



Engineering advance

## Household participation in an urban photovoltaic project in Switzerland: Exploration of triggers and barriers

Julia Koch\*, Oliver Christ

*Institute Humans in Complex Systems, School of Applied Psychology, University of Applied Sciences and Arts Northwestern Switzerland, Riggenschtrasse 16, 4600 Olten, Switzerland*



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## ABSTRACT

Over the course of the sustainable energy transition, distributed energy generation becomes increasingly important. Building residential energy installations requires resources (expertise, time, financial liquidity, space) not all citizens have at hand. Especially in urban areas, where land is scarce and many people live as tenants, only a minority qualifies. To include urban households in the energy transition, new smart and efficient solutions need to be developed. In this article, we examine an example of an innovative energy project in Zurich (Switzerland) that complements the concept of community energy, offering residents a simple and cost-effective way to participate in photovoltaic installations in their city. The aim of the study is to gain understanding of the project characteristics that trigger or hinder participation, drawing on qualitative data from semi-structured telephone interviews with participants and non-participants ( $n = 18$ ). The main drivers for participation are the direct and tangible way of supporting local sustainable energy generation, and the desire to feel as a co-owner at little effort and expense. Conversely, reservations against photovoltaics and a lack of financial resources, knowledge, or interest act as barriers for participation. The study lays a foundation for further quantitative examination and for the development of other urban energy projects.

## 1. Introduction

Over the course of the ongoing transition from fossil and nuclear to renewable energy resources, the government in Switzerland strives to increase the production and use of renewable energy through a systematic restructuring of the energy supply system and incentive schemes (Energy Strategy 2050, see [SFOE, 2017](#)). During the last decades, electricity has been produced mainly by centralized institutional electric utilities; now, after the initiation of a turnaround in energy policy, distributed forms of energy production, such as rooftop solar energy, have become ever more important ([Gutschner, Gnos, & Nowak, 2010](#)). An increasing number of households invested in residential photovoltaic installations during the past years ([IEA, 2014](#); [Hostettler, 2013, 2014, 2015, 2016](#)). However, building such a residential energy installation requires resources not all citizens have at hand: Apart from a basic technical understanding, action knowledge about relevant legal, political, or constructional aspects are requisites to build an energy installation on one's property ([EU SWD, 2015](#); [Nogee, Clemmer, Paulos, & Haddad, 1999](#)). This entails time for gathering information and evaluating different alternatives. Moreover, construction of an installation requires sufficient funds. In 2009, the Swiss national

government created a feed-in remuneration system (KEV) that compensates operators of photovoltaic installations for any additional power they produce and feed into the national grid ([SFOE, 2016](#)). However, due to an unexpected increase of new photovoltaic installations, the demand for remuneration cannot be met anymore after the fund's cap was reached. In July 2016, nearly 48'000 installations were on the waiting list ([Swissgrid, 2016](#)). Since 2014, a new funding instrument of one-time subsidy (EIV) supplements KEV that covers a maximum of 30% of the costs of an installation ([SFOE, 2016](#)). In addition to the required financial means, the installation takes up a certain amount of space, mainly on the roof's surface. In urban areas in Switzerland, where land is scarce and a majority lives as tenants ([FSO, 2017](#)), only a minority qualifies for such a project.

As a solution to these restrictions, citizens join forces to build common installations for their neighborhoods. Such "community energy projects" (e.g. [Kalkbrenner & Roosen, 2016](#); [Thapar et al., 2016](#)), also often described under the term "energy cooperatives", involve residents in the development and maintenance process of the installation, and/or generate a collective benefit in return ([Walker & Devine-Wright, 2008](#)). Several studies show that environmental considerations, such as a desire to support environmental sustainability, and the energy

\* Corresponding author.

E-mail addresses: [julia.koch@mailbox.org](mailto:julia.koch@mailbox.org) (J. Koch), [oliver.christ@fhnw.ch](mailto:oliver.christ@fhnw.ch) (O. Christ).

transition from fossil fuels and nuclear power towards renewable energy, are often the main reason for citizens to participate in community energy projects (Hübner et al., 2012; Ott & Wieg, 2014; Rogers et al., 2008). According to studies carried out by High-Pippert and Hoffman (2007), Ott and Wieg (2014), and Rogers et al. (2008), the main further motivational factors for participation in a community energy project are related to the idea of strengthening the community (e.g. the desire to create regional value, to ensure regional energy supply, and to become more independent of energy companies).

The desire to engage actively in the community is a motivating aspect to certain citizens, and can result in a high willingness to volunteer for a local community energy project (Kalkbrenner & Roosen, 2016). However, a highly cooperative and democratic setting also has its drawbacks: It entails costs for collective decision-making (Huybrechts & Mertens, 2014), and carries a risk of conflicts about interests, values, goals, codetermination, or appropriate governance approaches (Burchell, Rettie, & Roberts, 2014; Yildiz et al., 2015) due to members' heterogeneous motivations. Walker, Devine-Wright, Hunter, High, and Evans (2010) report a case study about a community-owned wind farm where distrust among the participating residents evolved and conflicts arose, especially as the project grew. Moreover, whereas some citizens appreciate a strong active participation, others prefer engaging only to a low extent. In the study of Rogers et al. (2008) for example, residents preferred having a rather passive role in the development of a local community energy project, described by the term "low-level participation". Whereas almost 90% of the residents declared willingness to support it, only around 50% were willing to take an active part in the project by investing time or labor, and none of the surveyed residents could identify with the role of the project leader. Yildiz et al. (2015) support these findings: According to their study, only half of the participants in an energy cooperative regularly or frequently took part in organizational meetings, and 76% never brought in any ideas to develop the cooperative further.

## 2. Background

### 2.1. Overview of the project

In this article, we examine the case of an energy project that involves residents to a very low extent, following the idea of "low-level participation". The project called "ewz.solarzürri" has been run by the Zurich Municipal Electric Utility (ewz) since 2014. As opposed to community energy projects described above, participating households engage only in the form of a funding, without taking part in the implementation or maintenance of the project. They buy a selectable number of square meters of a photovoltaic installation on a specific public building at a one-off cost. In return, they receive a fixed annual amount of solar power over the next 20 years. On the one hand, they do not bear any financial risks: The utility ensures the defined contingent of power supply, and participating households can sell their share back to ewz or transmit it to another household if they move outside the city. On the other hand, their investment cannot generate any financial profit. In contrast to community energy projects, participation is not associated with any community-related rewards since the participants do not become legal co-owners, and their interaction is limited to individual customer relations with the electric utility. The idea is to offer households the opportunity to purchase solar power when they do not have the aforementioned resources at their disposal to build an installation on their private rooftop.

Participation is open to all households in the City of Zurich. Switzerland does not have a liberalized electricity market (see also Soland, Loosli, Koch, & Christ, 2017). Households can thus only purchase electricity from their local energy provider, which is ewz for the City of Zurich. Ewz offers several different electricity products to choose from. The cheapest option contains a mix of different forms of renewable energy. Other products entail specific energy types, such as

locally generated waterpower, or solar power from various parts of Switzerland. There is no option for non-renewable energy for households in Zurich (ewz, 2017a). Households that participate in ewz.solarzürri buy their contingent of the project in addition to their primary energy choice. The additional costs for the electricity purchased from ewz.solarzürri are about 6 CHF (approx. 5.15 EUR) for 80 kWh p.a. compared to the cheapest electricity product the utility company offers (ewz, 2017b). Spending on electricity in Switzerland generally ranges between 0.9% and 1.5% of the household income (ElCom, 2016), which is a rather low proportion compared to other European countries (Strom Report, 2015).

Ewz.solarzürri aroused great interest, and sold out after a few hours. Today, it involves more than 2500 households in nine installations (ewz, 2015). We aim at gaining a more in-depth understanding of the project characteristics that trigger participation in ewz.solarzürri. Certain characteristics of the project must outweigh the financial expenditure ("willingness to sacrifice", see Oreg & Katz-Gerro, 2006) and motivate electricity customers to sign up for participation, even though their level of interest in electricity and their impetus to change their electricity supply are generally rather low (Bakay & Schwaiger, 2006; Chassot, Wüstenhagen, Fahr, & Graf, 2013). As the project entails neither financial gain for participants nor community-related benefits, we cannot fully draw on previous studies about community energy projects to assess drivers for participation. For this reason, the article has a strong explorative character and aims at setting some groundwork for other energy projects that require low-level participation.

### 2.2. Drivers for participation in the project

Following the logic of community energy projects that involve residents to a higher extent, it is likely that environmental reasons mainly trigger participation in ewz.solarzürri. With their participation, residents contribute to the sustainable energy transition, not only by shifting to a renewable and locally produced source of energy but also by increasing demand for the project, which in turn leads to the construction of new installations and furthers the energy turnaround of the country as a whole. Furthermore, several studies show that solar energy is the energy type people prefer (Koch, Hulliger, Würzler, Schneeberger, & Christ, 2015; Kress & Landwehr, 2012; Schweizer-Ries, 2008; Wunderlich, 2012). Consequently, residents might participate in the ewz.solarzürri project because they are willing to support solar power production specifically, more so than other sources of energy.

Furthermore, according to a study of Sagebiel, Müller, and Rommel (2014), private energy customers are willing to pay more for locally generated power. The authors assume that locality creates a feeling of trust. As we know from other studies, a person's emotional attachment towards the location of an energy installation influences his or her attitude towards it ("place attachment", see e.g. Devine-Wright, 2009; Devine-Wright & Howes, 2010; Zoellner et al., 2012). As the photovoltaic installations of ewz.solarzürri are built on public rooftops in the city area, mainly on school buildings, it can be assumed that participation creates an emotional bond between the residents and "their" installation because it is located in their proximity and in a familiar place. According to the studies of Maruyama, Nishikido, and Iida (2007) and Ott and Wieg (2014), residents can be motivated to participate in a collectively owned energy installation by their desire to co-own an energy installation and generate their own electricity. The impression of an energy installation being "theirs" and a sense of pride resulting therefrom is described by the term "sense of ownership" (Warren & McFadyen, 2010). In the case of ewz.solarzürri, citizens do not become legal owners of the photovoltaic installations. Nevertheless, this does not necessarily inhibit participants from a sense of ownership, as this is a subjectively defined quality (Wüstenhagen, Wolsink, & Burer, 2007). If participation in ewz.solarzürri evokes a sense of ownership in participants, this would make the project a valuable alternative to the legal ownership of a private residential installation.

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