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# DELIVERABLE 1.2

# Report on psychological factors based on lab and panel studies

## Version 1.1

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# 1. Abstract

The present report compares motivational drivers of two forms of active energy participation: installing photovoltaic (PV) systems as a form of individual prosumerism and joining energy communities. Using representative panel survey data collected in all four project countries, Austria, Germany, Romania, and Sweden (total *N* = 1479), we examined how financial, environmental, social, independence, technical, and democratic motivations predict individuals' intentions to install PV systems or join energy communities. In addition, we tested whether the effects of biospheric values, public service attitudes, and energy citizenship on PV or energy community intentions are mediated by corresponding motivational dimensions. Results from multiple regression analyses indicate that environmental, independence and technical motivations were the most important predictors of PV intentions and social, independence, technical, and democratic motivations were the most important predictors of energy community joining intentions. These findings highlight the importance of tailoring communication and engagement strategies to the specific participation format: emphasizing technical empowerment and independence may be more effective for promoting PV uptake, whereas highlighting community benefits, social cooperation, and participatory governance may be especially relevant for increasing interest in energy communities.

# 2. T1.3 Experimental studies

The results of the experimental studies of task T1.3 have been uploaded as a preprint and can be found here: https://doi.org/10.5281/zenodo.18429525

# 3. T1.4 Panel studies: Introduction

The dependence on fossil fuels and the resulting growing challenges posed by climate change have underscored the urgent need for a rapid energy transition (Lund et al., 2017). While renewable energy technologies are essential for reducing greenhouse gas emissions, their successful implementation heavily depends on citizens' acceptance, engagement, and willingness to participate actively in the energy system (Perlaviciute et al., 2021; Sovacool, 2014).

Within this context, **prosumerism** and **energy communities** have emerged as pivotal concepts in the European Union (EU), playing a crucial role in the transition toward a more sustainable and decentralized energy system. Prosumerism refers to individuals who not only use energy but also generate it, and often also share excess energy with utilities and other consumers, therefore claiming a dual role as both producers and consumers of energy (Rathnayaka et al., 2015).

Prosumerism typically takes place at the individual or household level through, e.g., the installation of residential photovoltaic (PV) systems, enabling households to generate renewable electricity while simultaneously still being able to consume energy from the grid. Since PV prices have declined substantially over the last few decades, the economic barriers to PV uptake have lowered, making renewable energy production more accessible to private households across Europe (Bauske et al., 2022). Accordingly, the distribution of PV technologies has been widely studied as the outcome of multiple motivations, including economic considerations (e.g., cost savings and investment returns) or environmental concerns (Arroyo, & Carrete, 2019; Karakaya et al., 2015).

While prosumerism often is a (tough not required) part of energy communities, energy communities extend the concept of prosumerism beyond individual households to a col-

lective level of organization and participation. Rather than focusing solely on private ownership and self-consumption of renewable energy technologies, energy communities enable citizens to jointly produce, share, and govern energy resources within a shared social and institutional framework.

Energy communities are central to the EU's Clean Energy Package (CEP), which aims to empower consumers and place them at the heart of the energy transition. Renewable Energy Communities (RECs) and Citizen Energy Communities (CECs) are recognized as new market actors that are intended to prioritize community and societal benefits over profit maximization.

Importantly, motivations for joining an energy community may differ substantially from those driving individual PV adoption. Whereas PV installation is often associated with economic efficiency and personal autonomy, energy communities may additionally appeal to social and democratic motivations, such as a desire for communal engagement, shared decision-making, and contributing to a more participatory and just energy system. Experimental research indicates that perceptions of inclusive representation, and shared benefits play a crucial role in shaping individuals' willingness to participate in energy communities, highlighting the relevance of social and procedural justice for engagement (Goedkoop et al., 2023).

This distinction raises the question of how motivations for engaging in energy communities differ from motivations for prosumerism. In general, there are several motivations that might be central to either installing PV systems or joining energy communities. One important motivation might be **environmental motivations** referring to individuals' desire to contribute to climate change mitigation, preserve natural resources, and reduce environmental harm by using clean, renewable energy sources such as solar power. Environmental motivations have previously been linked to both PV system uptake and contributing to energy communities (Schulte et al., 2022).

**Social motivations** on the other hand, capture the desire to collaborate with others, strengthen neighborhood ties, and engage in collective decision-making. They might be especially important for contributing to energy communities and several studies found social or communal motivations to be related to energy community involvement (Sloot et al., 2019; Sloot et al., 2021).

**Independence motivations** refer to the desire for self-sufficiency, energy security, and greater control over energy production and consumption. They might be especially relevant for people owing a PV system as producing one's own electricity can reduce reliance on external energy providers and could therefore increase perceived control over energy costs and supply. Especially in recent years where fear of blackouts has increased in the general population (Századvég, 2022), energy independence motivations for installing PV systems or joining an energy community might be an important aspect.

**Financial motivations** encompass expectations of economic benefits, such as reducing electricity bills, increasing property value, benefiting from government subsidies or incentives, and earning income by feeding surplus energy into the grid. Extensive research on PV adoption consistently identifies financial considerations as the strongest and most robust predictor of installation intentions and behavior (Scheller et al., 2024). Lower investment costs, favorable feed-in tariffs, and subsidy schemes substantially increase the attractiveness of PV systems, particularly for homeowners. Although, financial profits may not be the primary focus of energy communities, they are still relevant and could be a secondary outcome as shared energy production may reduce costs, optimize resource use, and therefore still provide economic benefits to members. Research also shows that

people often name financial motives as reasons for energy community involvement (Sloot et al., 2019).

**Technical motivations** refer to interest in, or enthusiasm for, innovative energy technologies and systems, including smart home technologies, energy monitoring, battery storage, and advanced grid interaction. Such motivations reflect curiosity, technological affinity, and enjoyment of experimenting with novel technical systems. Technical interest could motivate early adopters and technologically inclined individuals to engage with renewable energy solutions as both prosumers or in energy communities.

Lastly, **democratic motivations** refer to the desire to democratize the energy sector by shifting control over energy production and decision-making from large utility companies to citizens and local communities, enabling greater transparency, participation, and shared ownership. These motivations are closely linked to concepts of energy democracy and energy citizenship, which emphasize citizens' rights and responsibilities in shaping the energy system (see Hamann et al., 2023). These democratic motivations might be especially important for joining energy communities which explicitly offer opportunities for shared ownership, participatory decision-making, and local control over energy resources and offer a way to decentralize the energy system.

Next to these motivational dimensions, broader psychological constructs, including biospheric values, public service attitudes, energy citizenship, consideration of future consequences, willingness to sacrifice, and privacy concerns could be related to people's willingness and intentions to either install PV systems or join energy communities.

Despite growing policy interest in both prosumerism and energy communities, comparative quantitative evidence on citizens' motivations to engage in these different forms of participation remains limited. Existing research has often focused either on adopters of PV systems or on members of specific energy communities, without systematically comparing the motivational drivers underlying intentions to install PV systems versus intentions to join energy communities. Moreover, intentions to install PVs and to join energy communities might vary across national contexts, shaped by differences in energy systems, regulatory environments, and cultural norms.

Against this background, we aimed to systematically compare motivations for two distinct pathways of active participation in the energy system: installing PV systems as a form of prosumerism, and joining energy communities, in Austria, Germany, Romania, and Sweden. Specifically, we studied how different motivations— environmental, social, independence, financial, technical, democratization of the energy sector—predict peoples' intentions to engage in these forms of participation. We expected that:

**H1: a)** Financial motivations will be the strongest predictor of individuals' intention to install photovoltaic (PV) systems. That is, higher financial motivation is associated with higher intention.

**H1: b)** Environmental motivations will show a small effect on intention to install PV systems. Note, we do not explicitly expect effects of social and democratic motivations on intentions to install PV systems.

**H2:** Biospheric values will predict environmental motivations positively, which in turn predict individuals' intention to install PV systems. I.e., we expect a mediation.

**H3: a)** Environmental, **b)** social, and **c)** democratic motivations will have an effect on individuals' intention to join energy communities. That is, higher environmental, social and

demotic motivations are associated with higher intention to join energy communities. This effect will likely be stronger than for PV systems.

**H4:** Public service attitudes will be positively related to social motivations to join an energy community, which in turn predict individuals' intention to join energy communities. I.e., we expect a mediation.

**H5:** Energy citizenship will be positively related to democratic motivations to join an energy community, which in turn predict individuals' intention to join energy communities. I.e., we expect a mediation.

All hypotheses were preregistered before the data collection (https://osf.io/fx85t/overview?view_only=07e754c33aed4514873de6ed131b8af0).

# 4. Methods

## 4.1 Participants

### 4.1.1 Austrian Sample

For the Austrian survey we used the online panel "Talk", to gather a representative sample of the Austrian population (based on age, gender, education, and federal state) and invited them to take part in the online survey in German programmed with Limesurvey. Participants were compensated for their participation by the panel. In total, 936 people (partially) completed the survey out of which 548 had to be excluded, most of them because they did not finish the survey, did not pass the attention check or because they finished the survey too quickly. Out of the remaining 388 participants, 50.8% were female and 49.2% male. Their ages ranged from 18 to 85 ($M$ = 51.45, $SD$ = 17.96). Sixty-five percent had completed at most lower-level education.

### 4.1.2 German Sample

For the German survey we used the online panel "Talk", to gather a representative sample of the German population (based on age, gender, education, and federal state) and invited them to take part in the online survey in German programmed with Limesurvey. Participants were compensated for their participation by the panel. In total, 1066 people (partially) completed the survey out of which 686 had to be excluded, most of them because they did not finish the survey, did not pass the attention check or because they finished the survey too quickly. Out of the remaining 380 participants, 52.9% were female and 46.6% male. Their ages ranged from 18 to 84 ($M$ = 52.89, $SD$ = 16.38). Sixty percent had completed at most lower-level education.

### 4.1.3 Rumanian Sample

For the Rumanian survey we used the online panel "Talk", to gather a representative sample of the Rumanian population (based on age, gender, and federal state) and invited them to take part in the online survey in Rumanian programmed with Limesurvey. Participants were compensated for their participation by the panel. In total, 1115 people (partially) completed the survey out of which 766 had to be excluded, most of them because they did not finish the survey, did not pass the attention check or because they finished the survey too quickly. Out of the remaining 349 participants, 51.9% were female and 48.1% male. Their ages ranged from 18 to 80 ($M$ = 46.99, $SD$ = 14.70). Sixty-one percent of the sample reported having completed a university degree, which is substantially higher than the Romanian population average of approximately 20%. This indicates that the sample is uncharacteristically highly educated.

### 4.1.4 Swedish Sample

For the Swedish survey we used the online panel "Norstat", to gather a representative sample of the Swedish population (based on age, gender, education, and federal state) and invited them to take part in the online survey in Swedish programmed with Limesurvey. Participants were compensated for their participation by the panel. In total, 877 people (partially) completed the survey out of which 515 had to be excluded, most of them because they did not finish the survey, did not pass the attention check. Out of the remaining 362 participants, 47% were female and 53% male. Their ages ranged from 18 to 88 ($M$ = 50.88, $SD$ = 18.06). Forty percent had completed a university degree.

### 4.1.5 Combined Sample

In the following, most analysis will be conducted with a combined sample of all four countries ($N$ = 1479), unless otherwise specified.

## 4.2 Procedure

When clicking on the survey link, participants were initially provided with a brief overview of the study and prompted to provide their informed consent. Subsequently, they answered some questions regarding demographic variables. Following this, participants answered some questions regarding their prior familiarity with PV systems, feeding electricity into the grid and energy communities. They then evaluated their own subjective knowledge on energy communities. Then they had to answer an objective energy community knowledge questionnaire. Afterwards, they were presented with a concise introduction and description of energy communities, followed by an attention check assessing whether they had read the description of energy communities. Only if they answered the attention check correctly were they able to continue with the survey. Next, participants rated different motivations for installing PV systems and joining energy communities and indicated their intention to install PV systems and join an energy community. Afterwards, they answered questions about their biospheric values, willingness to sacrifice, energy citizenship, public service attitudes, consideration of future consequences and privacy concerns. Lastly, they indicated how concentrated or distracted they were while completing the survey.

## 4.3 Measures

The complete survey translated in English can be found in the Appendix.

**Subjective Knowledge** about energy communities was assessed with three self-developed items, concerning people's subjective knowledge about who can fund an energy community, the technical aspects of energy communities and how to found an energy community with items like "I know who can establish and operate an energy community." ($\alpha$ = .91).

**Objective Knowledge** about energy communities was measured with a self-developed questionnaire with questions about social, legal, and technical aspects of energy communities. Example items include: "What best describes an energy community?", with the answer options i) "A new type of electricity meter for households", ii) "A company for distributing electricity to corporations", iii) "A group of citizens who share energy" (correct answer), iv)"A subsidy fund for public electricity providers", v) "A government program for electricity prices". In total, six items were used with a single-choice answer format giving participants five answer options per question out of which only one was correct. The reliability of the scale was rather low with $\alpha$ = .49. This low reliability, however, might be due to the broad conceptualization of energy community knowledge. Because the scale asks about different aspects of energy community knowledge, it is questionable whether Cronbach's $\alpha$ even offers a good indication of the scale's quality (see Tavakol et al., 2011). To better evaluate the scale's quality, we examined item-level characteristics.

The items showed acceptable difficulty levels (with proportions of correct answers ranging from 48% to 84% and moderate discrimination indices (point-biserial correlations between .45 and .59, suggesting that the scale effectively differentiated participants across a range of knowledge levels.

**Motivations to install PV** was measured with six self-developed items focusing on people's environmental, social, independence, financial, technical, and democratic motivations to install a PV system. Each of these motivations was assessed with one item respectively and people had to rate how motivating each of these aspects is to them to install a PV on a seven-point rating scale. An example item was "Climate protection: Contributing to climate protection and the conservation of natural resources through renewable energies.".

**Motivations to join Energy Communities** was measured identically to motivation to install PV. People had to rate six self-developed items focusing on environmental, social, independence, financial, technical, and democratic motivations to join an energy community on how motivating they find each aspect to join an energy community on a seven-point rating scale. An example item was "Community: Strengthen neighborly relations and make joint decisions on energy production and use.".

**Intention to install PV** was measured with four items like "I am interested in installing a photovoltaic system (e.g., in the garden or on the balcony)." (seven-point rating scale, $\alpha$ = .95).

**Intention to join an Energy Community** was measured with four items like "If the opportunity arises, I will join an energy community." (seven-point rating scale, $\alpha$ = .96).

**Biospheric Values** were assessed with two items namely "I am convinced that people should care for nature. Environmental protection is important to me." and "It is important to me that the earth is respected. The welfare of animals and plants is close to my heart." (seven-point rating scale, $\alpha$ = .90).

**Energy Citizenship** was measured on the individual level with nine items by Held et al. (2024) with items like "I feel responsible for contributing to a just and sustainable energy transition" (seven-point rating scale, $\alpha$ = .93).

**Public Service Attitudes** were assessed with four items including items like "Meaningful service to society is very important to me." (seven-point rating scale, $\alpha$ = .92).

The following measures were only included for exploratory purposes and are not part of the primary analyses of this report:

**Willingness to Sacrifice** to reduce greenhouse gas emissions was measured with three items like "To what extent would you be willing to pay significantly higher prices in order to reduce greenhouse gas emissions?" (seven-point rating scale, $\alpha$ = .88).

**Considering Future Consequences** was measured with six items out of which three were about considering future consequences and three where about considering immediate consequences. The three items about considering immediate consequences were reverse coded. Example items include "When I make a decision, I think about how it might affect me in the future." (seven-point rating scale, $\alpha$ = .74).

**Privacy Concerns** was measured with five items like "I am concerned that third parties may access my personal data." (seven-point rating scale, $\alpha$ = .95).

# 5. Analysis and Results

We conducted descriptive analyses and built the mean composite scores for the scales following a reliability analysis. We first looked descriptively at country differences of relevant variables to gain an overview of the current state of things in each of the countries (see Figure 1-6 and Table 1).

**Figure 1.** People already owning PV, feeding electricity into the grid, and being members of energy communities per country in percent.

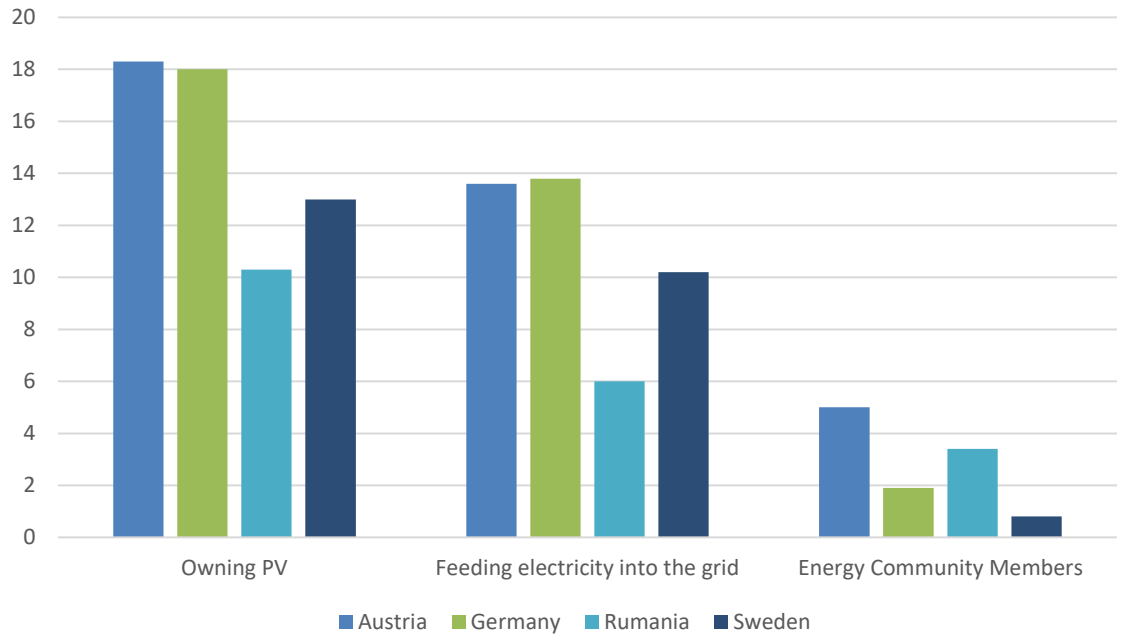
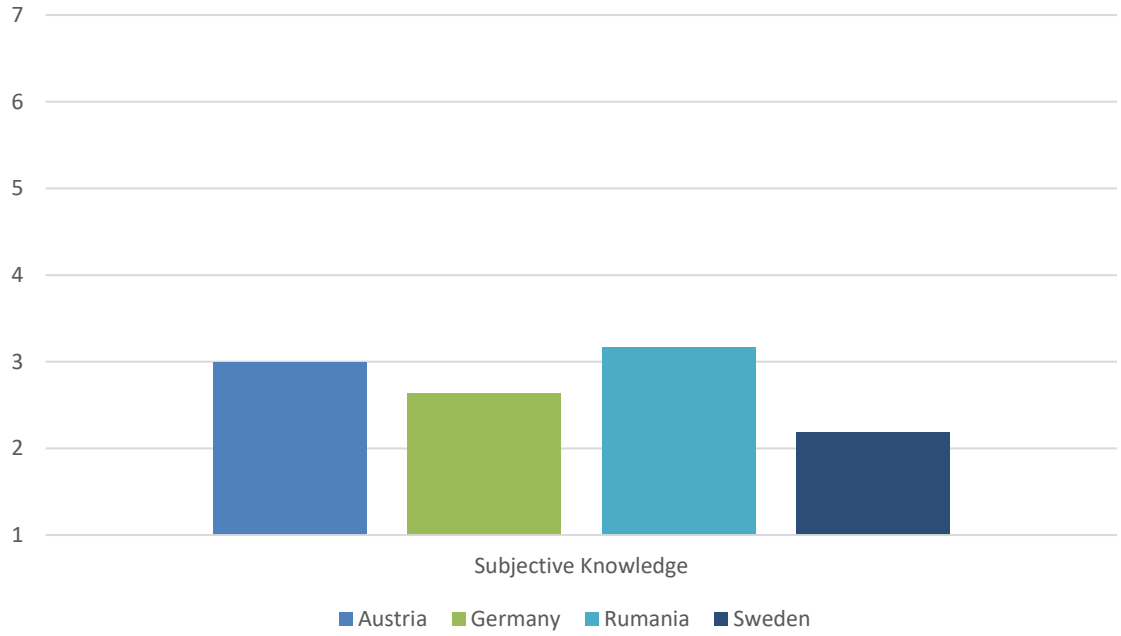
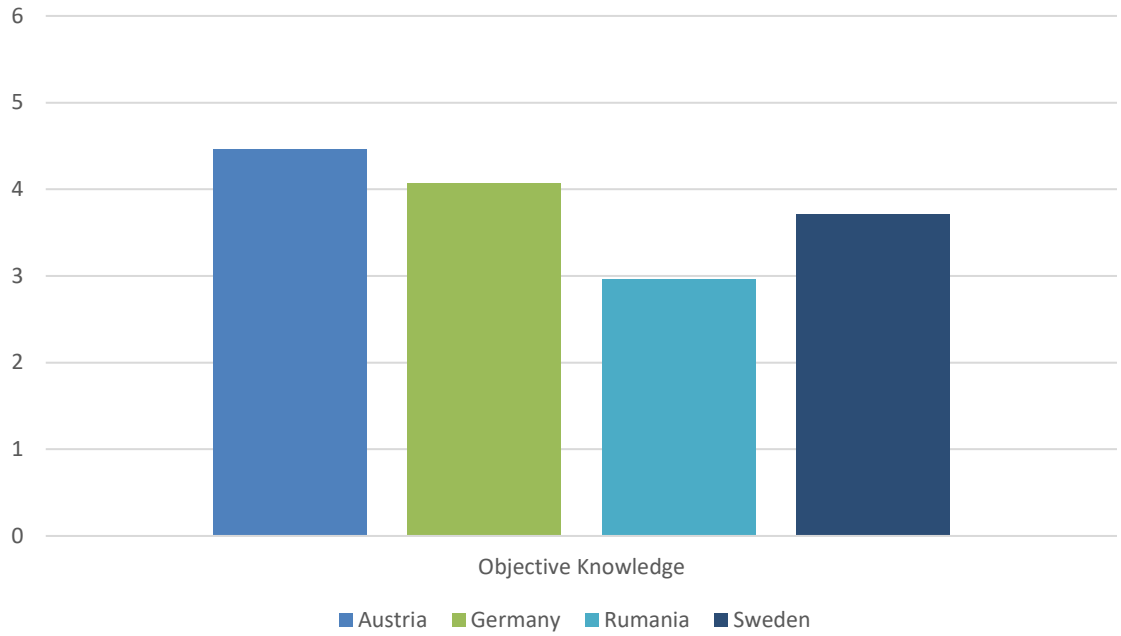



**Figure 2.** People's subjective prior knowledge on energy communities per country.



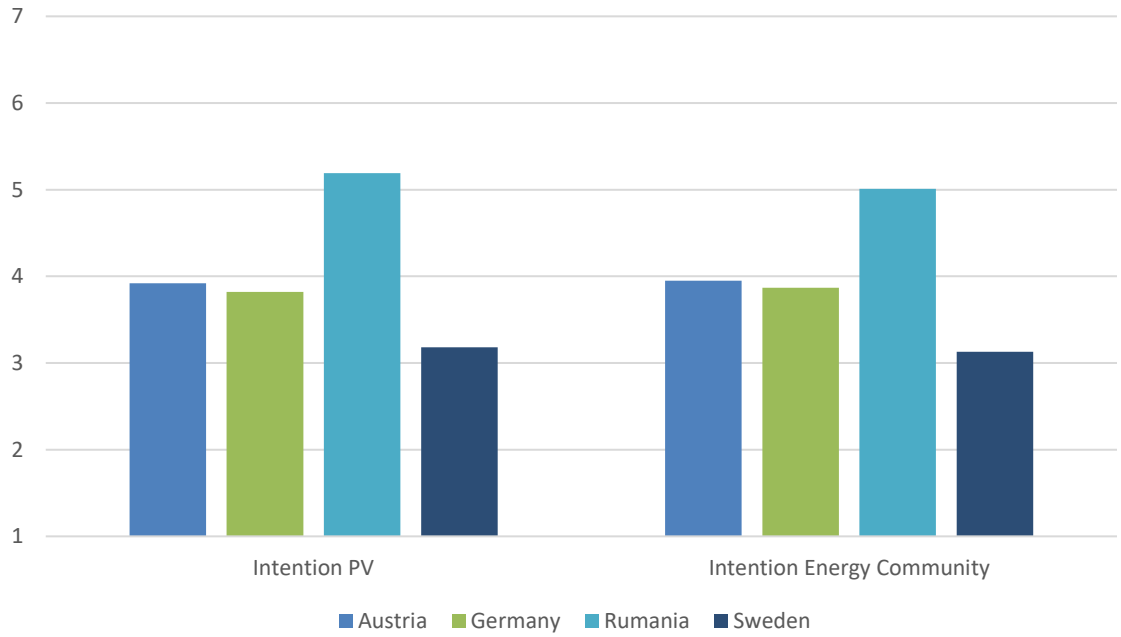

*Note.* Scale ranged from 1"I don't know anything about it." to 7" I am very familiar with it."

**Figure 3.** People's objective prior knowledge on energy communities per country.



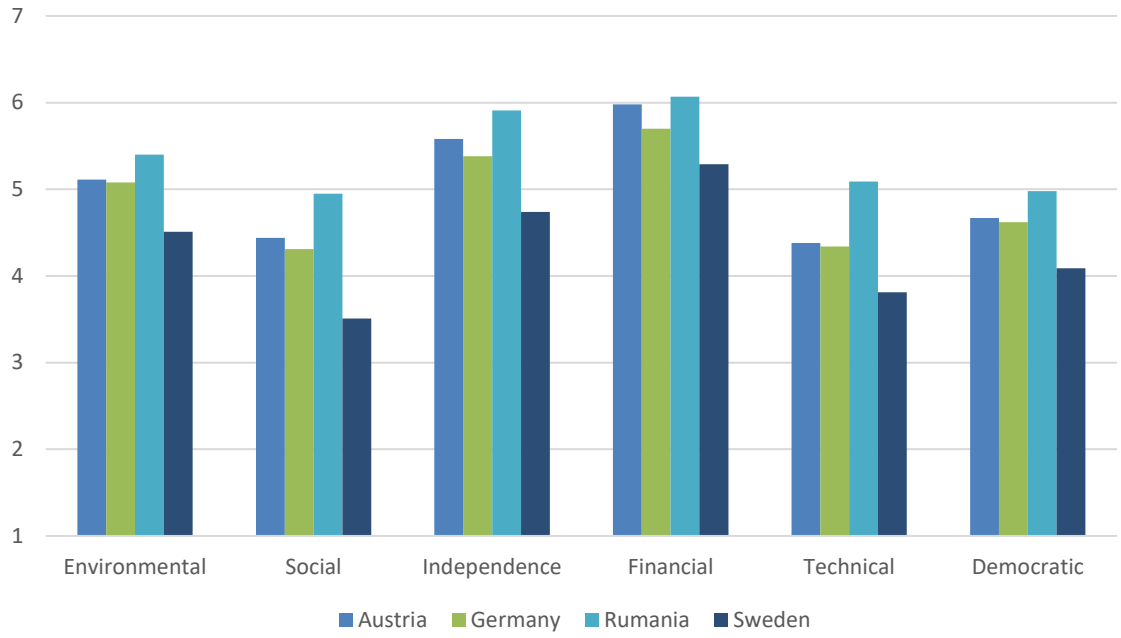

*Note.* Scale ranged from 0 to 6 points based on the number of correctly answered questions.

**Table 4.** People's intention to install PV or to join an energy community per country.



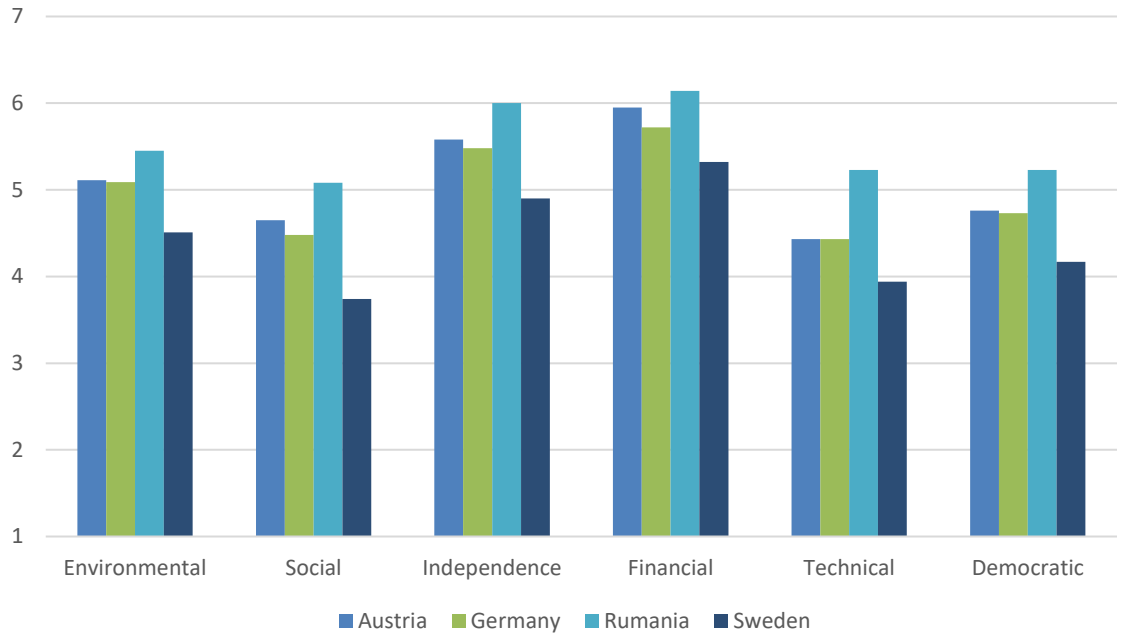

*Note.* Scale ranged from 1 "do not agree at all" to 7 "completely agree".

**Figure 5.** Motivations for installing PVs per country




*Note.* Scale ranged from 1 ”not motivating at all” to 7 ”very motivating”.

**Figure 6.** Motivations for joining an energy community per country




*Note.* Scale ranged from 1 ”not motivating at all” to 7 ”very motivating”.

**Table 1.** Heat map of bivariate correlations

| | PV Intention | Energy Community Intention | Subjective Knowledge | Objective Knowledge | Biospheric Values | Willingness to Sacrifice | Energy Citizenship | Public Service Attitudes | Considering Future Consequences |
|---|---|---|---|---|---|---|---|---|---|
| Energy Community Intention | .748** | -- | | | | | | | |
| Subjective Knowledge | .298** | .386** | -- | | | | | | |
| Objective Knowledge | -.074** | -.023 | -.030 | -- | | | | | |
| Biospheric Values | .325** | .373** | .112** | .052* | -- | | | | |
| Willingness to Sacrifice | .376** | .416** | .206** | -.112** | .434** | -- | | | |
| Energy Citizenship | .595** | .692** | .337** | -.024 | .602** | .563** | -- | | |
| Public Service Attitudes | .409** | .533** | .185** | .002 | .617** | .490** | .736** | -- | |
| Considering Future Consequences | .222** | .227** | -.074* | .157** | .456** | .235** | .374** | .438** | -- |
| Privacy Concerns | .115** | .120** | -.035 | -.075** | .170** | .079** | .174** | .180** | .145** |

*Note.* ** = $p<.01$, * = $p<.05$

We then performed regression analyses to see which motivations (environmental, social, independence, financial, technical, democratization of the energy sector) predict people's intention to install PV systems and join an energy community.

We predicted that financial motivations will be the strongest predictor of individuals' intention to install PV systems (H1a) and that environmental motivations will show a small effect on intention to install PV systems (H1b). We did not explicitly expect effects of social and democratic motivations on intentions to install PV systems. We conducted a two-

stage hierarchical multiple regression analysis with intentions to install PV systems as the dependent variable. The demographic variables gender, age, education and income were entered at stage one of the regression. The motivations (environmental, social, independence, financial, technical, democratization of the energy sector) were entered at stage two. The hierarchical multiple regression revealed that at stage one, the demographic variables explained a significant amount of variation in people's intention to install PVs ($R^2$= .03, $F$ (4,1140) = 8.84, $p$ <.001). The only significant predictor was age, with younger people having higher intentions of installing PVs. The demographic variables accounted for 3% of the variance in the intention to install PVs. Introducing the motivations environmental, social, independence, financial, technical, democratization of the energy sector at step two contributed significantly to the regression model ($R^2$ change = .35, $F$(6,1134) = 107.24, $p$<.001). They accounted for 35.1% of the variation in PV intention. The results of the regression analysis are displayed in Table 2. They revealed that the motivations environmental, independence, and technical all predict PV intention, with technical motivations being the strongest predictor. In total, the model could explain 38.1% of the variance in PV intention.

Contrary to H1a, financial motivations were not the driving factor for explaining the dependent variable. Instead, independence and technical features stood out for participants' intention to install a PV system. However, confirming H1b, environmental motivations indeed showed a small effect.

**Table 2**. Regression analysis with PV intention as dependent variable

| **Predictor** | ***B*** | ***SE B*** | ***β*** | ***t*** | ***p*** |
|---|---|---|---|---|---|
| **Step 1** | | | | | |
| Gender | -.160 | .113 | -.042 | -1.418 | .157 |
| Age | -.018 | .003 | -.165 | -5.628 | <.001 |
| Education | .000 | .000 | .024 | .822 | .411 |
| Income | .059 | .050 | .035 | 1.171 | .242 |
| **Step 2** | | | | | |
| Gender | -.087 | .092 | -.023 | -0.944 | .345 |
| Age | .015 | .003 | -.138 | -5.797 | <.001 |
| Education | .000 | .000 | .008 | .356 | .722 |
| Income | .087 | .041 | .052 | 2.144 | .032 |
| Environmental | .135 | .036 | .130 | 3.786 | <.001 |
| Social | .061 | .037 | .057 | 1.663 | .097 |
| Independence | .232 | .042 | .206 | 5.577 | <.001 |
| Financial | .028 | .043 | .023 | 0.665 | .506 |
| Technical | .277 | .036 | .261 | 7.713 | <.001 |
| Democratic | .048 | .040 | .044 | 1.207 | .228 |

*Note.* Most important predictors with beta > .1 are highlighted.

Next, we conducted a two-stage hierarchical multiple regression analysis with intention to join energy communities as the dependent variable. We predicted that environmental, social, and democratic motivations would have an effect on individuals' intention to join energy communities (H3). The demographic variables gender, age, education and income were entered at stage one of the regression. The motivations (environmental, social, independence, financial, technical, democratization of the energy sector) were entered at stage two. The hierarchical multiple regression revealed that at stage one, the demographic variables did not explain a significant amount of variation in people's intention to join an energy community ($R^2$= .01, $F$ (4,1328) = 1.67, $p$ = .156). Introducing the motivations environmental, social, independence, financial, technical, democratization of the

energy sector at step two contributed significantly to the regression model ($R^2$ change = .45, $F(6,1322) = 180.55$, $p<.001$). They accounted for 44.8% of the variation in energy community intention. The results of the regression analysis are displayed in Table 3. The regression analysis revealed that all included motivational variables, i.e., environmental, social, independence, financial, technical, democratization predict people's intention to join an energy community, with social motivations being the strongest predictor. On the other hand, the effects of environmental motivation and financial motivation are very small (beta < .1). In total, the model was able to explain 44.9% of the variance in energy community joining intention. Hence, H3 could be confirmed by our data.

**Table 3**. Regression analysis with energy community intention as dependent variable

| **Predictor** | ***B*** | ***SE B*** | ***β*** | ***t*** | ***p*** |
|---|---|---|---|---|---|
| **Step 1** | | | | | |
| Gender | -.070 | .100 | -.020 | -0.698 | .485 |
| Age | -.007 | .003 | -.063 | -2.295 | .022 |
| Education | .000 | .000 | .025 | .895 | .371 |
| Income | .022 | .044 | .014 | 0.487 | .626 |
| **Step 2** | | | | | |
| Gender | -.071 | .076 | -.020 | -0.932 | .352 |
| Age | -.008 | .002 | -.073 | -3.498 | <.001 |
| Education | .000 | .000 | .007 | .335 | .738 |
| Income | .073 | .033 | .047 | 2.219 | .027 |
| Environmental | .090 | .030 | .091 | 3.029 | .002 |
| Social | .226 | .032 | .263 | 8.333 | <.001 |
| Independence | .116 | .041 | .103 | 2.865 | .004 |
| Financial | .085 | .039 | .071 | 2.187 | .029 |
| Technical | .100 | .029 | .101 | 3.431 | <.001 |
| Democratic | .182 | .036 | .175 | 5.045 | <.001 |

*Note.* Most important predictors with beta > .1 are highlighted.

A mediation analysis was conducted to examine H2 that biospheric values will predict environmental motivations, which in turn predict individuals' intention to install PV systems. An effect of biospheric values on PV intention was observed ($b = 0.48$, $t(1223) = 12.03$, $p < .001$) with people who reported higher biospheric values also reporting higher intentions to install PVs. After entering the mediator environmental motivations into the model, biospheric values predicted environmental motivations significantly ($b = 0.81$, $t(1223) = 24.41$, $p < .001$), with people who reported higher biospheric values also reporting higher environmental motivations. Environmental motivations then in turn predicted PV intentions significantly ($b = 0.43$, $t(1222) = 8.20$, $p < .001$), with people who reported higher environmental motivations, on average also reporting higher intentions to install PVs. A small remaining effect of biospheric values on PV intention after controlling for the mediations of environmental motivations, was observed ($b = 0.13$, $t(1223) = 2.85$, $p = .005$). Environmental motivations significantly mediated the effect of biospheric values on PV installation intention, thus confirming H2.

To examine H4 that public service attitudes will be positively related to social motivations to join an energy community, which in turn predict individuals' intention to join energy communities, a second mediation analysis was performed. An effect of public service attitudes on energy community intention was observed ($b = 0.70$, $t(1422) = 23.73$, $p < .001$) with people who reported higher public service attitudes also reporting higher intentions to join an energy community. After entering the mediator social motivations into the model, public service attitudes predicted social motivations significantly ($b = 0.69$, $t(1422) = 23.16$, $p < .001$), with people who reported higher public service attitudes also

reporting higher social motivations. Social motivations then in turn predicted energy community intentions significantly ($b$ = 0.45, $t(1421)$ = 18.72, $p$ < .001), with people who reported higher social motivations, on average also reporting higher intentions to join an energy community. A remaining effect of public service attitudes on energy community intention after controlling for the mediations of social motivations, was observed ($b$ = 0.40, $t(1422)$ = 12.77, $p$ < .001). Social motivations significantly mediated the effect of public service attitudes on energy community joining intention, although a significant direct effect of public service attitudes remained, indicating a partial mediation. This confirmed our H4.

Lastly, a third mediation analysis was performed, to examine our hypothesis that energy citizenship will be positively related to democratic motivations to join an energy community, which in turn predict individuals' intention to join energy communities (H5). An effect of energy citizenship on energy community intention was observed ($b$ = 0.90, $t(1422)$ = 26.15, $p$ < .001) with people who reported higher energy citizenship also reporting higher intentions to join an energy community. After entering the mediator democratic motivations into the model, energy citizenship predicted democratic motivations significantly ($b$ = 0.79, $t(1422)$ = 29.99, $p$ < .001), with people who reported higher energy citizenship also reporting higher democratic motivations. Democratic motivations then in turn predicted energy community intentions significantly ($b$ = 0.27, $t(1421)$ = 11.18, $p$ < .001), with people who reported higher democratic motivations, on average also reporting higher intentions to join an energy community. A remaining effect of energy citizenship on energy community intention after controlling for the mediations of democratic motivations, was observed ($b$ = 0.69, $t(1422)$ = 22.54, $p$ < .001). Hence, democratic motivations significantly partially mediated the effect of energy citizenship on energy community joining intention, which confirmed H5.

# 6. Conclusion

In this report, we examined psychological factors underlying peoples' intentions to engage more actively in the energy transition through two distinct pathways: (1) installing PV systems as a form of prosumerism, and (2) trough joining energy communities. Using large-scale panel survey data from Austria, Germany, Romania, and Sweden, we compared the relative importance of environmental, social, independence, financial, technical, and democratic motivations, and tested mediation models linking broader psychological constructs (biospheric values, public service attitudes, and energy citizenship) to participation intentions.

Overall, the findings show that intentions to install PV systems and to join energy communities are shaped by partially overlapping but still distinguishable motivations. For PV installation intentions, the included motivations explained a significant amount of variance beyond demographics. While financial motivations were rated highest on average, suggesting that participants generally perceived financial considerations as highly motivating, regression analyses revealed that technical motivations were the strongest predictor of intentions to install PV systems, followed by independence motivations and environmental motivations. This suggests that, in addition to economic considerations, interest in technology and the desire for greater autonomy and control over energy supply are particularly relevant for PV uptake intentions. Environmental motivations also contributed to PV intentions, consistent with the idea that climate-related concerns remain an important, though not exclusive, driver of prosumerism.

For joining energy communities, the included motivational factors were even more predictive than for PV intentions, while demographic variables were unsignificant. Importantly, all assessed motivations (environmental, social, independence, financial, technical, democratization of the energy sector) contributed significantly to energy commu-

nity joining intentions, with social motivations being the strongest predictor. Environmental and democratization-related motivations were also strong predictors, supporting the assumption that energy community participation is strongly linked to collective, community-oriented, and participatory aspects, beyond individual benefit maximization.

The mediation analyses further showed that broader psychological orientations matter for both pathways of engagement, primarily through their effects on the different motivations. Biospheric values were positively related to PV installation intentions, and this relationship was partially mediated by environmental motivations. Similarly, public service attitudes predicted intentions to join an energy community partly through social motivations. Finally, energy citizenship was strongly associated with energy community joining intentions, with democratic motivations partially explaining this effect. Across models, the remaining direct effects indicate that these broader psychological constructs also capture additional motivational pathways not fully represented by the single-item motivation indicators.

Taken together, these results indicate that PV prosumerism and energy community participation are not driven by identical psychological mechanisms. While PV intentions appear particularly connected to technological interest and independence motivations, energy community intentions are more strongly connected to social and democratic engagement motives. These insights highlight the importance of tailoring communication and engagement strategies to the specific participation format: emphasizing technical empowerment and independence may be more effective for promoting PV uptake, whereas highlighting community benefits, social cooperation, and participatory governance may be especially relevant for increasing interest in energy communities.

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# 8. Appendix Complete Survey

| Item Name | Item Text | Scale |
|---|---|---|
| intro1 | | |

| | | |
|---|---|---|
| intro0 | Welcome and thank you for your interest in this study! This survey is interested in your opinion on energy communities. The study is conducted by the Institute of Psychology at the University of Graz. If you would like to participate in this survey, please click "Continue" and agree to the privacy policy on the next page. If you have any questions, please contact the study management: Dr. Hilmar Brohmer (hilmar.brohmer@uni-graz.at) | --- |
| intro2 | | |
| cons | Study Information: We present you with the concept of energy communities. You will be presented with various information about these communities and decide whether this information would motivate you to theoretically join such a community. Please complete this online questionnaire on a computer and in a quiet and undisturbed place. Answer all questions and do not leave any out, even if some questions seem similar to you – this is very important for answering our research questions. Anyone who is at least 18 years old and has native-level German skills can participate. Thank you for your interest in our study! Privacy Information: The collection and analysis of your responses is completely anonymized and in compliance with GDPR and data protection law requirements. The Ethics Committee of the University of Graz has positively reviewed the study. Your participation is voluntary and can be terminated at any time without giving reasons and without suffering any disadvantages. What data is collected and processed? In the context of this study, short questionnaires on energy communities are presented. Personal data (including age and gender) as | --- |

| | | |
|---|---|---|
| | well as various information about energy communities are collected. What happens to the collected data? The data is treated strictly confidentially. Your information is completely anonymized. It is not possible to draw conclusions about specific individuals. The anonymized research data will be evaluated for scientific publications and published on scientific clouds (repositories) to ensure scientific transparency. Where and for how long is the data stored? The data is stored encrypted on secure data carriers for 10 years from publication (legitimate interest/legal obligation from the university statute) for the purpose of proving good scientific practice. Information about your rights: The survey data is anonymized; information about or deletion of data concerning you is therefore not possible. If you believe that our processing violates the GDPR, you have the right to complain (Art. 77 GDPR) to the Austrian Data Protection Authority, Barichgasse 40-42, 1030 Vienna, Tel.: +43 1 52 152-0, Email: dsb@dsb.gv.at. Data Protection Officer: University of Graz Executing academic unit at Karl-Franzens-University Graz and joint contact point for the project: Prof. Katja Corcoran, Institute of Psychology, University of Graz, Universitätsplatz 2/DG, 8010 Graz; Contact: katja.corcoran@uni-graz.at | |
| cons1 | Please agree to the following three points: 1. I consent to my personal data (study-related answers and demographic information) collected in the course of this study being processed by the University of Graz through statistical data analysis for research purposes and used for the publication of scientific works. 2. I agree that my anonymized data may be made available in scientific databases (e.g., in the Open Science Framework; https://osf.io/) for the purpose of sci- | 0=I disagree and do not want to participate; 1=I agree and want to participate |

| | | |
|---|---|---|
| | entific transparency. 3. I can terminate my participation at any time and withdraw my consent to the processing of my data at any time by writing to hilmar.brohmer@uni-graz.at. The withdrawal does not affect the lawfulness of the data processed until the withdrawal. | |
| demos | | |
| demosintro | Please first answer a few questions about yourself. | |
| sex | What is your gender? | 0=male; 1=female; 3=diverse/non-binary |
| age | What is your age (in years)? | --- |
| natio | What is your nationality? | 0=Austrian; 1=German; 2=another |
| dwelling | In what type of environment do you live? | 0=In the countryside (under 10,000 inhabitants); 1=In a small town (from 10,000 inhabitants); 2=In a big city (from 100,000 inhabitants) |
| educ | Your highest completed school or vocational education? | 0=compulsory school, 1=completed vocational training; 2=high school diploma/university entrance qualification; 3=completed university degree (Uni, FH, etc.); 4=another: |
| political | Your political orientation (this is not mandatory) | 0=very left; 5=center; 10=very right |
| income | Which income group - based on monthly net income (per person, minus taxes and | 0=up to €1599; 1=€1600 - €2299; 2=€2300 - |

| | | |
|---|---|---|
| | social security) - would you assign yourself to? (this is not mandatory) | €2999; 3=from €3000 |
| ecar | Do you regularly drive an electric car for private purposes? (E-car means exclusively battery-powered electric cars, no hybrid or combustion engine vehicles) | 0=I don't drive a car privately; 1=No, I drive a combustion engine or hybrid car privately; 2= |
| ecar2 | How long have you been driving an electric car? | 1=For the last one to three years (since 2023); 2=For four to six years (since 2019-22); 3=For seven years and longer (before 2019) |
| prereq | | |
| solar | Have you ever dealt with the topic of photovoltaic systems (i.e., solar systems for electricity generation)? | 1=I haven't dealt with it yet; 2=I have already dealt with the topic; 3=I already own a photovoltaic system |
| feedin | Have you ever looked into the fact that you can feed self-generated energy into the power grid (e.g., when you have produced too much of your own energy from solar systems)? | 1=I have not dealt with it yet; 2=I have already dealt with the topic; 3=I am already a member of an energy community |
| ECs | Have you already dealt with the topic of energy communities? | |
| Knowledg-Sub-jective | | |
| knowSu1 | I know who can establish and operate an energy community | 1=I know nothing at all; 2=I know almost nothing; 3=I have a basic understanding; 4=I know averagely; 5=I know well; 6=I know |

| | | |
|---|---|---|
| | | very well; 7=I know everything about it |
| knowSu2 | I am familiar with the technical aspects of energy use in an energy community | 1=I know nothing at all; 2=I know almost nothing; 3=I have a basic understanding; 4=I know averagely; 5=I know well; 6=I know very well; 7=I know everything about it |
| knowSu3 | I know how an energy community may be legally established in my country | 1=I know nothing at all; 2=I know almost nothing; 3=I have a basic understanding; 4=I know averagely; 5=I know well; 6=I know very well; 7=I know everything about it |
| knowledge objective | | |
| SocialAspects1 | What best describes an energy community? | 1=A new type of electricity meter for households; 2=A company for electricity distribution to corporations; 3=A group of citizens who use energy together; 4=A funding pool for public electricity providers; 5=A government program for electricity prices |
| SocialAspects2 | Who may join an energy community? | 1=Only large energy companies and investors; 2=Only single persons with energy experience; 3=Citizens, small companies and local authorities; 4=Only people who own their own photovoltaic system; 5=Only companies |

| | | |
|---|---|---|
| | | with over 50 employees |
| LegalAspects1 | Is self-generation of electricity mandatory for participation in energy communities? | 1=No, it is not a requirement; 2=Only when using renewable energy; 3=Yes, in every case and without exception; 4=Only if you want to receive funding; 5=Depending on the size of the household |
| LegalAspects2 | Are members of an energy community legally allowed to share electricity with each other? | 1=Only in emergencies after consultation; 2=Only with government approval; 3=Only with special technical equipment; 4=No, that is legally prohibited; 5=Yes, that is legally permitted |
| TechnicalAspects1 | Which energy source is NOT typical for energy communities? | 1=Energy through solar panels; 2=Wind power in fields; 3=Small hydroelectric plants; 4=Use of heating oil; 5=Electricity from biogas plants |
| TechnicalAspects2 | How are energy communities connected to the grid? | 1=They usually remain connected to the public grid; 2=They only supply large companies; 3=They store electricity exclusively in batteries; 4=They use exclusively their own grids; 5=They do not need connection to the grid |
| PAVintro | | |

| | | |
|---|---|---|
| ECintro1 | Thank you! In the following, you should read various descriptions of energy communities. Before we start, please read the following information. | --- |
| explEC | What is an energy community? In an energy community, at least two partners (e.g., households, small businesses, municipalities) - up to several hundred members - join together to collectively produce, store, consume, and possibly sell energy. The members rely on renewable energies: for example, through solar systems in an apartment building or block of houses. You can find more information at the following link (opens in new tab): Climate and Energy Fund (https://www.youtube.com/watch?v=DmedjR7SgbM&ab_channel=Klima-undEnergiefonds) | 0=I have read the paragraph (click to continue) |
| atten | | |
| atten | Answer the following question before continuing: What is an energy community as described on the previous pages? (This is a test to see if you have read carefully) | 1=A community of persons, companies or municipalities for joint energy production; 2=An association only of companies; 3=A community of states for a common energy market; 4=A community of esoteric or religious persons |
| | | |
| Motivation | | |
| MotivationPV | Please evaluate to what extent the following aspects would motivate you to acquire a PV system. | |

| | | |
|---|---|---|
| Environmental | To contribute to climate protection and the preservation of natural resources through renewable energies. | 1=not motivating at all; 7=very motivating |
| Social | To collaborate with others, strengthen neighborhood relationships, or participate in joint decisions. | 1=not motivating at all; 7=very motivating |
| Independence | To be independent in my energy supply and have more control over my energy production and use. | 1=not motivating at all; 7=very motivating |
| Financial | To reduce electricity costs, increase the value of my property, and possibly generate income through government subsidies or grid feed-in. | 1=not motivating at all; 7=very motivating |
| Technical | To try out new and innovative energy technologies such as smart home systems, battery storage, or energy monitoring. | 1=not motivating at all; 7=very motivating |
| Democratic | That citizens and local communities gain more influence on energy supply and the energy sector becomes more democratic. | 1=not motivating at all; 7=very motivating |
| MotivationEC | Please evaluate to what extent the following aspects would motivate you to join an energy community | |
| Environmental | To contribute to climate protection and the preservation of natural resources through renewable energies. | 1=not motivating at all; 7=very motivating |
| Social | To collaborate with others, strengthen neighborhood relationships, or participate in joint decisions. | 1=not motivating at all; 7=very motivating |
| Independence | To be independent in my energy supply and have more control over my energy production and use. | 1=not motivating at all; 7=very motivating |

| | | |
|---|---|---|
| Financial | To reduce electricity costs, increase the value of my property, and possibly generate income through government subsidies or grid feed-in. | 1=not motivating at all; 7=very motivating |
| Technical | To try out new and innovative energy technologies such as smart home systems, battery storage, or energy monitoring. | 1=not motivating at all; 7=very motivating |
| Democratic | That citizens and local communities gain more influence on energy supply and the energy sector becomes more democratic. | 1=not motivating at all; 7=very motivating |
| bridge | | |
| bridge1 | Thank you! Click "Submit" to be redirected to the main part of the study. This may take a few seconds as some content needs to be loaded first. | |
| intent | To what extent would you agree with the following statements about energy communities? | |
| intEC1 | I intend to join an energy community in the coming years. | 1=Strongly disagree; 7=Strongly agree |
| intEC2 | If I get the opportunity, I will join an energy community. | 1=Strongly disagree; 7=Strongly agree |
| intEC3 | It is likely that I will become a member of an energy community. | 1=Strongly disagree; 7=Strongly agree |
| intPV | To what extent would you agree with the following statements about photovoltaic systems (solar systems for electricity generation)? | |
| intPV1 | I intend to install a photovoltaic system in the coming years (e.g., in the garden or on the balcony). | 1=Strongly disagree; 7=Strongly agree |

| | | |
|---|---|---|
| intPV2 | If I get the opportunity, I will install a photovoltaic system at my place. | 1=Strongly disagree; 7=Strongly agree |
| intPV3 | It is likely that I will install a photovoltaic system at my place. | 1=Strongly disagree; 7=Strongly agree |
| Block1 | | |
| Env | Please indicate to what extent you agree with the following statements | |
| Env1 | I would say that I am environmentally conscious. | 1=Disagree; 4=Agree |
| Env2 | Being environmentally conscious is an important part of my personality. | 1=Disagree; 4=Agree |
| Env3 | I would describe myself as someone who cares about the environment. | 1=Disagree; 4=Agree |
| Digi | The following statements deal with the digitalization of life (e.g., Internet as a source of information, apps for controlling technical devices, social networks, etc.). Please indicate to what extent you agree with the following statements. | 1=Disagree; 4=Agree |
| Digi1 | I see digitalization as an opportunity for better networking of everyday objects. | 1=Disagree; 4=Agree |
| Digi2 | I see digitalization as a way to connect people worldwide. | 1=Disagree; 4=Agree |
| Digi3 | I see digitalization as a significant facilitation of communication and handling of everyday things. | 1=Disagree; 4=Agree |
| Digi4 | I see digitalization as a way to access fast, current, and comprehensive information and knowledge. | 1=Disagree; 4=Agree |

| | | |
|---|---|---|
| Digi5 | I see digitalization as a threat to individual privacy ("transparent person"). | 1=Disagree; 4=Agree |
| Digi6 | I see digitalization as problematic with regard to hacker attacks. | 1=Disagree; 4=Agree |
| Digi7 | I see digitalization as a predominantly negative development regarding human security. | 1=Disagree; 4=Agree |
| Digi8 | I see digitalization as a development that makes people lonely. | 1=Disagree; 4=Agree |
| Digi9 | I see digitalization as a stress factor due to the possibility of constant accessibility. | 1=Disagree; 4=Agree |
| Digi10 | I see digitalization as problematic with regard to the development of addictive behavior. | 1=Disagree; 4=Agree |
| ECSHeld | Please indicate how much you agree with the following statements. | |
| ECS1 | Affordable sustainable energy is an important right for me | 1=Strongly disagree; 7=Strongly agree |
| ECS2 | It is an important right for me to be informed about the energy efficiency of various products. | 1=Strongly disagree; 7=Strongly agree |
| ECS3 | I consider the possibility of actively participating in the energy market (e.g., producing/selling/trading/storing energy) to be an important right. | 1=Strongly disagree; 7=Strongly agree |
| ECS4 | I feel responsible for supporting others to participate in the sustainable energy transition (e.g., by sharing my knowledge). | 1=Strongly disagree; 7=Strongly agree |

| | | |
|---|---|---|
| ECS5 | I feel responsible for contributing to a sustainable energy transition myself. | 1=Strongly disagree; 7=Strongly agree |
| ECS6 | I feel responsible for actively participating in the energy market (e.g., producing/selling/trading/storing energy). | 1=Strongly disagree; 7=Strongly agree |
| ECS7 | I am willing to actively work to ensure that no one is disadvantaged in the sustainable energy transition | 1=Strongly disagree; 7=Strongly agree |
| ECS8 | Investing time, effort, and money to be able to use more renewable energy fills me with pride. | 1=Strongly disagree; 7=Strongly agree |
| ECS9 | I am open to helping shape energy policy and laws. | 1=Strongly disagree; 7=Strongly agree |
| BIOS | | |
| BIOS1 | I am convinced that people should take care of nature. Environmental protection is important to me. | 1=Strongly disagree; 7=Strongly agree |
| BIOS2 | It is important to me that the Earth is respected. The well-being of animals and plants is close to my heart. | 1=Strongly disagree; 7=Strongly agree |
| Block2 | | |
| WTS | | |
| WTS1 | To what extent would you personally find it acceptable to pay much higher prices to protect the environment | 1=very unacceptable; 7=very acceptable |
| WTS2 | To what extent would you personally find it acceptable to pay much higher taxes to protect the environment | 1=very unacceptable; 7=very acceptable |

| | | |
|---|---|---|
| WTS3 | To what extent would you personally find it acceptable to make sacrifices to your standard of living to protect the environment | 1=very unacceptable; 7=very acceptable |
| CFC | | |
| CFC1 | I consider how things might be in the future and try to align my everyday behavior accordingly. | 1=Strongly disagree; 7=Strongly agree |
| CFC2 | When I make a decision, I think about how it might affect me in the future. | 1=Strongly disagree; 7=Strongly agree |
| CFC3 | I generally consider possible future consequences in my behavior. | 1=Strongly disagree; 7=Strongly agree |
| CIC | | |
| CIC1 | I tend to behave in ways that make me feel good right now, without thinking about the future. | 1=Strongly disagree; 7=Strongly agree |
| CIC2 | I only act according to my current needs and deal with future problems as they arise. | 1=Strongly disagree; 7=Strongly agree |
| CIC3 | I think it's rather unnecessary to sacrifice something in the present, since future consequences can be dealt with later. | 1=Strongly disagree; 7=Strongly agree |
| ATI | | |
| tech1 | I like to explore technical systems in more detail. | 1=Strongly disagree; 7=Strongly agree |
| tech2 | I like to try out the functions of new technical systems. | 1=Strongly disagree; 7=Strongly agree |

| | | |
|---|---|---|
| tech3 | It's enough for me that a technical system works, I don't care how or why. | 1=Strongly disagree; 7=Strongly agree |
| tech4 | It's enough for me to know the basic functions of a technical system. | 1=Strongly disagree; 7=Strongly agree |
| psa | | |
| psa1 | I admire people who initiate measures to help the community. | 1=Strongly disagree; 7=Strongly agree |
| psa2 | Meaningful service to society is very important to me. | 1=Strongly disagree; 7=Strongly agree |
| psa3 | It is important to contribute to activities that address social problems. | 1=Strongly disagree; 7=Strongly agree |
| psa4 | It is important to me to contribute to the common good. | 1=Strongly disagree; 7=Strongly agree |
| PC | | |
| PC1 | I am concerned that third parties can access my personal data | 1=Strongly disagree; 7=Strongly agree |
| PC2 | I am concerned that those responsible do not keep my personal data secure | 1=Strongly disagree; 7=Strongly agree |
| PC3 | I worry that the information I provide on the internet could be misused | 1=Strongly disagree; 7=Strongly agree |
| PC4 | I am concerned that third parties create a profile of me to predict my consumer behavior | 1=Strongly disagree; 7=Strongly agree |
| PC5 | I am concerned that I do not have sufficient control over the data collected about me | 1=Strongly disagree; 7=Strongly agree |