***ARE EU CITIZENS willing to engage with commUnity-based energy cooperatives? evidence from a cross-country discrete choice experiment***

Hangjian Wu, Department of Economics, Trinity College Dublin, +353 851557156, WUH4@tcd.ie

James Carroll, Department of Economics, Trinity College Dublin, +353 (0)1 896 1043, JACARROL@tcd.ie

Eleanor Denny, Department of Economics, Trinity College Dublin, +353(0)1 8963709, dennye@tcd.ie

## Overview

In response to the increasing threats from climate change, the European commission has set out the Green Deal aiming to target a climate-neutral economy by 2050, with various policies being implemented to reduce emissions in all sectors of the economy (European Commission, 2012). A key focus has been on increasing penetrations of renewable generation across the EU in both large and smaller scale projects. From the customer perspective, individuals’ acceptance of and attitudes towards renewable energy use have been increasingly studied in the literature, with many showing that citizens are willing to bear a higher electricity price to shift to cleaner energy, and their preferences differ according to the renewable technology applied, socio-economic status, environmental attitudes and knowledge about renewable energy and climate change (see Stigka et al. (2014) for a literature review). Most of these studies based their assumption on large and centralised renewable energy provision, yet a fundamental shift in energy behaviour needs multi-dimensional participation and transition (Walker and Devine-Wright, 2008).

To meet the increasing demand for innovative solutions to renewable energy generation and distribution, energy cooperatives, a type of renewable energy community characterised by energy localisation and commitment to energy democracy, has been flourishing in some European countries in recent years. Energy cooperatives are community-based energy organisations which provide their investors/customers with locally produced renewable energy and energy related services. Members of energy cooperatives are usually investors who collectively own the organisations and share investment returns, and are allowed to participate in the decision making of cooperatives’ important affairs (e.g., profit allocation, reinvestment and the setting of energy price). Compared with renewable energy provided by large private or state-owned companies, distinctive characteristics of energy cooperatives, such as open participation and democratic controls, reduce the cost of regulation and information asymmetry (Sagebiel et al., 2014). In addition, this decentralised approach also enhances social cohesion and contributes to the local economy (e.g., by creating green jobs) (Caramizaru and Uihlein, 2020).

Only a limited number of studies explore citizens’ acceptance of energy cooperatives using Discrete Choice Experiments (DCEs) (Sagebiel et al., 2014; Salm et al. 2016; Kalkbrenner et al., 2017; Knoefel et al., 2018). DCE allows the simulation of real-life decision making by creating experimental scenarios where respondents are asked to make choices based on multiple dimensions of a studied good. Results from DCEs on energy cooperatives suggest that consumers prefer to pay a higher electricity price for the renewable providers to be local energy cooperatives rather than national providers or private providers, as well as for other corporate features (proximity to the projects, chances of participation in decision making and policy transparency). However, the German population has been predominantly focused in these studies, perhaps because energy cooperative is relatively developed in this country, whilst given the unequal distribution of energy cooperatives across the Europe, little is known about citizens’ acceptance towards energy cooperatives in other European countries. In addition, most of these studies take a consumer perspective and either explore the trade-offs between households’ electricity price and several renewable-related and cooperative-related features, or focus on customers’ preferences towards a generic instead of cooperative-specific business model, yet attitudes towards cooperatives as citizen investors are rarely discussed.

This paper examines a key gap in the literature about citizens’ attitudes towards renewable energy provided by energy cooperatives in multiple European countries using a DCE. To our best knowledge, we are the first to conduct a large-scale DCE across five countries in Europe, which allows for a cross-country comparison on preference and welfare estimates. We also contribute to the literature on the investigation of people’s willingness-to-engage with energy cooperatives from the perspective of citizen investors and identify a number of new characteristics of energy cooperatives that are relevant to investors.

## Methods

The data collection was conducted from June to October, 2020 in five European countries (France, Germany, Poland, Spain and Sweden) where the extent of the development of energy cooperatives varies. Approximately 3,000 valid responses were collected from the general public, with 600 per country. In the DCE, respondents were asked to choose between two hypothetical energy projects run by energy cooperatives with varied features and levels. Each energy project is characterised by a selection of attributes (i.e., economic return, project technology, carbon reduction, project location, minimum investment, minimum duration, level of participation) reflecting financial and non-financial benefits and requirements of joining in a typical energy cooperative. The design of the choice cards was finalised with the assistance of partners of the EU-funded project SocialRES, who are experts in the field of renewable energy and energy cooperatives. We constructed a D-efficient fractional-factorial design of eight choices per respondent and analysed the data using mixed logit models to account for unobserved individual-level heterogeneity (Hensher and Greene, 2003). We also extend the basic mixed logit model to investigate the determinants of preference heterogeneity across individuals, by including interaction terms of individual characteristics, such as environmental and political attitudes, risk attitude, investment experience and socio-economic status.

## Results

Results from the analysis of the pooled data of the DCE suggest that: (a) with very few opt-outs, it is evident that investing in renewables through energy cooperatives is appealing to EU citizens; (b) individuals prefer solar rather than wind energy and larger carbon reductions; (c) individuals are less likely to choose renewable energy projects located outside their country, and dislike increases in the cooperative’s minimum investment amount and minimum duration; (d) individuals consider participation in the cooperative’s quarterly or annual meetings, where they have chances to influence the decision making of the cooperative, as irrelevant. We also observe a moderate level of cross-country differences in preferences. For example, (a) the level of carbon reduction is commensurate with the size of the renewable project in our design; whilst Spanish respondents always prefer a higher level of carbon reduction, French respondents only prefer carbon reductions from small and medium-scale renewable projects, but not from large-scale projects. German respondents are insensitive towards any level of carbon reductions; (b) whilst respondents from other countries seem to have no interest in participation, Spanish respondents prefer attending both quarterly and annual meetings organised by energy cooperatives. Results from the exploration of the inter-personal preference heterogeneity suggest that a number of demographic and attitudinal variables play roles in explaining the differences in preference estimates. Notably, we find that although people on average have no interests in participating in cooperatives’ meetings, younger people, male, prior green investors and those who consider decision rights as a very important aspect when investing in cooperatives, are more likely to participate these meetings. To produce more policy-relevant results, the above preference estimates are also converted to welfare estimates.

## Conclusions

Renewable energy cooperatives, characterised by local energy production and consumption and open participation, have been rapidly developing across the Europe. Despite a growing body of qualitative evidence showing the promising role of energy cooperatives in energy transition, studies aiming to quantify people’s preferences for renewable projects run by cooperatives still remain scarce. We are the first to investigate individuals’ willingness to engage with energy cooperatives using a large-scale DCE covering multiple European countries. Our results substantiate both the financial and non-financial motivations of cooperatives’ investors and suggest the level of preference for renewable projects are country-specific and depend on people’s socio-demographic characteristics, environmental and political attitudes. Our results have profound implications regarding the feasibility of a community-based approach to promote cleaner energy use for a number of European countries.

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