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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, Riggenbachstrasse 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 systematical 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 (J. Koch), oliver.christ@fhnw.ch (O. Christ).

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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.solarzüri" 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.solarzüri buy their contingent of the project in addition to their primary energy choice. The additional costs for the electricity purchased from ewz.solarzüri 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.solarzüri 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.solarzüri. 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.solarzüri. 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, Würgler, Schneeberger, & Christ, 2015; Kress & Landwehr, 2012; Schweizer-Ries, 2008; Wunderlich, 2012). Consequently, residents might participate in the ewz.solarzüri 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.solarzüri 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.solarzüri, 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, & Bürer, 2007). If participation in ewz.solarzüri evokes a sense of ownership in participants, this would make the project a valuable alternative to the legal ownership of a private residential installation.

Table 1
Sample description.

	Participants	Non-participants
Sample size	n = 10	n = 8
Age	37–72, M = 50	42–77, M = 59
Gender	10 male	4 male, 4 female

Compared to building an own installation, the resources required in terms of financial investment, time, and cognitive effort are much lower. The project therefore also enables residents to take part in the energy transition who would otherwise not be able do so.

Briefly, the project characteristics are environmental sustainability, the regional factor of proximity to where energy is generated, sense of ownership, and financial conditions. We examine how they determine citizens' decision in favor of or against participation. In addition, we explore supplementary motivational and hindering aspects. To get a broad range of triggers and barriers to participation, we consider the viewpoints of participants and non-participants.

3. Method

Eighteen interviews with residents, carried out between 4 and 15 May 2015, provide empirical data for this qualitative study. 50 households (26 participants and 24 non-participants) were selected out of all households near the project's initial photovoltaic installation. They all had received a promotional mailing containing a flyer with information about the project, and an application form to participate within the last eight months. We selected our interviewees regarding a balanced distribution of the familiar characteristics (gender, and place of residence within the city) to maximize the diversity of the results. All 50 persons then received a letter including a brief explanation of the study, an announcement of a call for an interview, and a voucher for a local leisure park. Within the following days, we called their private phone numbers in random order, using the software "Skype". We aimed at interviewing ten participants and ten non-participants. An overview of the final sample is displayed in Table 1. The age of the respondents was unknown before the interview and inquired at the beginning of the interview. Nine of the selected non-participants refused to take part in the study. Their reasons were lack of interest, high age, or bad health condition. Additionally, we could not reach seven non-participants by telephone. Accordingly, only eight instead of ten interviews with non-participants could eventually be realized.

The fact that the sample of participants only consists of men can be traced back to the fact that in all cases when female participants were contacted, the male partner living in the same household preferred to answer the interview questions. This is in line with the findings of a study conducted by Hübner et al. (2012), according to which mainly men take decisions regarding electricity of heterosexual couples sharing a household. Our sample group was interviewed following a semi-structured questionnaire. It contained questions regarding the person's perception of the project in terms of the project characteristics that had turned out to be relevant, see Section 1, which are: environmental sustainability (support for renewables in general, and support for solar power specifically), sense of ownership (for participants only), the regional factor, financial conditions, and additional questions to explore further triggers and barriers. With the respondents' consent, we recorded the interviews. One of the interviews could not be recorded because the person expressed strong negative emotions against the project. To obtain a large diversity of results and avoid the risk of the respondent immediately ending the interview, the interviewer forewent the recording and took notes instead.

The interview lasted 10–20 minutes. All interviews were transcribed and evaluated qualitatively by means of the "content structuration" method. According to Mayring (2008), the method enables to structure the material by applying previously defined (deductive) or newly developed (inductive) categories. Five categories were set deductively, following the categories mentioned above, and used for the interview questionnaire. Further motivational or hindering aspects in terms of participation were assessed inductively from the interview transcripts. Table 2 provides an overview of the category system applied.

All quotes transporting any relevant content (135 in total) were assigned to the appropriate categories. Two researchers carried out this step independently to calculate the interrater reliability statistic Cohen's Kappa ($\kappa = 0.66$). This value can be considered substantial (Landis & Koch, 1977). In a second step, the selected quotes were paraphrased and generalized to a higher level of abstraction, and reduced, in accordance with the procedure Mayring (2008) proposed.

To give an overview of interactions between various drivers for decision, we analyzed the above-mentioned quotes for each respondent separately. Based on the quotes, we rated every deductively defined category (Table 2) in terms of its importance for the respondent's decision for or against participation in ewz.solarzüri. The results are presented in Table 3. Two categories repeatedly rated as important for one single respondent indicate that they are interrelated.

4. Results

Table 3 shows how important the 18 respondents considered each of the five categories for their decision on participation. Support for sustainable power production in general, the regional factor, and the financial conditions turned out to be the categories most often taken into consideration. Whereas participants had concluded that they wanted to support sustainable power production (in half of the cases even regardless of the exact costs), non-participants had evaluated the price as too high even though they also considered environmental sustainability as relevant for power production (no. 1, 3, 4, and 6). The significance of support for local production, solar energy specifically, and of a sense of ownership varies between respondents. Two participants considered all categories important for their decision (no. 2 and 5).

Table 2
Category system.

Deductively defined categories	Additional inductively developed categories
Environmental sustainability	Social influence
- Support for sustainable power production in general	Knowledge
- Support for solar power specifically	Possibility to build an installation of one's own
Sense of ownership	Objections against the project
Regional factor	Lack of interest
Financial conditions	
Promotional communication	

Table 3
Importance of various categories for respondents' decision for or against participation.

	Participants										Non-participants							
Respondent number	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
Environmental sustainability: Support for sustainable power production in general	X	X	X	X	X	X	X	X	X	X	X	-	X	X	-	X	-	X
Environmental sustainability: Support for solar power specifically	X	X	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
Sense of ownership: Be a co-owner / energy producer	-	X	-	-	X	X	-	-	X	-	-	-	-	-	-	-	-	-
Regional factor	-	X	X	X	X	X	X	X	X	-	X	X	-	-	-	-	-	-
Financial conditions	-	X	X	-	X	X	-	X	-	-	X	-	X	X	-	X	-	-

Legend:
X Important aspect for decision
- Unimportant aspect for decision
——— Interaction between support for sustainable power production and the regional factor
—·—·— Interaction between support for sustainable power production and financial conditions
----- Interaction between the regional factor and financial conditions

Some categories turned out to be more strongly interrelated in comparison. In Table 3, the three major interactions between drivers for participation are marked with frames. To eight out of the ten participants, the possibility to support sustainable power production and energy generation in the region conjointly determined their decision to participate in ewz.solarzüri. To five of these persons, the assessment of financial conditions was important at the same time. This indicates that, in terms of participants' decisions, there are interactions between the aspect of supporting sustainable power production, of supporting regional energy production, and – to a smaller extent – the assessment of the financial conditions. Furthermore, to all participants that considered the possibility to become a co-owner and energy producer (sense of ownership) important for their decision, the possibility to support sustainable power production and regional power production also mattered. For non-participants, the importance of the possibility to support sustainable power production and the importance of the financial conditions show the most frequent interaction.

To understand the participants' and non-participants' considerations in further depth, we further elaborate the qualitative results for each of the specific categories in the following paragraphs.

4.1. Environmental sustainability in energy production

All ten participants interviewed stated the will to promote environmental sustainability in energy production as one of their main reasons for participation. They mainly sought to support renewable energies, promote the energy transition in Switzerland, and reduce the country's reliance on nuclear power, fossil resources, and coal combustion. Two participants also felt obliged to contribute to change because the opportunity exists, and they owed it to the next generation. One of them said "It is fatal if all actors want to pay the cheapest price. I understand that not everybody is able to make a difference, but those who have the option should." Further reasons were to promote the diversification of the energy system, and to enhance the country's independence from foreign countries. Moreover, one of the participants strongly favored the idea of decentralized power generation the project realizes. Another one perceived the participation as complimentary to his sustainable lifestyle, explaining, "We have already changed our way of living through a variety of means, such as buying LEDs for our whole apartment. It thus made sense to me to also produce our electricity in a sustainable way." Seven participants did not have a specific preference for solar power. They were willing to support any kind of renewable energy. The other three participants, in contrast, preferred solar power to other types of energy sources. They cited both rational reasons (considering solar power hardly interferes with environmental protection or seeing low potential for the technology) and emotional ones ("Intuitively, the decision for participation in a solar power project feels easier for me to take. I don't know why. I can't tell if I could see a windmill as equally attractive. Or a run-of-river power plant. […] For any reason, solar power is the most likable to me.").

Five out of the eight non-participants we interviewed also considered sustainability as important to them, yet chose not to participate for other reasons. Two expressed reservations about the project because they did not see solar power as the best type of energy. One respondent criticized the irregular output of photovoltaic installations, the lack of storage possibilities, as well as the cumulatively high amount of energy the production of photovoltaic cells requires (grey energy). The other respondent objected that building a photovoltaic installation should be everyone's own business, and should not be supported by the company or the state. He further elaborated that Switzerland produced too much power anyways, and exported it to foreign countries. For this reason, he saw no point in building additional domestic power plants. The six other non-participants did not have any objections against solar power, but they deemed it equivalent to their current electricity portfolio (mainly hydropower), and thus saw no reason to spend additional time and money (see also Section 4.4) to change their supply. "If there already is clean energy from hydroelectric power plants, I don't need additional solar power."

4.2. Sense of ownership

Eight respondents indicated that their participation had emotional meaning to them. This emotion seemed to manifest in various forms: Four persons declared feeling like co-owners of the installation and like energy producers instead of consumers (see Table 3), calling the installation "theirs". Some specified awareness that they do not co-own the installation in a legal way. A representative statement thereto: "We already had 100% solar power before. But now, it was a transition of sorts from any random solar panels to our own ones." Their participation evoked positive emotions, such as a sense of self-sufficiency or pride, as the following quotes illustrate: "This is more of an emotional thing. You get the feeling that you are more independent of the rest of the energy production system"; "I like the thought of being a co-owner of a photovoltaic installation. It means that I act in an energy-conscious

way and recognize the signs of our time"; and "From time to time I can walk by and make myself aware that I own some square meters of solar cells up there." The four other participants did not necessarily see the installation as their own but appreciated the tangible purpose of their invested money, and the visualization of a specific surface required to produce the electricity for their own household. To two of the interviewed participants, participation did not have any emotional value.

4.3. Regional factor

According to the participants, the regional nature of power production enhances the feeling of tangibility and transparency of the project. To two of the participants, it did not matter where in the world their electricity was produced, as long as the project was trustworthy and economically and ecologically sound. The others all demanded domestic production and preferred energy generated within their city or its surroundings. They all considered close proximity (their own neighborhood and the roof of a building familiar to them) not a requisite but a highly appreciated plus. The following quote represents the majority's attitude: "Electricity can be produced in any Swiss region. Producing it directly in Zurich is even nicer, in an emotional way. Even though it hardly matters. […] It is produced on a school building I know. And that's quite lovely." Two of the eight non-participants also declared preferring locally generated power. To the others, the location of production did not matter, and one respondent admitted to never have given that aspect any thought before.

4.4. Financial conditions

Five participants named the price of the offer as a key factor for their decision for participation. They had compared the price of the offer to what they paid for their current electricity supply, and mostly considered the additional price low. Two of the participants had compared the conditions with the option of investing in a private residential photovoltaic installation. They also considered the price low. In addition, one person mentioned that the participation in ewz.solarzüri is less time consuming: "The fact that I only pay a one-off charge and do not need to deal with the topic again is very pleasant." To the five other participants, the price was not a crucial factor on which to base their decision. One participant, for instance, stated that a price in this magnitude did not matter to him if it serves a useful purpose. However, to four non-participants, the price was a barrier to participation. Either they did not have enough money to meet the one-off costs, or they were content with their current product and did not see any necessity for a change. One respondent also explained feeling no personal obligation to act since solar power is becoming more important without his personal support.

4.5. Other relevant factors

First, the personal social environment seems to have an additional influence on the respondents' decisions for or against participation. One of the non-participants sought advice from friends whenever he did not have enough knowledge about a certain topic on which to base a decision: "I'm not good at technical stuff. I cannot decide. I thus prefer relying on the opinions of others."

Second, two respondents explained that their knowledge about renewable energy production – through many years of experience deriving from work in a related field, or out of personal interest – helped them reach a detailed understanding of ewz.solarzüri, and reinforced their willingness to participate accordingly. One of them explained: "It was very comprehensible to me. I have been dealing with the topic of solar power production for twenty years now, and I regularly read about it." In contrast, another person made clear that the lack of knowledge about the mechanisms of the project (how the generated electricity is distributed) led to a decision against participation. One person expressed objections to the project because Switzerland produced a power surplus (mentioned in Section 4.1). Switzerland exports power but also relies on imports during certain periods, according to the annual grid data report of Swissgrid (2015) – the respondent's opinion thus classifies as resulting from a lack of knowledge to some extent.

Finally, the option of building a private energy installation also influences the decision for participation. Four participants claimed they were not able to construct a photovoltaic installation by themselves, either because they were tenants, because they were not allowed legally to alter the façade of their house, or because their rooftops were insufficient in size for a photovoltaic installation covering the full amount of their electricity consumption. As described above in Section 4.4, the participation in ewz.solarzüri is considered attractive as it requires little financial resources and time in comparison to the construction of a private residential installation. While the lack of the option to build an installation of their own can be a motivating factor for participation in ewz.solarzüri, owning an energy installation, in turn, impedes the decision to participate. One non-participant explained: "We already possess such an installation on our rooftop […], so those who *do not* should rather participate."

Apart from three persons objecting to solar power or the project itself, and from three being constrained financially, barriers to participation are of a rather passive nature. Respondents were content with the electricity they currently obtained, and thus had no interest to invest time and money in assessing alternatives. Three non-participants did not care about sustainability of their electricity in general, and the majority was indifferent in terms of the place where their electricity was produced.

5. Discussion

As expected based on previous studies about community energy projects (Section 2.2), the main driver for participation in the ewz.solarzüri project was the desire to support renewable power and the country's energy transition. To most participants, the specific renewable energy source did not determine participation. The regional nature of the project, however, was another main driver. The installation may not necessarily be located within their neighborhood or on a familiar building, as long as it was in Switzerland and preferably even in Zurich or its surrounding area. Proximity to the installation seemed to enhance the sense of tangibility and transparency.

Apart from the motivational factor of directly supporting renewable and local energy production, the financial conditions turned out to play a key role for the decision to participate. They posed a barrier for half of the non-participants we interviewed, even though they supported the idea of sustainable energy generation in principle. Most of these non-participants compared the offer of ewz.solarzüri to their current electricity product, which also comprises renewable energy sources (see Section 2.1), and saw no or not enough additional value in comparison. It is probable that their decision was also influenced by the "status quo bias", the tendency of people to remain at the status quo (e.g. Kahneman, Knetsch, & Thaler, 1991). The participants, in contrast, rather compared the offer to building a private residential photovoltaic installation of their own under the current conditions in Switzerland (Section 1), or of taking part in a community project. They perceived ewz.solarzüri as less expensive and less time consuming in comparison. The "low-level participation" setting of the project, and the fact that participants do not become legal owners, did not eliminate the sense of ownership in participants: Almost half of them declared feeling as if the plant was "theirs" and as if they properly produced the electricity. Participation had an emotional value for the majority of participants. Therefore, neither legal ownership nor a broad involvement in the processes of initiation, administration, decision-making, or construction of the plant – as it is the case for community energy projects – seem required to make participants *feel* as owners and as electricity

producers. A low level of participation appears sufficient to evoke a sense of ownership and related positive emotions, such as independence and pride.

In addition to these factors, the analysis indicates that the decision for or against participation is influenced by the possibility to build a private photovoltaic installation, social influence like the opinions of friends, colleagues, and family, and the levels of knowledge of and interest in the topic of electricity production.

On the one hand, we are aware that the findings of our study are limited in their validity for the overall population, due to the small sample size of the study. On the other hand, qualitative research does not intend to show representative results but to create a deeper understanding of a given issue. We focused on triggers and barriers regarding the unexplored type of community energy projects requiring a low-level participation rather, as opposed to conducting quantitative hypothesis testing. For further research, the findings provide a basis on which influencing factors on participation in a low-level participation energy project, and their interactions can be examined in a larger sample. As such, research could apply validated scales to measure determining psychological constructs, such as environmental awareness, place attachment, sense of ownership, knowledge, and social influence/social norms. Additional socio-demographic factors influencing participation, e.g. housing status (tenant vs. homeowner), income or education, could also be considered. This would allow identifying different customer segments, learning more about how an energy project should be designed to meet their specific needs, and adapting the information and promotion accordingly. To broaden the scope, it would be valuable to assess in what form and to what extent the different customer segments are interested in participating (e.g. financial investment, legal ownership, time investment in decision and building processes etc., see Section 1).

6. Conclusions

Overall, the study describes a specific example of a of a low-level-participation energy project in Switzerland that allows urban residents to contribute to the country's energy turnaround. The outcomes of the study provide a better understanding of the reasons why citizens decide to take part in such a project. The findings indicate that it constitutes a valuable complement to existing community energy concepts and incentive programs for residential installations. It specifically offers a less costly, risky and time-consuming opportunity for residents who lack the resources to build a residential installation of their own, and who prefer being involved in an energy project only to a low extent. The case ewz.solarzüri sets a successful example for other cities. The concept can equally well be applied to other types of renewable energy (see e.g. Windtegoed in the Netherlands as an example for wind energy (Qurrent, 2017). Our study lays a foundation to better understand driving factors for participation in urban households in order to design similar energy projects in accordance with customers' needs and expectations.

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