

## UNDERSTANDING PREFERENCES FOR CHARACTERISTICS OF RENEWABLE ENERGY COMMUNITIES

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### 1. Introduction and Background

Building energy self-sufficiency, reducing energy costs, and meeting lower emissions targets through renewable energy technology (RET) has become a central focus of many community and private sector energy projects. The spread of renewable energy technology has been facilitated by lower installation costs, increased reliability of the technology, and supporting policy and investment [1]. Additionally, the expansion of RET has opened the discussion around how energy systems of the future will be configured. As the decentralization of energy production and management becomes a real possibility, with citizens taking on greater responsibility within the system, rethinking future communities becomes more important. New opportunities and shifting responsibilities will create new roles for involved stakeholders, including private sector and citizens.

While ample literature focuses on the acceptance of single RET in specific sites, it is important to recognize that RET operates within a system of multiple processes and actors that interact at numerous levels [2]. This embeddedness makes it essential to understand configurations of renewable energy projects that would appeal to citizens beyond acceptance of single RET on single sites. Examples of community renewable energy projects, such as the Hunziker Areal in Zurich, Switzerland and Vauban in Freiburg, Germany, have shown that the appeal of living in such communities goes beyond reliance on RET and includes benefits such as green mobility options and shared community spaces. The aforementioned projects fit into the EU's plans to

develop 100 Positive Energy Districts (PEDs) – places that couple “built environment, sustainable production and consumption, and mobility to reduce energy use and greenhouse gas emission and to create added value and incentives for the consumer” – by 2025 [3]. Despite numerous such projects in development across the EU, no academic attention has been given to exploring the appeal of the multiplicity of benefits offered by PEDs or PED-like projects.

The purpose of this research is to address this gap by understanding the appeal of different configurations of PEDs. Creating suitable renewable energy community configurations for individuals can increase the likelihood that they engage in their community and become energy citizens. Greater citizen engagement within renewable energy communities is important because it can mean more rewarding, emissions-cutting outcomes from the use of RET and related technologies (e.g. smart meters). In this study, configurations of PEDs and PED-like communities are studied because of their salience to the EU’s energy transition agenda and their ability to offer a variety of valuable services that result from community-private sector partnerships.

This research explores the appeal of three attributes that characterize renewable energy communities: RET ownership and engagement from the citizen, availability of mobility options, and availability of communal spaces. These attributes align with characteristics seen in PEDs, as well as established drivers of RET acceptance found in the literature. Ownership of RET has been found to be important in a community’s acceptance of a renewable energy project [4], and may predict a citizen’s involvement with RET. Citizen engagement and acceptance of renewable energy structures has been found to be higher when the project is citizen-driven and locally-owned [5-7]. An analysis of several case studies in Germany found that community ownership of wind turbines led to wider acceptance of their installation compared to wind farms owned by a commercial company [6]. Renewable energy cooperatives have also been found to attract individuals that are favorable towards renewable energies [4] and motivated to participate in local energy policy decisions, though once having joined, individuals often prefer delegating issues of cooperative development to an executive [8].

Ownership and technology has also been studied in the context of access-based car sharing [9]. The research showed that lack of ownership was a driver behind lack of engagement for the brand and care for the cars. In this context, the preferred type of ownership structure may predict an individual’s intended engagement within the PED.

Further, understanding the configuration of mobility aspects within a PED is important as mobility is often a central focus in renewable energy communities. Mobility options describing restrictions around private cars and allowance of electric vehicles are explored. Finally, the availability of communal spaces, such as community gyms and workspaces, is tested in order to explore the appeal of including human-centric aspects to potential residents.

## 2. Methodology

We ran a choice-based conjoint experiment, a common method used in market research [10,11], to test preferences for PEDs. The experiment was integrated into the Swiss Household Energy Demand Survey (SHEDS) which collects data from a sample representative of the Swiss population (excluding Ticino). The experiment sample consisted of a random SHEDS subsample of 1500 respondents.

During the experiment, respondents were shown six choice sets consisting of two PED options each. Each PED option is described by different levels of the aforementioned attributes: ownership and citizen engagement (e.g. the PV is owned by you and you are an active trader; the PV is owned by a cooperative), mobility (e.g. public transportation replaces private cars; only a shared fleet of electric vehicles exists), communal spaces (e.g. a PED might include a shared gym, workspace, or guest rooms for a small monthly fee).

Latent class analysis will be applied to the data to segment respondents into groups that share similar preferences in their choices. Additionally, Hierarchical Bayes (HB) estimation may be used to understand the importance for each attribute level. This analysis can indicate which characteristics of renewable energy communities are important in an individual's choice and what segments of consumers could exist. Such information around consumer desires can be critical to the acceptance of RET projects.

## 3. Research Aims

The results of the research will indicate the importance of various attributes in renewable energy communities, highlighting which benefits hold the most potential for citizen engagement. Ultimately, the intention is to provide policy-makers and entrepreneurs involved in the development of renewable energy communities with more information on segments of potential residents and their preferences. Creating configurations of renewable energy communities that entice citizens to interact with RET and others in their community puts them closer on the path of becoming human-centric, energy-positive communities.

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