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Does Energy Community Membership Change Sustainable Attitudes and Behavioral Patterns? Empirical Evidence from Community Wind Energy in Germany

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Abstract: Community energy is seen as a helping hand for local, decentralized energy transition. Besides the main goal of supporting the community-friendly and socially acceptable development of renewable energies, the hope is also that a pro-environmental influence on sustainability behavior will be triggered when joining a community energy project. An analysis of a survey among 16 community energy projects in Germany, with 565 completed questionnaires, shows that a certain part of the members pays more attention to their energy behavior and develop a more positive attitude towards a decentralized energy transition and citizen participation after joining the community energy project. Therefore, we can empirically support that climate protection projects, such as community energy, influence pro-environmental attitudes and behavior, but this does not apply equally to all population groups. Members with higher income and stronger interest in returns are less likely to change their behavior. Based on these findings, we recommend the development of community energy policies that are more responsive to differences in social structure and address both privileged and underprivileged groups in a sophisticated way using specific offers and modes of involvement within the associations.

Keywords: renewable energy; community energy; behavior change; social acceptance; pro-environmental behavior; energy efficiency; hierarchical logistic regression

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1. Introduction

For the last two decades, energy systems around the globe have been changing to achieve diverse sustainability goals, as formulated in national and international policy strategies and legislative acts such as Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market [1–3]. These efforts gained further traction with the goal of carbon neutrality by mid-century, as determined by the Paris Agreement in 2015 [4–6]. To achieve this goal, it is necessary to promote sustainable technologies across the energy sector's value-added chain and change energy consumption patterns among consumers [7].

For the first, a plethora of studies have analyzed the technical feasibility of 100% renewable energy systems (RES) by 2050 by comparing broad technological portfolios, with the majority of studies finding that 100% renewable energy is possible from a technical perspective, particularly for the electricity sector by using a large variety of technologies, further supporting measures such as carbon taxation, feed-in tariffs, or feed-in priority for energy produced from renewable resources [8]. For the latter, the discussion of sustainable behavior in an energy context also gained a great deal of attention in parallel with the consideration of technical feasibility. Here, academic work analyzing the energy-related behavior of consumers investigates the influence of various factor groups, such as individual aspects (e.g., bounded rationality, personal intent, cognitive biases), interpersonal aspects (e.g., socio-demographical determinants that can influence human behavior), community-related aspects (e.g., social norms), societal aspects (e.g., structural barriers, communication environment), and policy and systemic aspects (e.g., the institutions and socio-political groups organizing the society), and identify various relevant influences on the energy-related behavior of consumers [9]. Findings show that, for example, pro-environmental attitudes, social influence, and social norms can have a positive effect on sustainable behavior [10,11]. Here, the majority of studies focus on household [12] or stakeholder influences on sustainable action [13], where attitudes and behaviors are impacted through advising, assisting, and financing services [14,15]. Less is known about how membership in community energy influences members' attitudes and behaviors. Basically, collective climate action is driven by social identification, ingroup norms, group-based emotions, and collective efficacy beliefs [16]. A first study could show that the awareness on energy issues is increased and wider participation in community initiatives is promoted [17]. Another study found that the organizational setting of being an owner or co-owner of energy infrastructure promotes an individual's willingness to show flexible demand [18]. However, most studies only focus on one factor group and mainly neglect the interactions between various factors. Furthermore, the question of energy-efficient behavior has not been investigated so far as well.

This paper ties to this gap and analyzes the effects on people's sustainability behavior and attitudes towards RE after joining a community energy project. Specifically, based on a survey among members of community energy projects in Germany, we analyzed the influence of socio-demographic factors and motivations to enter community energy projects on their energy consumption behavior as well as their attitude towards RE and sustainability. To do so, we estimate a hierarchical logistic regression model for 10 altitudinal and behavioral dimensions.

2. Theoretical Background

Citizen participation is one of the key drivers of the energy transition, especially in Germany. This has resulted in the financial participation of citizens in the energy sector; there are around 1700 community energy projects in Germany, of which around 900 are energy cooperatives (e.g., [19–21]). Numerous studies from other countries have analyzed community energy systems, highlighting the dynamic growth of this social and organizational innovation in the energy sector. Among these country studies are analysis related to developments in Belgium [22], Italy [23], the United Kingdom [24–26], the US [27], Denmark [28,29], Netherlands [30–32], Norway [33], Canada and New Zealand [34], Australia [35], and Japan [36,37]. In these studies, various topics are dealt with, including aspects such as community-related aspects, economic aspects, and spatial references [38]. In addition, business models and regulatory aspects as well as the importance of intermediaries and grassroots activities are frequently addressed [21,39–42]. However, the topics that are likely most dealt with in the academic literature are analyses related to members' motivations and behavior. Research on the motives of participants in community energy projects has shown that it is particularly ecological motives, rather than financial or property motives, that motivate people to become members [43–45]. Other studies have shown that social aspects play a significant role as well. For example, the willingness to volunteer in community projects is higher than the willingness to invest money. Thus, social norms, trust, environmental concern, and community identity as well as ownership are important determinants of willingness to participate in community energy [46]. Accordingly, social aspects are significant for pro-environmental behavior. Other studies confirm findings that individual environmental values, social contextual factors, and social norms, besides economic preferences such as time preferences, trust, and negative reciprocity, play a certain role [47]. Although there is a great willingness to participate and community energy projects themselves can be 'tipping points' for diffusion and dissemination [48], it is still largely unknown why no further activation of individuals and communities is coming from the projects. It should be borne in mind that, in terms of social structure, these are often better-off individuals ("elite clubs"; see Radtke and Ohlhorst 2021), and that for low-income individuals financial savings and not financial gains or environmental motivations are the main driver to participate [49]. Accordingly, a more critical perspective of community energy, which also emphasizes the negative aspects and inequalities, has emerged [50–52].

While, as the previous deliberations show, the literature on participants' motives to join a community energy project is quite substantial, the analysis of participants' behavior is less developed. Here, the first studies indicate positive effects on the consumption behavior of the (financial) participants to the extent that participants are willing to flexibilize their consumption to support grid stability [18,53]. Further research, for example, an empirical analysis of the changes in energy-efficient consumption behavior of community energy participants, is not yet available in the literature.

Accordingly, complex frameworks and behavioral models on pro-environmental behavior (PEB) (e.g., [54–56]) as well as the value–belief–norm (VBN) theory [57] must be drawn to show how values are first channeled into beliefs (the environment in general, as well as environmental awareness and responsibility), then individual norms (derivation for one's own actions), and finally into a specific behavior. The decisive factor here often is the effect of behavioral precursors (values, world views, and environmental attitudes), with values having a strong effect on attitudes toward climate protection [58]. However, according to the norm activation model [59], the decisive, distinctive, and differing rationalities that lead to more altruism and orientation towards the common good can only be influenced with difficulty, most likely through moderators and mediators [60]. Hereby, group members of pro-environmental initiatives can enable pro-environmental social identity formation within their related community [61]. However, it could also be shown that the single setting of environmental and communal appeals without the use of financial appeals is not sufficient to promote involvement in community environmental initiatives [62].

If we summarize the findings in terms of a model, we can assume that general preferences and values are initially active at the individual level, which are strongly influenced by socialization, upbringing, education, and social environment (global attitudes). Finally, values are more strongly activated and classified through direct confrontation, for example, through involvement in sustainability conflicts, discourses in the immediate personal environment, construction of energy plants, or founding an energy cooperative. Finally, the immediate personal situation and the strong influence of the surrounding peer group as well as contextual place attachments and identities are of great importance for the formation of individual lifeworld views. Thus, it is community aspects (social capital, social needs, and environmental concern) that have a decisive influence on sustainable action [10].

Furthermore, it also was examined whether involvement in community energy initiatives is associated with sustainable energy behaviors, which showed that different types of personal pro-environmental motivation are related to involvement and sustainable energy intentions and behaviors [63]. However, besides this initial research, further research on the relation of participation in community energy initiatives and members' changes in behavior has not been investigated further. From this gap in the literature, we derive the research question of our paper, which is to investigate which structural (socio-demographic) and intrinsic variables, or influences, show a connection with changes in individual behavior. Our aim is to show which variables are related to changes in electricity consumption and the environmentally friendly behavior of energy consumers.

3. Methodology

The following chapters give a brief overview of the sampling process, specifications on measurement, and statistical procedure. The data were obtained through a survey. The total sample contains 565 members of community wind energy projects in Germany. The questionnaire was distributed online directly to individual members of the projects. Community energy projects throughout Germany participated in the survey. In this context, the regional distribution of community energy in Germany has been reflected: There are more wind energy projects in northern Germany and more photovoltaic projects in the south [45,64–66]. Overall, fewer citizen energy projects have been established in eastern Germany [67,68]. Therefore, wind energy projects from the north in particular, but also some from the center and south of western Germany are included in the sample. For this paper, we analyzed to what extent socio-demographic predispositions and individual characteristics, vis-à-vis the installation and different motivations to enter community energy projects, influence the formation of specific attitudes towards sustainability dimension of people who are involved in wind energy projects. To this end, the survey incorporated questions regarding the variables listed in Table 1, including their measurement. Participants had the option to skip questions (see Appendix A for full overview of all variables, measurement, as well as the respective labels and values).

Table 1. Overview of questions regarding demographics and the installation.

Variables	Measurement
Socio-demographics:	
Gender	2 categories “male” and “female”
Age	9 categories from “under 18” to “over 85 years”
Income	8 categories from “less than 500 Euro” to “over 10,000 Euro” gross per month
Urban or rural environment	7 categories from “downtown” to “village (under 5000 inhabitants)”
Individual characteristics vis-à-vis the wind energy project:	
Shares acquired	7 categories from “less than 500 Euro” to “over 10,000 Euro” gross per month
Spatial distance to the installation	6 categories from “very close (less than 500 m)” to “more than 50 km away”
The frequency of seeing the installation	4 categories “daily” to “never”
Identification with the wind energy project	5 categories from “fully” to “I oppose the project”
Motivation to enter a wind energy project:	
Financial	5 categories from “strongly agree” to “strongly disagree”
Ecological	
Empowerment of citizen energy	

The sustainability dimensions were jointly measured by asking people if they developed certain attitudes. Therefore, they had to answer the following question and select applicable answers:

Since my participation in a community energy project, I . . .

- . . . developed a positive opinion towards RE.
- . . . am of the opinion that one has to live with impairments of RE (like noise and looks of wind turbines).
- . . . think that decentral energy production is possible (without big power plants).
- . . . endorse community projects.
- . . . am opposing big power plants.
- . . . endorse citizen participation in society.
- . . . am mindful of my own energy consumption.
- . . . have a general environmentally friendly attitude.

- . . . did not change my attitude towards RE.
- . . . have a critical attitude towards RE.

In summary, we wanted to analyze to what extent the (independent) variables from Table 1 influence the formation of the above-mentioned attitudes (dependent variables). As the participants could select which attitude they developed or not, the outcome variable is dichotomous. To estimate the influence of a variety of predictors on a dichotomous outcome variable logistic regression (LR) has been identified as a reliable method [69–72]. While following the same statistical principles as the ordinary least square regression (OLR), LR calculates the natural probability for one event in a binary outcome variable [72]. To do so, one has to estimate the linear equation on a logit scale to account for the parameter range of a logistic model, being 0 and 1. The base model therefore may be described as

$$\hat{y}_i = \frac{e^{\beta_0+\beta_1 x_1+\beta_2 x_2+\ldots\beta_i x_i}}{1+e^{\beta_0+\beta_1 x_1+\beta_2 x_2+\ldots\beta_i x_i}} \quad (1)$$

where $\hat{y}_i$ corresponds to the probability of outcome i on a binary scale e with β_i as the regression coefficient for variable x_i. As seen in [72], the logit transformation requires to calculate the natural logarithm of the odds of a positive response y as opposed the negative outcome $(1-y)$, resulting in

$$ln\left(\frac{\hat{y}_i}{1-\hat{y}_i}\right) = \beta_0+\beta_1 x_1+\beta_2 x_2+\ldots\beta_i x_i \quad (2)$$

In practical terms, considering the predictors from Table 1, we ran

$$ln\left(\frac{\hat{y}_i}{1-\hat{y}_i}\right) = \beta_0+\beta_1 gender+\beta_2 age+\ldots\beta_{11} empowerment \quad (3)$$

for all attitudinal dimensions defined above. We note that generalized binary models fail to capture the complexity of predictor composition [73]. Therefore, the final models for all attitudinal dimensions were built up by applying a systematic hierarchical approach that removes one predictor in each iteration with the z-score at the very end of the absolute range. The hierarchical procedure automatically stops when (i) all predictors hold significant odds ratios; or (ii) all predictors are ultimately removed from the estimation. The systematic hierarchical process is widely applied given the unknown composition of a variety of predictors in the context of binary analyses [73,74]. Every final model was tested against the Hosmer–Lemeshow goodness-of-fit estimator to evaluate the model fit.

4. Results

The following section presents all the hierarchical logistic models as defined in Section 3. The calculations were done with Stata 16. Solely the final models are depicted if they hold at least one significant predictor. The tables include odds ratios that reflect the changes in likelihood that a predictor causes in the dichotomous dependent attitude variable. For the final models, the Hosmer–Lemeshow goodness-of-fit test was generated to evaluate the model fit. Any violations that may arise will be mentioned along the following model description.

4.1. Generally Positive Attitude towards Renewables

The first model analyzed the influence of general demographics and motivations for involvement in RE on whether participants have a positive attitude towards RE after their participation. No iteration yielded a significant result. The general attitude towards renewables was thus not influenced by the analyzed demographics nor the motivation to participate in RE.

4.2. Living with Impairments of Renewables

The influence of demographics and motivations for participation on the notion that one must live with the impairments caused by renewables was analyzed (e.g., noise or looks of RE installations). Table 2 shows that, in the final model, the predictors income, the number of times the participant sees the installation, and the identification with the installation significantly influence the outcome variable. Looking at the odds ratios one can interpret that every unit additional income increases the likelihood of respondents believing one has to live with the impairments of renewables by a factor of 1.00132. Further, if respondents see the installation on a regular basis, it is 1.58 times more likely that they are willing to live with mentioned impairments. The same holds true for whether respondents identify with the installation. They are 2.28 times more likely to live with the mentioned impairments.

Table 2. Logistic regression: people believe one must live with impairments of renewables.

Impairments of Renewables	Odds Ratio	z-Statistic	*p*-Value
Income	1.000(0132) *	2.15	0.031
Views	1.584 *	2.12	0.034
Identification	2.284 *	2.48	0.013

Note: 359 observations. An asterisk (*) denotes the significance level with * $p < 0.05$.

4.3. Decentralized Energy Production without Big Power Plants

The influence of demographics and motivations for participation on the conviction of respondents that decentralized energy production is possible without big power plants was analyzed. Table 3 summarizes the results. The final model includes three predictors, these being identification with the installation as well as the two motivational dimensions financial incentives and ecological incentive. The identification with the renewable energy installation increases the likelihood of believing in a decentralized energy transition by 2.176 times. Further, if respondents are involved in wind turbines due to the prospect of financial gain, the odds of believing in a decentralized energy transition decrease by a factor of 0.599. On the contrary, if participants obtained shares of wind turbines because of ecological reasons, the odds of believing in decentralized energy production without big power plants increase 2.981 times.

Table 3. Logistic regression: people believe in decentral energy production without big power plants.

Decentralized Energy Production	Odds Ratio	z-Statistic	*p*-Value
Identification	2.176 **	2.70	0.007
Financial motivation	0.599 **	−2.65	0.008
Ecological motivation	2.982 **	2.81	0.005

Note: 476 observations. An asterisk (*) denotes the significance level with ** $p < 0.01$.

4.4. Endorsement of Collaborative Reneable Energy Projects

The influence of demographics and motivations for participation on whether the participants endorse a collaborative approach to renewable energy projects was analyzed. Table 4 shows the final model. When solely identification is used as a predictor, a significant odds ratio of 1.808 is reported, which means the likelihood of endorsing collaborative renewable energy projects increases by exactly this factor when respondents identify with the renewable energy project that they are involved with.

Table 4. Logistic regression: endorsement of collaborative renewable energy projects.

Collaborative RE Projects	Odds Ratio	z-Statistic	*p*-Value
Identification	1.808 *	2.18	0.029

Note: 476 observations. An asterisk (*) denotes the significance level with * $p < 0.05$.

4.5. Opposing Big Power Plants

The influence of demographics and motivations for participation on whether the participants oppose big power plants after being involved with a wind energy project was analyzed. Table 5 summarizes the final model. In this instance the best model fit was reached with the predictors gender, whether participants see or identify with the installation, and if they acquired shares of the installation due to financial reasons. When respondents are involved with their wind turbine project for financial reasons, the odds of being opposed to big power plants decrease by 0.574. The other predictors are insignificant but remain as control variables in the model as further hierarchical iterations weaken the model fit.

Table 5. Logistic regression: opposing big power plants.

Opposing Big Power Plants	Odds Ratio	z-Statistic	*p*-Value
Gender	1.661	1.36	0.175
Views	0.720	−1.26	0.207
Identification	2.426	1.80	0.071
Financial motivation	0.574 *	−2.12	0.034

Note: 422 observations. An asterisk (*) denotes the significance level with * $p < 0.05$.

4.6. Endorsement of Citizen Participation in RE Projects

The influence of demographics and motivations for participation on whether the respondents endorse citizen participation in RE projects after their involvement in wind energy projects was analyzed. In Table 6, one can see that the final model holds one significant predictor. If the motivation of respondents to participate in wind energy projects was to increase citizen (co-)ownership, the likelihood to endorse citizen participation after the wind project is 3.484 times higher compared to people who did not participate to promote citizen energy in the first place.

Table 6. Logistic regression: endorsement of citizen participation in RE projects.

Citizen Participation	Odds Ratio	z-Statistic	*p*-Value
Participatory motivation	3.484 ***	4.00	>0.001

Note: 520 observations. An asterisk (*) denotes the significance level with *** $p < 0.001$; *p*-values smaller than 0.001 are reported as <0.001.

4.7. Paying Attention to Own Energy Consumption

The influence of demographics and motivations for participation on whether the respondents pay attention to their own energy consumption after their involvement in wind energy projects was analyzed. Table 7 shows that the final model includes four significant predictors: age, income, if respondents see the wind installation regularly, and whether they entered the wind energy project to gain financial benefits. By every year the respondents are older the likelihood of paying attention to their own energy consumption increases by a factor of 1.023. Further, an additional unit of income decreases the likelihood of paying attention to the own energy consumption by 0.99986 times. Interestingly, if respondents see the wind installation that they are invested in regularly, the chances of them paying attention to their own energy consumption decreases by 0.579. Lastly, if respondents entered a wind project to realize financial profits, the likelihood of them paying attention to their energy consumption decreases by 0.484.

Table 7. Logistic regression: paying attention to own energy consumption.

Own Energy Consumption	Odds Ratio	z-Statistic	*p*-Value
Age	1.023 *	2.18	0.029
Income	0.999(8552) *	−2.00	0.046
Views	0.579 *	−2.10	0.036
Financial motivation	0.484 **	−2.84	0.005

Note: 393 observations. An asterisk (*) denotes the significance level with * $p < 0.05$ and ** $p < 0.01$.

4.8. Developed a Pro-Ecological Attitude

The influence of demographics and motivations for participation on whether the respondents developed a pro ecological attitude in the course of their involvement in wind energy projects was analyzed. The final model in Table 8 shows one significant predictor. If people engaged in the wind energy project due to the prospect of financial gains, the likelihood of them developing a pro-ecological attitude decreases by a factor of 0.495.

Table 8. Logistic regression: developed a pro-ecological attitude.

Pro-Ecological Attitude	Odds Ratio	z-Statistic	*p*-Value
Financial motivation	0.495 *	−2.43	0.015

Note: 393 observations. An asterisk (*) denotes the significance level with * $p < 0.05$.

4.9. Attitude towards RE Did Not Change

The influence of demographics and motivations for participation on whether the respondents' attitude towards RE did not change in the course of their involvement in wind energy projects was analyzed. The final model holds no significant results. The respective tables are omitted.

4.10. Critical Attitude towards RE

The influence of demographics and motivations for participation on whether the respondents' attitude towards RE changed in a negative way in the course of their involvement in wind energy projects was analyzed. The final model holds no significant results. The respective tables are omitted.

5. Discussion

The empirical analysis presented in this paper added new insights into the scientific literature on changes in attitudes and behavior of people who are members of community energy infrastructures.

The finding that every unit of additional income increases the likelihood of community energy participants, believing one has to live with the impairments of renewable energy infrastructures, add to the general literature that community energy raises the acceptance for renewable energy [27]; however, this finding is sharpened by emphasizing the importance of financial compensation as a factor to raise acceptance. In addition, factors such as the possibility to see the installation on a regular basis and the degree of personal identification with the installation influence the acceptance positively, so that, in conclusion, the factors that result in a tight emotional bond can be seen as an additional influence to raise the acceptance [75–82].

Tied to the question of general acceptance of renewable energy infrastructures, we added a related perspective by checking whether the participants believe in the success of a decentralized energy transition. Here, the finding that the personal identification with the locally installed renewable energy installation and the indication that one has joined the community energy initiative for ecological reasons increase the belief in the success of a decentralized energy transition fit together consistently, as the spatial proximity to the energy infrastructure makes the technical feasibility of a decentralized energy system more tangible [83–87]. On the contrary, the negative relation between the presence of strong financial motives for participation in community energy and the belief in the success of a more decentralized energy system might be because centralized, large-scale infrastructures normally provide a higher return-on-investment than decentralized infrastructures [88–90]; accordingly, people do not necessarily have disbelief in the success of a decentralized energy transition but rather prefer a system design where higher financial return is possible. This finding also fits well with the finding in Section 4.5, where people with stronger financial motives do not show opposition to large-scale infrastructures.

The subsequent results of the analyses helped to analyze the experiences the participants of the community energy infrastructure had and their changes in behavior. The finding that people with the motivation to increase citizen (co-)ownership the still endorse citizen participation after joining and experiencing the membership highlights that the participants' expectations to have a say in local energy policy obviously were fulfilled. This might be to some extent because the surveyed participants mostly were members of renewable energy cooperatives, which is an organization that is explicitly designed for democratic co-determination.

A particular focus was on the question of whether the members of community energy projects pay more attention to their energy consumption after their participation. This tests a central assumption, namely, whether (financial) participation in renewable energy projects leads to individual behavioral changes; i.e., whether pro-environmental behavior is stimulated (e.g., [91,92]). The results show that especially older people indicate that they control their energy consumption more closely. This may be because, firstly, younger people pay more attention to their energy consumption anyway, as they have been more conditioned and socialized in this respect. Second, when focusing on older people's behavior, this result is somewhat surprising compared to existing studies, in that it might be difficult for older people to part from their habitual consumption pattern and they are less likely to adopt energy efficiency measures or consume energy more efficiently [93,94]. Accordingly, the social setting of participating in a community energy project incentivizes older people to implement behavioral changes in their daily lives.

In contrast, people with higher incomes—most of whom are also older—pay less attention to their energy consumption, and the wealthier they are, the more so. This is probably due to a lavish lifestyle. It is true that people with higher incomes have more opportunities to use energy-efficient appliances; for example, their scope for design is disproportionately greater. However, in the mostly spacious living environment and combined with a more elaborate, resource-intensive lifestyle, people see fewer opportunities to effectively reduce their energy consumption if the lifestyle is not changed seriously. This confirms the assumption of an income and age group difference, according to which living situations—especially coupled with a higher standard of living—have a decisive influence on environmental behavior [95–101]. It is important to emphasize the significance of higher income, which inevitably goes hand in hand with more resource-intensive lifestyles. However, it is a remarkable finding that older groups of people can be activated regarding behavioral change by participating in a community energy project. Likewise, the finding dampens hopes for behavioral change in the case of the materially better-off population. Regarding a possible role model function of persons in highly responsible professional positions, this is to be regarded as problematic. However, this confirms known results, which consistently show that people with high incomes maintain particularly resource-intensive lifestyles.

Two other factors additionally influence behavioral changes in a different way: Physical proximity to wind turbines and high financial motivation reduce the willingness to change behavior. The first result offers a complex perspective: It is known from other studies that people in the immediate proximity of wind turbines tend to view them critically but behave passively [102]. This would explain why they are less willing to change their behavior despite participating financially. This could be an indirect indication of "bought" acceptance [103]. However, the most likely assumption is that wind turbines are predominantly located in rural areas, and potentially fewer younger or academic or higher-income individuals live nearby. This leaves a group of people who are presumably less attentive to their own energy consumption overall. However, it is unlikely that this is directly related to wind turbines. A plausible explanation for this would be that the participating members seeing the spinning wind turbines feel that there is always enough electricity being produced and that especially in the immediate vicinity, where wind power is more prevalent in the energy grid, there is no discernible reason to save electricity in the face of constantly renewable energy. This would need to be investigated further through further surveys.

The results can be confirmed by comparative calculations: A return orientation is most likely to prevent pro-environmental behavioral changes across the board; in the case of no behavioral changes or non-environmental behavioral changes, demographic characteristics do not play a role.

With our results, we can show that presumably individual and interpersonal aspects play a greater role than previously assumed, where social influence and social norms can have not only a positive effect on sustainable behavior, but also a negative one. Thus, we confirm the research findings that community aspects [10,46], social norms, trust, environmental concern, and community identity [46], and especially individual attitudes such as individual environmental values, social contextual factors, and social norms [47], as well as identification, ingroup norms, group-based emotions, and collective efficacy beliefs [16], play a crucial role not only in the willingness to participate but also in the effects of participation, such as attitude and behavioral change.

Similarly, we confirm previous findings that the awareness on energy issues can be increased and wider participation in community initiatives is promoted through community energy [17]. Likewise, we tend to confirm findings in the literature that members have significantly more positive attitudes toward RE than non-members and a distinction within membership between communities of place and communities of interest [104]. We hypothesize that members of a community of interest develop less diffusion potential of pro-environmental attitudes and behavior if there is a particular interest in return, whereas communities of place can develop more diffusion and transformation potential in the case of strong emotional attachments (e.g., as a place-based climate protection project with strongly emphasized place attachments and identities), because in these communities more people participate in total on different social levels and thus more people can be reached who already carry a willingness to change their behavior. To give an example: A community of interest in the form of a distant and closed, strongly return-oriented project with only a few participants from the local community and thus little local connection can presumably develop less activation and change potential than an inclusive, open, and participatory community of a place project in which many people from all parts of the population of the community are involved (see distinction of the process and outcome dimensions of community energy [105,106]).

In summary, this allows us to validate two findings that seem contradictory at first glance: On the one hand, group members of pro-environmental initiatives can enable pro-environmental social identity formation [61]; on the other hand, the finding is also true that the single setting of environmental and communal appeals without the use of financial appeals does not seem to be sufficient to promote involvement in community energy [62]. From this perspective, we conclude that a financial orientation should not be considered a significant problem factor, but that it can act as an obstacle to diffusion potential if it represents a unique selling proposition. The strength of community energy lies precisely in the fact that financial incentives are merged with climate protection and community goals. It is therefore important to strike a healthy balance and create projects in which different interests, perspectives, and attitudes of members come together. If such a project is in addition not pursued in isolation as an external, distant project of investors, but is strongly integrated and anchored in a community of place, the chances increase that a project environment will be created in which initially non-environmental attitudes of members and consequently also behaviors will be influenced, even if this appears to be difficult to reconcile with the lavish lifestyles of wealthy members.

6. Conclusions

Based on the empirical analyses, we can sum up the most relevant factors and draw an overall picture of the essential findings on behavioral changes due to community energy. Here, the focus is on the following four aspects:

1. Community energy increases the acceptance of renewable energy through financial participation and through an emotional attachment to the energy project.

2. Ecological motivation for community energy goes hand in hand with support for the local energy transition on the one hand, and financial motivation with acceptance of conventional centralized energy systems on the other hand.
3. Experiences with community energy strengthen the trust and belief in citizen participation in the energy transition and in communities.
4. High income and return-orientation mean less behavior change effects for pro-environmental behavior; however, older persons change their behavior more in comparison. Thus, community energy can lead to behavioral changes, but wealthy and return-oriented participants are less influenced. Hence, we can draw a differentiated perspective regarding the effects of community energy on individuals. On the one hand, we confirm the positive assumptions in the literature, which understand community energy as a vehicle that offers individual access to energy infrastructures and the energy transition as well as climate protection measures through material participation, thus stimulating a bottom-up transformation at the local level with the communities [107–111]. Community energy can thus act as a door opener, activating individuals and stimulating further climate protection action and pro-environmental behavior. Another, more pessimistic interpretation assumes that these hoped-for spillover and diffusion effects tend to fail to materialize, that community energy remains in the niche, and that even negative effects can occur. These primarily concern the closed nature of the projects, which can trigger local opposition, little interest in community shaping of the projects, and a lack of further individual effects beyond the achievement of a financial gain [103,112,113]. In this regard, van Veelen (2018) [114] spoke of 'mythic communities' by meaning the ideal of 'homogenous populations where locally evolved norms and collaborative processes help to manage resources (more) sustainably and equitably'.

Our data show that neither an optimistic nor a pessimistic interpretation of community energy is accurate. Both readings can be confirmed and refuted. First, regarding the central assumption that community energy can contribute to individual changes in attitude and behavior, we can state that this can be empirically supported. Participants gain a more positive attitude towards citizen participation and the decentralized energy transition, and they even change their energy consumption behavior. However, this is not true for all participants. To the crucial question of whether people who exhibit less environmentally friendly behavior are motivated to change, we can answer that this is probably not the case. This is because both high-income individuals and those with strong financial motivations are least likely to change or reduce their energy consumption. Since the first group of persons has the highest values in resource consumption, this sends a bad message for the hope of influencing the least climate-friendly milieus.

However, attitudes toward participatory energy projects change and belief in the decentralized energy transition increases. Participating members build a bond with their project, which influences their global attitudes. This indicates that further changes in attitude and behavior are likely, which were not asked about in the survey. However, the limits of reality are also indirectly revealed: We have no evidence that serious changes with respect to specific forms of action occur at a higher rate. This confirms studies on environmental behavior, according to which a change in thinking about climate protection is becoming more widespread, but actual changes in one's own ways of acting are hardly ever sought or implemented (e.g., [115–117]). Numerous other examples in the context of participatory climate protection initiatives such as community gardening, agriculture, eco villages, or repair cafes show similar patterns (e.g., [118–121]). It can therefore be strongly assumed that there is a core of strongly ecologically motivated individuals in the communities who do not show any changes in attitude or behavior because they already think and act pro-environmentally. Another group participates for more selfish reasons for their own benefit, behaving passively and not changing their behavior. Then we find a third group of individuals who are neither strongly environmentally nor financially motivated and change their behavior because of their experience in the project. Presumably, these are individuals who have not previously given much thought to climate protection, but who show a fundamental willingness to change and are able to link this to their lifestyle and resources. Here, community energy can make a significant contribution to stimulating and promoting spillover and diffusion effects at the individual level.

We can thus conclude that, as is often the case, the empirical truth lies in the middle: On the one hand, community energy has the potential to stimulate a far-reaching change in thinking and behavior in the interest of climate protection; on the other hand, this potential is limited.

For further research, it would be of great interest to examine the described groups more closely regarding their individual attitudes and reasons for behavioral change or deliberate no change. In this context, personal as well as local factors will probably play a major role, which is why comparative case studies would be appropriate. Further surveys with a focus on behavioral change could also provide further insights into the relevant factors of influence. Finally, larger studies that compare community energy with other similar climate protection projects in terms of effects are also conceivable.

In the future, energy policies should take more into account that even highly rated and reputable community energy projects cannot solve the problem that not all groups of people can be reached regarding a desired change in behavior. Therefore, other, complementary strategies are needed, which focus more on groups that participate but have no further interest in climate protection. In this context, costly lifestyles with high resource consumption need to be focused on more strongly to develop targeted incentives that stimulate connectable climate protection without generating effects that have no measurable outcome. Broadly based and integrative concepts are required here that are not focused on energy generation alone, but also on adjacent sectors such as mobility, housing and consumption. Therefore, the activating role of intermediaries is of crucial importance, as they can establish cross-links between institutions, couple policy sectors, and bridge differences between different lifestyles and social milieus [122–125]. Community models separately are reasonable in terms of the diffusion and transformative effects shown here and should be applied to achieve the goal of a just and participatory energy transition and climate protection, but more is needed than just starting a RE project and operating energy plants. Community energy could activate and achieve much more as done to date, by broadening the focus and overcoming the narrow approach through networking and influencing all spheres of the sustainability transformation of society.

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Appendix A

Table A1. Overview of all variables and their respective level of measurement.

Variable	Measurement								
Gender	0 female				1 male				
Age	1 under 18 years	2 18–25 years	3 26–35 years	4 36–45 years	5 46–55 years	6 56–65 years	7 66–75 years	8 76–85 years	9 older
Income	1 less than 500 Euro	2 501–1500 Euro	3 1501–2500 Euro	4 2501–3500 Euro	5 3501–5000 Euro	6 5001–7000 Euro	7 7001–10,000 Euro	8 more than 10,000	
Urban or rural environment	1 village below 5000 inhabitants	2 small town 5000–20,000 inhabitants	3 medium-sized town 20,000–100,000 inhabitants	4 suburbs	5 quarter close to suburb	6 quarter close to the city center	7 city center		
Shares acquired	1 less than 500 Euro	2 500–1000 Euro	3 1001–2000 Euro	4 2001–3000 Euro	5 3001–5000 Euro	6 5001–10,000 Euro	7 more than 10,000		
Distance to installation	1 max. 500 m	2 max. 5 km	3 max. 10 km	4 max. 20 km	5 max. 50 km	6 more than 50 km			
Frequency to see the installation	1 never	2 seldom	3 a few times per week	4 daily					
Identification with project	1 oppose the project	2 have some doubts	3 am neutral	4 mostly identify with the project	5 fully identify with the project				
Financial motivation									
Environmental motivation	1 strongly disagree	2 disagree	3 neutral	4 agree	5 strongly agree				
Citizen empower-ment									

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