveys and the main DCE surveys. The study's limitations are then reviewed, followed by a discussion of the key findings.

4.1. Screening surveys: Sample descriptions and results

Table 3 presents the demographic characteristics of the samples from both countries. In terms of gender and age, the Korean sample can be considered nationally representative. The UK sample is balanced in terms of gender but over-represents individuals aged 30–49 and under-represents those 60 years and older. However, we attempted to adjust this imbalance by ensuring that participants invited to the main survey maintained a balanced representation across gender and age groups using stratified random sampling.

In this study, the 'prosumer' group has been expanded to include not only those who already have solar panels installed at their home ((a) in Table 4), but also those who are actively taking steps to install them ((b) and (c)) or have had experience of having them within the past five years ((d)). These individuals are expected to make choices from a prosumer's perspective based on their common interest and previous experience (See Section 4.4 for limitations). Respondents who haven't taken any steps despite their interest in installing solar panels ((e)) or who are not interested or unable to install them ((f)) are categorised as consumers.

The results indicate that over 18% in the UK were classified as prosumers, compared to approximately 14% in Korea. A higher ratio of UK respondents (9.27%) are actively researching solar panel options compared to Korean respondents (5.87%), increasing the UK prosumer pool. In Korea, a higher ratio of respondents (35.33%) are not interested in, or unable to, install solar panels compared to the UK (26.60%). This may be partially due to the fact that a dominant share of housing in Korea (51.9%) consists of apartments [67].

All respondents in the prosumer groups were invited to participate in the main surveys. From the consumer pool in each country, 515 respondents were randomly selected for the main survey considering gender and age group balance (see Appendix B.1 for details).

4.2. DCEs: Sample descriptions

In the UK, 226 out of 273 invited prosumers (82.8%) responded to the main survey, whilst in Korea, 177 out of 211 (83.9%) prosumers responded. Among the consumer group, 440 out of 515 (85.4%) in the UK and 443 out of 515 (86.0%) in Korea participated in the main survey. After applying the data exclusion criteria[9] based on the minimum survey completion times set in the PAP, responses from 174 prosumers and 362 consumers in the UK were retained. In Korea, 80 prosumer responses and 312 consumer responses were retained (discussed further in Section 4.4).

The samples from all sub-groups, particularly the consumer groups, are generally representative in terms of age, gender, and region (Tables 5 and 6). However, there is an under-representation of individuals aged 75 and older across all sub-groups. This might be due to their lower familiarity with online surveys and lesser interest in the topic at their life stage. Due to the nature of prosumers, the prosumer samples were not intended to be nationally representative. In both countries, the prosumer samples have a higher proportion of individuals aged 25 to 54 and those with higher household incomes. A higher proportion of prosumers turned out to be early adopters of new technologies.

4.3. DCEs: Results

In this section, the results from MIXL are described attribute by attribute.

[7] Sample size $\geq (m \times c)/(t \times a)$
m = multiplier (500–1000)
c = largest number of levels across all attributes
t = number of choice task per respondent
a = number of alternatives per task.

[8] These calculations were conservative, based on the original design with seven choice tasks per respondent. After pilot testing, the number of choice tasks was increased to eight. This means the minimum sample sizes could be reduced to 157 and 313, respectively.

[9] See Appendix B.2 for details.

Table 3
Screening surveys: Sample description.

	UK			Korea		
	Sample (N = 1500)		Across the UK	Sample (N = 1500)		Across Korea
	Number	Ratio (%)	Ratio (%)	Number	Ratio (%)	Ratio (%)
Gender						
Female	750	50.00	51.75	735	49.00	50.55
Male	750	50.00	48.25	765	51.00	49.45
Total	1500	100.00	100.00	1500	100.00	100.00
Age						
18–19 years	6	0.04	–	–	–	–
20–29 years	214	14.27	16.30	251	16.73	15.93
30–39 years	429	28.60	17.62	268	17.87	15.96
40–49 years	369	24.60	16.39	322	21.47	19.15
50–59 years	267	17.80	17.86	349	23.27	20.07
60 years and older	207	13.80	31.84	310	20.67	28.89
Unknown	8	0.53	–	–	–	–
Total	1500	100.00	100.00	1500	100.00	100.00

Table 4
Screening surveys: Results.

[Q] Which of the following best describes your current situation?	UK		Korea	
	Number	Ratio (%)	Number	Ratio (%)
Prosumer group				
(a) I have solar panels installed at my home.	109	7.27	76	5.07
(b) I have signed a contract to install solar panels at my home.	5	0.33	8	0.53
(c) I am actively researching solar panel options (researching on websites, obtaining quotes, etc.).	139	9.27	88	5.87
(d) I do not currently have solar panels, but I have had them within the past 5 years.	20	1.33	39	2.60
Sub-total	**273**	**18.20**	**211**	**14.07**
Consumer group				
(e) I am interested in installing solar panels but haven't taken any steps yet.	828	55.20	759	50.60
(f) I am not interested in, or unable to, install solar panels at my home.	399	26.60	530	35.33
Sub-total	**1227**	**81.80**	**1289**	**85.93**
Total	1500	100.00	1500	100.00

4.3.1. Buying electricity: Consumers & prosumers

Table 7 presents the MIXL results for consumers and prosumers buying electricity. The percentage of renewable electricity sources and the change in electricity bills are treated as continuous variables, whereas the different levels of the other attributes are treated as dummy variables. Fig. 3 summarises the importance of attributes as percentages.

Consumers and prosumers in both the UK and Korea demonstrate statistically significant preferences for electricity generated from higher percentages of **renewable sources**. However, the relative importance of this attribute, compared to other attributes, is greater in the UK (18.7% for consumers and 20.2% for prosumers) than in Korea (11.9% for consumers and 12.8% for prosumers).

Lower monthly **electricity bills** are more preferred, and this is statistically significant across all sub-groups. In fact, price is the most important attribute for all sub-groups, particularly in the UK (59.5% for consumers and 56% for prosumers) compared to Korea (46.4% for consumers and 36% prosumers).

For UK consumers and prosumers, the mean coefficients for electricity generated within their **local community** are 0.01 and 0.08, respectively. For Korean consumers and prosumers, the corresponding values are −0.071 and −0.201, respectively. However, none of the coefficients were statistically significant at the 10% level. The location of electricity generation is the least important attribute across all sub-groups.

In Korea, consumers prefer the national government as their primary choice for both the **electricity generator** (0.807) and **provider** (1.126), followed by the local government (0.418 for generator and 0.836 for provider). Korean prosumers also prefer these two entities, with the local government being slightly more favoured as an electricity generator (1.331) and the national government as an electricity provider (1.131). UK consumers, on the other hand, favour non-profit organisations (0.463 for generation and 0.676 for provision), followed by the local government (0.356 for generation and 0.559 for provision). UK prosumers prefer households with small-scale generators as their top choice for generation (0.8), followed by non-profit organisations (0.723). For electricity provision, UK prosumers favour non-profit organisations (0.59) over private companies. In terms of relative importance, these attributes are more significant in Korea than in the UK.

Regarding **added benefits**, consumers in both countries show statistically significant lower preferences for the option to select their preferred generators through a mobile application (−0.573 in the UK and −0.308 in Korea), compared to the simple fixed-price option. Similarly, UK consumers and Korean prosumers show lower preferences for allowing their electricity provider to adjust the usage timing of electric appliances (−0.667 and −0.556, respectively), despite potential financial benefits. Whilst UK prosumers and Korean consumers show positive mean coefficients for ToU tariffs (0.21 and 0.108, respectively), these are not statistically significant.

4.3.2. Selling electricity: Prosumers

Table 8 presents the MIXL results for prosumers selling electricity. The change in selling prices is treated as a continuous variable, whereas the different levels of the other attributes are treated as dummy variables. Fig. 4 compares the importance of each attribute.

Table 5
DCEs: UK sample description.

	UK		
	Respondents (%)		Across the UK (%)
	Consumers (N = 362)	Prosumers (N = 174)	
Gender			
Female	48.07	44.83	51.75
Male	51.38	55.17	48.25
Non-binary or other*	0.28	0.00	–
Prefer not to say	0.28	0.00	–
Age			
18–24	6.63	4.60	7.85*
25–34	14.36	20.11	17.42
35–44	19.89	25.86	16.81
45–54	19.61	25.86	17.23
55–64	21.82	14.37	16.49
65–74	14.09	7.47	12.99
75 and older	3.59	1.72	11.21
Prefer not to say	0.00	0.00	–
Region			
Scotland	6.63	7.47	8.06
Northern Ireland	3.04	1.72	2.83
Wales	3.59	5.75	4.63
North East England	4.97	5.75	3.97
North West England	9.39	8.62	11.12
Yorkshire & Humberside	8.84	6.90	8.20
East Midlands	8.29	6.32	7.30
West Midlands	8.01	6.90	8.91
East of England	6.08	7.47	9.47
London	11.88	12.64	13.12
South East	17.96	18.39	13.88
South West	11.33	12.07	8.53
Prefer not to say	0.00	0.00	–
Household annual income			
Up to £10,000	4.42	3.45	–
£10,001 to £20,000	12.98	13.22	–
£20,001 to £30,000	17.96	12.07	Median:
£30,001 to £40,000	14.36	8.05	£32,400
£40,001 to £50,000	15.19	13.79	–
£50,001 to £60,000	8.29	12.07	–
Over £60,001	23.20	32.76	–
Prefer not to say	3.59	4.60	–
Adoption of new technology			
I am sceptical of new technologies and use them only when I have to.	5.52	3.45	–
I am usually one of the last people I know to use new technologies.	12.43	7.47	–
I usually use new technologies when most people I know do.	53.59	38.51	–
I like new technologies and use them before most people I know.	23.20	36.21	–
I love new technologies and am among the first to experiment with and use them.	4.14	13.79	–
Prefer not to say	1.10	0.57	–

Interestingly, Korean prosumers prefer lower **selling prices** (−0.041), whilst UK prosumers favour higher selling prices (0.065). All coefficients are statistically significant at the 1% level. Despite the opposite preference directions, the selling price is the most important attribute for prosumers in both countries, with it being more important in the UK (63%) than in Korea (40%).

Final electricity consumers located in the **local community** result in mean coefficients of 0.087 for UK prosumers and −0.131 for Korean prosumers. However, these coefficients are not statistically significant. The location of final consumers is the least important attribute for prosumers in both countries (4.6% in the UK and 6.4% in Korea). In other words, whether the consumers buying their electricity are located locally or elsewhere within the country is not significant.

Both UK and Korean prosumers prefer households experiencing fuel poverty as their **final electricity consumers** (0.478 and 0.791, respectively), with this preference being statistically significant. Public facilities, such as schools and hospitals, have the second highest mean coefficients in both countries (0.459 in the UK and 0.257 in Korea), although this result is not statistically significant in Korea. Overall, the relative importance of this attribute is considerable, with 17.1% for UK prosumers and 20.4% for Korean prosumers.

Similar to the case of buying electricity, Korean prosumers prefer the national government as the **electricity provider** facilitating the selling process to final consumers (0.901), followed by local governments (0.592). Private companies are the least preferred option as an electricity provider in Korea. On the other hand, the mean coefficients in the UK are not statistically significant. With that caveat, whilst non-profit organisations yield the highest mean coefficient (0.238), private companies do not appear to be a preferred option compared to other alternatives, even in the UK. This attribute is a far more important in Korea (23.7%) than in the UK (6%).

In both countries, although the results are not statistically significant, all other **added benefit** options yield negative mean coefficients compared to the fixed-price scheme. The relative importance of this attribute is approximately 9% in both countries.

Table 9 summarised the attributes and levels with the highest mean coefficient across the sub-groups, irrespective of their statistical significance.

4.4. Limitations

By addressing the limitations early on, we aim to provide a more informed interpretation and analysis of the results in the discussion

Table 6
DCEs: Korean sample description.

	Korea		
	Respondents (%)		Across Korea (%)
	Consumers (N = 312)	Prosumers (N = 80)	
Gender			
Female	53.21	50.0	50.55
Male	46.15	50.0	49.45
Non-binary or other	0.00	0.0	–
Prefer not to say	0.64	0.0	–
Age			
20–24	5.45	3.75	7.69
25–34	14.42	20.00	15.54
35–44	18.91	20.00	17.70
45–54	18.59	23.75	20.32
55–64	24.36	26.25	18.99
65–74	16.67	5.00	11.30
75 and older	1.28	1.25	8.45
Prefer not to say	0.32	0.00	–
Region			
Seoul	18.91	20.00	18.30
Busan	9.94	2.50	6.36
Daegu	6.09	3.75	4.57
Incheon	6.73	3.75	5.84
Gwangju	1.60	6.25	2.74
Daejeon	1.60	5.00	2.78
Ulsan	0.96	1.25	2.14
Gyeonggi	22.76	32.50	26.68
Gangwon	2.24	3.75	2.94
Chungbuk	3.21	2.50	3.12
Chungnam	3.85	1.25	4.21
Jeonbuk	3.21	5.00	3.41
Jeonnam	3.21	3.75	3.52
Gyeongbuk	6.09	2.50	4.98
Gyeongnam	7.37	3.75	6.34
Jeju	1.60	1.25	1.33
Sejong	0.64	1.25	0.74
Prefer not to say	0.00	0.00	–
Household annual income			
Up to ₩15,000,000	8.01	3.75	–
₩15,000,001 to ₩30,000,000	15.06	6.25	Median:
₩30,000,001 to ₩45,000,000	18.27	15.00	₩34,540,000
₩45,000,001 to ₩60,000,000	20.51	20.00	–
₩60,000,001 to ₩75,000,000	14.10	21.25	–
₩75,000,001 to ₩90,000,000	9.29	11.25	–
₩KRW 90,000,000	12.18	21.25	–
Prefer not to say	2.56	1.25	–
Adoption of new technology			
I am sceptical of new technologies and use them only when I have to.	6.73	11.25	–
I am usually one of the last people I know to use new technologies.	9.62	7.50	–
I usually use new technologies when most people I know do.	54.17	37.50	–
I like new technologies and use them before most people I know.	23.40	37.50	–
I love new technologies and am among the first to experiment with and use them.	4.17	6.25	–
Prefer not to say	1.92	0.00	–

section. This study's limitations mainly stem from: (1) challenges in recruiting prosumers in both countries, (2) the small sample sizes available after data cleaning, and (3) subsequent issues with statistical significance.

According to Gill [68], only 4.1% of UK homes have solar panel installations in April 2023. In Korea, the current ratio is anticipated to be lower than that of the UK.[10] We partially overcame this recruitment challenge by extending the pool of prosumers using a broader definition. Whilst the level of experience with the technology and market may vary among these individuals, we assume that their shared interest or prior experience in energy generation provides a common foundation for decision-making.

Despite this attempt, after applying the data exclusion criteria based on minimum survey completion times, a considerable number of responses had to be excluded. Even though the minimum completion times had been estimated through pilot testing, the actual completion times in all sub-groups were shorter than the estimated times. Particularly, in Korea, only 80 out of 177 prosumer responses were retained. Given the choice between data quality and sample size, we prioritised data quality by removing rushed responses.

This shortfall in the sample might affect the robustness of the statistical analysis, potentially limiting the generalisability of the findings for this sub-group. However, the MIXL results indicate that the robustness of the analysis for the Korean prosumer group is comparable to that

[10] The number of households with solar panels was reported to be 0.34 million in 2017 [69], but this data is now outdated.

Table 7
MIXL results — Buying.

Attribute	Level	UK		Korea	
		Consumers	Prosumers	Consumers	Prosumers
		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Renewable electricity sources	25%, 50%, 75%, 100%	0.030*** (0.027***)	0.039*** (0.046***)	0.012*** (0.020***)	0.013*** (0.007)
Electricity bill per month	−20%, −10%, 0%, +10%, +20%	−0.198*** (0.113***)	−0.230*** (0.139***)	−0.105*** (0.093***)	−0.074*** (0.055**)
Location of electricity generation	Within the country *(baseline)*	–	–	–	–
	In your local community	0.010 (0.337)	0.080 (0.712)	−0.071 (0.834***)	−0.201 (0.163)
Electricity generator	Private company *(baseline)*	–	–	–	–
	National government	0.149 (0.594)	0.297 (0.989)	0.807*** (0.062)	1.018*** (1.610**)
	Local government	0.356** (0.651)	0.671* (0.265)	0.418** (0.657)	1.331*** (0.882)
	Non-profit organisation	0.463** (0.186)	0.723* (0.156)	0.229 (1.001**)	0.669** (1.142*)
	Households with small-scale generators	0.171 (0.829*)	0.800* (1.857**)	0.238 (0.971**)	0.563* (0.664)
Electricity provider	Private company *(baseline)*	–	–	–	–
	National government	0.160 (0.052)	0.262 (1.157*)	1.126*** (1.078***)	1.131*** (1.321**)
	Local government	0.559*** (0.444)	0.240 (0.174)	0.836*** (0.394)	0.998*** (0.028)
	Non-profit organisation	0.676*** (0.782*)	0.590* (0.625)	0.498*** (0.813**)	0.471 (0.701)
Added benefit	Fixed price *(baseline)*	–	–	–	–
	Provider control	−0.677*** (1.622***)	−0.447 (1.750**)	−0.221 (1.237***)	−0.556* (1.243*)
	Consumer control (ToU tariffs)	−0.046 (0.908**)	0.210 (1.494**)	0.108 (0.995***)	−0.355 (0.259)
	Selection	−0.573*** (0.044)	−0.124 (0.551)	−0.308** (0.575)	−0.164 (0.622)

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
(The significance of the mean indicates whether the mean estimate is statistically different from zero, whilst the significance of the SD indicates whether there is unobservable heterogeneity in preferences around the mean.)

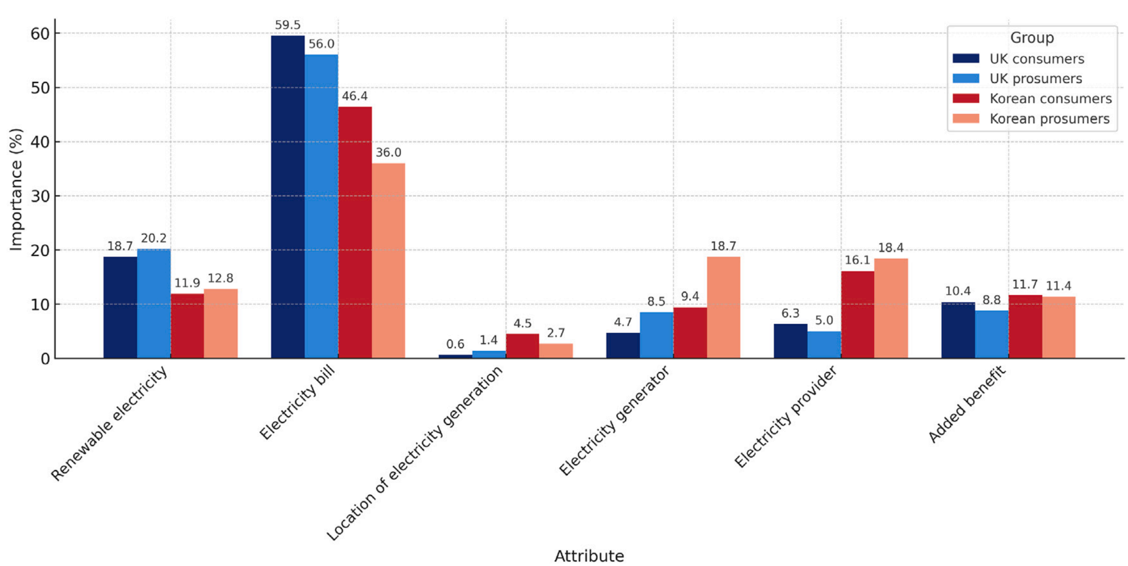

Fig. 3. Attribute importance — Buying.

of the UK prosumer group, based on the relative sizes of the standard errors and the significance levels of the parameters. Nevertheless, future research with larger prosumer samples, if possible, would enhance the reliability and generalisability of the findings. Larger sample sizes would also enable an analysis of observed heterogeneity based on demographic factors, which could provide further insights into the role of individual characteristics in shaping preferences.

Another limitation of the DCE design is the potential for ambiguity in how respondents interpreted the 'added benefit' levels and the selling price attribute. For instance, the varying price option might overlap

Table 8
MIXL results — Selling.

Attribute	Level	UK	Korea
		Mean (SD)	Mean (SD)
Selling price	−20%, −10%, 0%, +10%, +20%	0.065*** (0.126***)	−0.041*** (0.081***)
Location of final consumers	Within the country *(baseline)*	–	–
	In your local community	0.087 (0.502**)	−0.131 (0.693**)
Final consumers	Not-specified *(baseline)*	–	–
	Family or friends	0.182 (0.770**)	−0.142 (0.391)
	Households in fuel poverty	0.478*** (0.859**)	0.791*** (0.211)
	Public facilities	0.459*** (0.316)	0.257 (0.852*)
Electricity provider	Private company *(baseline)*	–	–
	National government	0.068 (0.366)	0.901*** (1.335***)
	Local government	0.101 (0.400)	0.592** (0.439)
	Non-profit organisation	0.238 (0.052)	0.462** (0.342)
Added benefit	Fixed price *(baseline)*	–	–
	Provider control	−0.007 (0.734**)	−0.325 (0.711)
	Consumer control (ToU tariffs)	−0.208 (0.220)	−0.331 (0.034)
	Selection	−0.201 (0.019)	−0.137 (0.001)

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
(The significance of the mean indicates whether the mean estimate is statistically different from zero, whilst the significance of the SD indicates whether there is unobservable heterogeneity in preferences around the mean.)

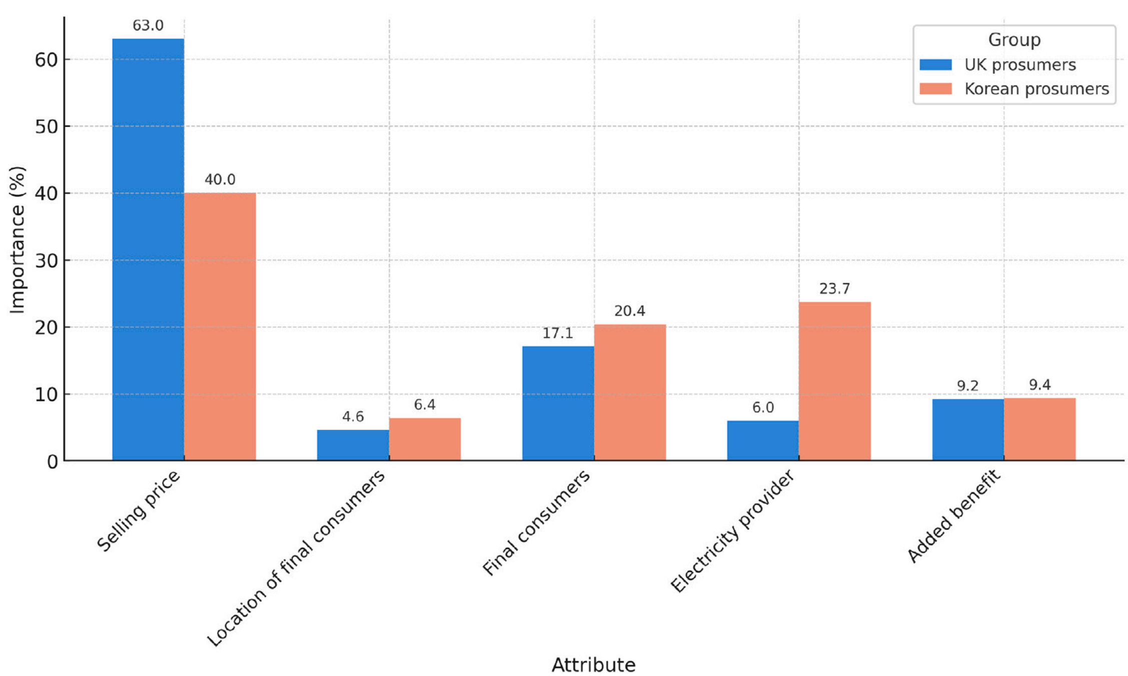

Fig. 4. Attribute importance — Selling.

conceptually with an explicit selling price in the same choice set. Although the survey design aimed to keep these attributes distinct, with added benefits offering supplementary options, we tested for potential collinearity by alternately excluding each attribute in mixed logit models. The analysis found no significant changes in the remaining coefficients, suggesting collinearity is less likely a problem. However, potential cognitive overlap in respondents' interpretations remains a limitation of the study design.

Table 9
Group comparisons for attributes and levels with the highest mean coefficient.

Attribute	UK			Korea		
	Consumers	Prosumers		Consumers	Prosumers	
	Buying	Buying	Selling	Buying	Buying	Selling
Renewable electricity sources	Higher	Higher	–	Higher	Higher	–
Electricity bill/Selling price	Lower	Lower	Higher	Lower	Lower	Lower
Location of electricity generation	Local community	Local community	–	Within the country	Within the country	–
Location of final consumers	–	–	Local community	–	–	Within the country
Final consumers	–	–	Households in fuel poverty	–	–	Households in fuel poverty
Electricity generator	Non-profit	Households	–	National government	Local government	–
Electricity provider	Non-profit	Non-profit	Non-profit	National government	National government	National government
Added benefit	Fixed price	ToU tariffs	Fixed price	ToU tariffs	Fixed price	Fixed price

Our study also shares the limitations inherent to choice experiment methods. Most importantly, preferences expressed in a controlled survey environment may not translate into actual behaviour in a real market context [70]. However, given that this study explored supply models that are not yet widely available, creating hypothetical scenarios was a practical approach to capture end-user decision-making that could potentially lead to behaviour. To enhance the validity of DCEs, future research can examine the actual choices of participants in pilot projects and compare the results.

4.5. Discussion

In this section, the key findings are summarised by answering the research questions, followed by a discussion of interesting findings.

RQ1 asked whether current end-user preferences differ **between the UK and Korea**. When buying electricity, Korean consumers and prosumers show clear preferences for the national and local governments as their electricity generator and provider, making these attributes important in Korea. Meanwhile, local electricity generation, despite its statistical insignificance and low importance, is more likely to be chosen in the UK but less likely in Korea. When selling electricity, Korean prosumers do not prefer higher prices, unlike their UK counterparts (discussed further later in this section). Regarding electricity providers, Korean prosumers again show a clear preference for the national and local governments.

RQ2 examined whether preferences **between consumers and prosumers** differ. In the UK, whilst consumers prefer non-profit organisations as their electricity generator, prosumers' most preferred option is households with small-scale generators. In Korea, prosumers' most preferred electricity generator is the local government, whilst consumers' top choice is the national government. In both countries, prosumers are more likely to choose households with small-scale generators over private companies, with statistically significant results. However, the results are not statistically significant for consumers.

RQ3 explored the changes in prosumer preferences **between buying and selling** electricity. In the UK, prosumers prefer lower electricity prices when buying but higher prices when selling, which aligns with general economic theory. In both countries, prosumers are least likely to choose an option where a provider controls the timing of use when buying electricity. When selling, they are least likely to select an option where consumers control the timing of sales based on ToU prices. However, these findings should be interpreted with caution, as they are statistically insignificant at the 10% level.

From the above findings, we observe some interesting similarities and differences between the two countries. When it comes to renewable electricity sources, it might be expected that prosumers are more environmentally conscious and would place higher importance on renewable sources compared to consumers. However, this was not necessarily the case. Within each country, there is little difference between the prosumer and consumer groups regarding the relative importance of the renewable source attribute (Fig. 3). The difference is more pronounced between the UK (19%) and Korea (12%), as Korean end-users place relatively greater emphasis on other attributes, such as the entities responsible for generating and providing electricity.

Price is the most important attribute across all sub-groups in both countries. The price attribute shows relatively higher importance in the UK, and this is further supported by respondents' optional free text comments. 29 out of 106 UK respondents indicated that price or cost is their first priority, whereas only 3 out of 101 Korean respondents mentioned the importance of price. This is inconsistent with findings from previous studies, which suggest that cost is not the most significant factor for UK consumers [40,45]. This shift in the importance of price might have been caused by the energy crisis triggered by recent geopolitical conflict. One comment stated: *'I feel like the current energy prices have affected my views somewhat so often I went off prices when choosing.'*

On the other hand, the least important attributes are the location factors in both countries. When buying electricity, whether it is generated locally or elsewhere within the country is not significant. This finding aligns with previous studies based on representative German samples [71–73], which found that the location of generation ranked lower in importance compared to price and electricity mix attributes. Similarly, for prosumers selling electricity, whether their final consumers are located locally or elsewhere is not crucial. These findings may have implications for the implementation of local energy market models, such as P2P electricity trading at the local community level, in the UK and Korea. Additionally, although the results are not statistically significant, the potentially contrasting views on locally generated electricity in the two countries may reflect differences in their current electricity regimes: Korea's centralised system and the UK's decentralised system.

Although most energy suppliers in the UK are private companies, both UK consumers and prosumers are less likely to choose this option compared to others for electricity generators and providers. Non-profit organisations are generally the most preferred choice. These results differ slightly from those of Fell et al. [41], where the local council was most preferred, followed by energy suppliers. However, these two studies are not contradictory, considering the differences in contexts and options, as Fell et al. [41] specifically assumed a P2P trading scheme. A more interesting observation is that end-user preferences derived from both studies do not align with the current UK electricity market regime.

Meanwhile, in Korea, end-users show distinct preferences for government involvement, particularly at the national level, which corresponds with the market regime. This is supported by Korean respondents' free text comments. One comment stated: *'I don't want private organisations involved. Even if the price seems low at the beginning, it will eventually increase.'* This is also consistent with a study by Li et al. [46], which found that Koreans prefer KEPCO as a trading agent in the case of P2P trading. However, this doesn't necessarily mean that Korean end-user preferences will remain unchanged. User preferences are often based on past experiences, and exposure to new models may change their preferences. For instance, in the telecommunications industry, Korea Telecom, a monopolistic public enterprise before deregulation in the 1990s [74], now holds only the third-largest market share in mobile services [75].

End-users in both countries are generally more likely to select the fixed-price scheme over other options, despite the potential financial benefits or freedom of choice offered by alternatives. Consumers in both the UK and Korea statistically significantly prefer the fixed-price scheme over the option of selecting preferred generators via a mobile app. Only ToU tariffs resulted in positive mean coefficients for UK prosumers and Korean consumers when buying electricity, although these findings are not statistically significant. These findings might indicate that end-users are still unfamiliar with other new types of electricity supply models. Alternatively, they might have concerns about interrupted electricity usage or prefer not to complicate their usage by logging into a mobile application. The following free text comment supports these speculations: *'No way do I want someone else deciding when my dishwasher goes on. Can't rely on the internet working to choose a supplier from an app ... I want electric to just work — turn the switch, and the light comes on.'* This highlights concerns about external control and the reliance on technology, reflecting a preference for simplicity and reliability in electricity supply.

It should be noted, however, that the added benefits presented to respondents lacked detailed information, such as the specific time windows or circumstances under which they could take back control of their appliances. For instance, Fell et al. [76] found that direct load control was generally acceptable when it included an override ability and clearly defined boundaries. Future research could consider the uncertainty surrounding end-users' controllability to better understand their willingness to cede control.

One finding that appears economically counterintuitive is that Korean prosumers prefer lower selling prices. The surveys clearly differentiated buying and selling scenarios, each explained three times with separate instructions and diagrams. Thus, confusion between these scenarios by respondents seems unlikely. Several potential reasons could explain this counterintuitive finding. Given that Korean prosumers most preferred selling electricity to households in fuel poverty, altruistic motivations could explain their preference for lower selling prices. This interpretation aligns with Hahnel and Fell [49], who found similar altruistic pricing among prosumers trading electricity with low-income households. Additionally, this might stem from a broader sense of social responsibility. Korean prosumers, who prefer transactions with the national government, might see charging higher prices as detrimental to the collective good. Although the following free text comment was from a UK prosumer, it provides some insight into prosumer motivations: *'I chose the options with the lowest prices for both import and export. Whilst I'd like to provide power to family and friends as a priority, I do not want to be part of driving prices up.'*

However, UK prosumers prefer higher selling prices, indicating a potential tension between financial incentives and socially-oriented objectives. To explore this discrepancy further, we conducted an additional analysis comparing prosumers who currently own solar panels with those planning or having previously owned them. Our aim was to investigate whether actual or potential experience with selling influenced their pricing preferences. The analysis revealed only minor differences between these sub-groups[11] in both countries, offering limited additional insight. Future research explicitly designed to disentangle these motivations, potentially through qualitative methods, would be valuable. Meanwhile, our findings provide insights into prosumer motivations that extend beyond purely economic considerations.

5. Conclusion and policy implications

We analysed prosumer and consumer preferences for new electricity supply models under the liberalised electricity market regime in the UK and the centralised regime in Korea.

The screening surveys show that 18% of respondents in the UK and 14% in Korea were categorised as broadly defined prosumers. Whilst the primary aim was to screen potential participants for the main surveys, the results also provide initial insights into the current proportion of the population at different stages of residential solar adoption in the two countries.

Choice data collected from the DCEs were quantitatively analysed using MIXL. The results indicate that, in both countries, price is the most important attribute across all sub-groups. In the UK, price is relatively more important than in Korea, possibly because UK end-users were hit harder by the recent energy crisis. In Korea, the increase in energy prices was mostly absorbed by KEPCO's debt rather than being passed on to the public [77].

Related to this, another notable finding is that Korean end-users have strong preferences for the national government as their electricity generator or provider. Several free text comments from Korean respondents indicated that they believe electricity is a public good, and that the stable supply of it should be the state's responsibility. In the UK, non-profit organisations are the most preferred electricity provider.

Between consumers and prosumers, the attribute of who generates the electricity is more important for prosumers than for consumers in both countries. Prosumers are more likely to choose households with small-scale generators over private companies, with statistically significant results in both countries, whereas the results for consumers are not statistically significant. However, when it comes to renewable electricity, there is no meaningful difference in attribute importance between consumers and prosumers within each country. Whilst a higher percentage of renewable electricity sources is preferred in both countries, it is relatively more important to UK end-users than to Korean end-users.

Prosumer preferences when buying and selling electricity do not differ significantly within each country. One interesting difference is that UK prosumers prefer lower electricity prices when buying but higher prices when selling, whereas Korean prosumers prefer lower prices for both buying and selling. Whilst our study suggests potential altruistic or collective motivations beyond economic incentives, further

[11] Both prosumers who currently have solar panels and those who do not exhibited positive mean coefficients for selling prices in the UK (0.121*** and 0.037***, respectively) and negative mean coefficients in Korea (−0.025 and −0.054***, respectively).

qualitative research could investigate the underlying reasons in more depth.

In both the UK and Korea, 'locality' — encompassing locally generated electricity or local electricity consumers — is the least important attribute relative to others, despite the MIXL results not being statistically significant. This is a somewhat unexpected finding given the increased interest in local energy market models in the industry and academia in recent years.

One policy implication is that end-users in both countries, including prosumers who were assumed to be more open to niche innovations, have yet to embrace new electricity supply models. This suggests that expecting transitions driven by the demand side might be premature. Nevertheless, these niche electricity supply models can play a crucial role not only in meeting consumer needs but also in achieving other policy outcomes, such as grid system optimisation and flexibility management. As increasing end-user acceptability remains an important task, policies such as utilising regulatory sandboxes or promoting trials at a local level can still be effective in both countries. Despite the limitations of sandboxes, such as short time frames and limited representation of consumer interests [78], they offer opportunities for societal experiments that allow interactions and co-evolution between users and innovations. This process of deliberately managing niche formation in a protected space is the core idea of strategic niche management [79,80]. In this context, future studies can examine end-user preferences before and after pilot projects to explore changes in their preferences over time.

Taken together, our study highlights the importance of considering socio-technical contexts when understanding end-user preferences. Current electricity end-user preferences in the UK and Korea differ, reflecting the contrasting market regimes and the varying impacts of the exogenous energy crisis. End-user preferences in a specific nation cannot be generalised to other regions without careful consideration of contextual factors. Accordingly, tailoring policies to the unique needs and preferences of end-users in each region can enhance the effectiveness of interventions and facilitate smoother transitions towards sustainable energy systems. Our findings imply that Korean end-users may prefer the government to continue its role as a public service provider. Whilst maintaining this role, the government also needs to implement and support test beds in real-world settings. The recent legislation of the Special Act is a positive step in this direction. In the UK, the national government's role can focus more on collaborative efforts with the third sector and local governments. It will be interesting to observe the impact of the recent foundation of Great British Energy, a publicly-owned energy company, as its main role will be facilitating investment and supporting local authorities and communities [81].

Funding

This research was supported by internal funding from University College London.

CRediT authorship contribution statement

Eun Jin Lim: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization, Project administration. **Michael J. Fell:** Conceptualization, Methodology, Writing – review & editing, Supervision, Project administration. **David Shipworth:** Conceptualization, Methodology, Writing – review & editing, Supervision, Project administration, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

The authors thank Sawtooth Software Inc. for providing access to the software through a student grant. We are grateful to all individuals who participated in the pilot testing for their valuable insights. Appreciation is also extended to the two anonymous reviewers for their constructive feedback.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.erss.2025.104072.

Data availability

Data is available at: OSFStorage.

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