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#### Statement of Originality

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## 1. INTRODUCTION

The decarbonization of energy systems in Europe is essential to achieve the ambitious climate goals, and a successful green transition requires that citizens play a more active role. AURORA aims to empower citizens in the energy transition through long-term engagement such as energy communities, and encourage behavioural changes in such communities. To achieve that, the project will foster the upgrade of established social communities (e.g. universities and local councils) into local energy communities. After the energy communities are established, the project will promote interventions to support citizen behavioural change. The mobile app developed in the project will then act as a tool to collect data for the researchers to assess the interventions that are carried out in the energy communities.

To upgrade social communities into energy communities, we need to understand the motivations and challenges for citizens to participate in such initiatives. Section 2 of this report deals with this. In subsection 2.1, we present the literature review of drivers and barriers found in existing energy communities. The participation in community energy-related activities and collective action is also analysed. To understand the specific drivers and barriers for local citizens in the 5 demonstration sites to participate in energy communities, we conducted an online survey, which was translated to the various local languages. The survey is on-going and the analysis on the responses we received until April 2023 is presented in subsection 2.2.

Section 3 of this report will describe the initial energy behaviour observed in the participants in the different locations, using the data that is collected through the beta-version of the AURORA app. The beta-version of the App (only available on iOS platforms) focuses on the useability and functionality testing and is only tested within the consortium and a small group of students in Denmark, therefore the authors would like to mention that the data collected is limited. As colleagues in Work Package 2 continue to improve the App and roll out the official version to general public in the coming months, this analysis will be repeated with more data in the next version of the D1.2 deliverable report. Section 4 will cover an assessment of the interventions that are carried out at the demonstration sites. Throughout the project, the interventions are defined by each local energy community, and will be tuned accordingly to better align with the needs of the local communities. A different work package (WP4) will be dedicated to this process. In this version of the report, we include some initial suggestions on approaches to behaviour change in this section. These suggestions are shared among the consortium and each demonstrator site could choose to adopt these or develop other interventions that better align with the needs of the community. Last but not least, Section 5 describes the plan for the next revision of this report.

## 2. DRIVERS AND BARRIERS IN UPGRADING LOCAL COMMUNITIES TO ENERGY COMMUNITIES

### 2.1 Literature review

Energy communities (EC) are a type of organization where citizens take part in energy collective action in an open democratic way and its main goal is to obtain environmental and social benefits for their members more than making a profit (1). Citizen participation in EC is essential to know the drivers and motivations leading citizens to take part in an EC project and identify the barriers impeding its development.



In this section, a literature review of the drivers and barriers found in existing EC has been carried out, and the participation in community activities related to energy and collective action is also analysed.

### 2.1.1 DRIVERS

Firstly, when engaging in collective action in EC, drivers can be classified as environmental, social, economic, market, and formation drivers. Environmental drivers are the main motivations for taking part in an energy project, followed by social motivations, since collective action is an interesting factor in becoming part of an organization. Environmental drivers include concern about the environment, raising awareness of traditional technologies and the elimination of fossil fuels to reduce carbon emissions, citizen participation in the energy transition, and mobilization to combat climate change.

In terms of social motivations, it is worth highlighting community identity as the main driver and benefit offered by EC. Community identity can be understood as belonging to a group, the creation of a sense of community, where common values are shared and relationships of trust, cohesion, and solidarity are built. Thanks to this social connection and collaboration in the community, benefits are obtained through community action and sharing the risks involved in being part of a project that would not be carried out individually. This category also includes drivers such as improving local conditions, local interaction in the community, fighting against energy poverty and social inclusion, citizen and community empowerment, change of social norms, and social acceptance of renewable energies. In addition, a behavioural subcategory can be defined with drivers such as showing the own environmental commitment to set an example (or vice versa), the contribution to the self-esteem of being part of an exciting project, and the transformation from individualist to collective thinking, where cooperation and common interests are created.

Economic drivers also play an important role in citizen involvement which, although not the main objective of an EC, must also be taken into account. These drivers can be classified as socioeconomic motivations such as the creation of local value, understood as the promotion of local development, job creation, support for the local economy, etc., as well as the generation of economic returns for the community, which means the redistribution of benefits and the use of economical surpluses in benefit of local purposes or activities, among others. Also belonging to this category of economic drivers is found the reduction of the electricity bill leading to saving money.

To finish with the drivers, market and formation drivers are defined. Among the first one, there are energy democracy, independence from big electricity companies, the creation of a new decentralized, fair, renewable, and decarbonized energy model, the change in the role of consumers in the energy market ("prosumers"), security of supply in case of power cuts or increases in energy prices, and the production of electricity and heating from renewable sources. Among the formation drivers, participation in an energy community provides formation on energy issues (how the energy works, the energy market, energy-saving techniques, reduction of consumption and carbon footprint, etc.) and it allows clear and transparent access to energy information. In addition, examples of successful energy communities and the use of innovative systems in these projects are also classified as formation drivers.



### 2.1.2 BARRIERS

Secondly, the barriers to face to start up an EC can be divided into institutional, economic, organizational, behavioural, market, and ethical barriers. The institutional barriers include problems related to the lack of a regulatory framework, constant changes in regulations, and the complexity of administrative procedures. The economic barriers are related to the difficulty in accessing financing for energy projects, especially small-scale projects, and the dependence on subsidies. As for organizational barriers, it should be noted that, in most cases, the work is carried out by volunteers, which results in a lack of dedication, time, and experience, as well as a lack of resources and expertise. There are also communication problems, both with citizens (as it is difficult to access and retain people from outside the community, and communication channels are usually one-way without taking into account citizens' opinions) and with the authorities.

Among the behavioural barriers are those related to citizens' lack of interest and commitment, the NIMBY (Not-In-My-Back-Yard), defined as it does not involve one's implication because it does not affect everyone, as well as thinking that individual action does not make a difference. There is a clear lack of information and formation regarding energy issues and great ignorance of what EC is. There are also problems of local opposition to renewable energies and internal conflicts within the group.

As for market barriers, the high costs of grid connection, especially in rural areas, the centralized energy model, which is a problem for the development of this type of project, and the natural monopoly on distribution networks, are some of the most significant barriers. It is also noteworthy the negative authorities' thinking regarding citizen participation in the governance of energy projects. Finally, the environmental and climate effects of new models and technologies and conflicts with the legislation are some ethical barriers ECs face.

Finally, Tables 1 and 2 summarize all the drivers and barriers discussed throughout the report, respectively.

*Table 1. Driver categories and references*

Category	Driver	References
Environmental	Environmental awareness	(1),(2),(3),(4),(5)
	Citizen participation in the energy transition	(4),(6),(7),(8),(9)
	Mobilization to combat climate change	(1),(9)
Social	Community identity	(1),(2),(3),(4),(5),(8),(9),(10),(11)
	Improvement of local conditions	(2),(4),(8)
	Fighting against energy poverty	(1),(4),(9),(10)
	Citizen empowerment	(1),(9)
	Changes in social norms	(4),(9)
	Social acceptance	(2),(3),(4),(8)
	To set an example	(2),(4)
	Contribution to self-esteem	(2)
	Transformations of individual thinking to a collective one	(8),(9)
Economic	Creation of local value	(1),(4),(5),(8),(9),(10),(12)
	Generation of returns to the community	(1),(3),(8),(9)
	Reduction of the energy bill	(1),(2),(3),(4)
Market	Energy democracy	(3),(5),(7),(12)



	Independence of big companies	(1),(2),(4),(5)
	New energy model	(8),(10),(12)
	Change in the consumer's role	(4),(6),(9),(10),(12)
	Security supply	(2),(4)
	Renewable energy production	(1),(3)
	Formation in energy-matter	(1),(2),(4),(9)
Formation	Access to a clear and transparent information	(3), (6),(13)
	Successful examples	(2),(9),(10),(12)
	Innovation systems	(2),(9)

Table 2. Barrier categories and references

Category	Barrier	References
Institutional	Lack of regulatory framework	(9),(10)
	Changes in normative	(9),(10)
	The complexity of the administrative procedures	(10)
Economic	Difficult access to financial	(5),(7),(10)
	Dependency on subsidies	(9),(10)
Organizational	Volunteer work	(7),(9)
	Lack of resources	(5),(9),(14)
	Communications problems	(7),(9),(15)
Behavioural	Lack of interest and awareness	(5),(6),(7),(9),(16)
	Lack of information and formation	(5),(12)
	Local opposition to renewables	(6),(9)
	Internal group conflicts	(13)
Market	High grid connection costs	(7),(9)
	Centralized energy model	(7),(9)
	Natural monopoly on distribution networks	(10)
	Negative thinking in the governance of energy projects	(7)
Ethics	Environmental effects of new technologies	(16)
	Conflicts with legislation	(16)

## 2.2 Analysis of survey

This document contains an analysis of the survey that was sent by the demo-sites. The last date of the analysis is **14th of April**. The scope of this report is to identify barriers and drivers found when asking people to take part in the Energy Community (EC). The analysis follows the questions of the survey, classified into four different areas: Contributing to energy transition, Energy communities, Labels for citizen's carbon emissions and About myself. First, a general analysis is done, and then, a country-specific analysis is presented.

**259 responses** were received in total, divided by countries as shown in Table 1. In the first version of the survey, the location was not included and due to this, it is misunderstood the number of answers in English (some of them are from Denmark and maybe from another location). To solve this problem, the survey includes now a question specifying the location of the survey respondents.

Table 3. Number of answers of the survey by country



Country	Number of answers
Denmark	51
Portugal*	72
Slovenia	13
Spain	112
United Kingdom	**

\*It includes 1 response indicating Angola as location but used Portuguese as language.

\*\*We have 10 people who responded in English, but not sure if their location is the UK (the location was asked later and nobody from UK answered the survey then).

## 2.2.1 GENERAL

### Contributing to the energy transition

#### Question 1

*“Considering the option of contributing to the energy transition in my University/in my neighbourhood and contributing to reach the 2030 climate targets sooner, I consider:”*

Figure 1 shows the answers to this question. 75% of the respondents feel co-responsible and part of the solution of the energy transition, while 11% of them consider themselves as part of the solution but not co-responsible. 8% of people do not know the answer, 5% think they are co-responsible but not part of the solution and 2% do not feel any of both parts.

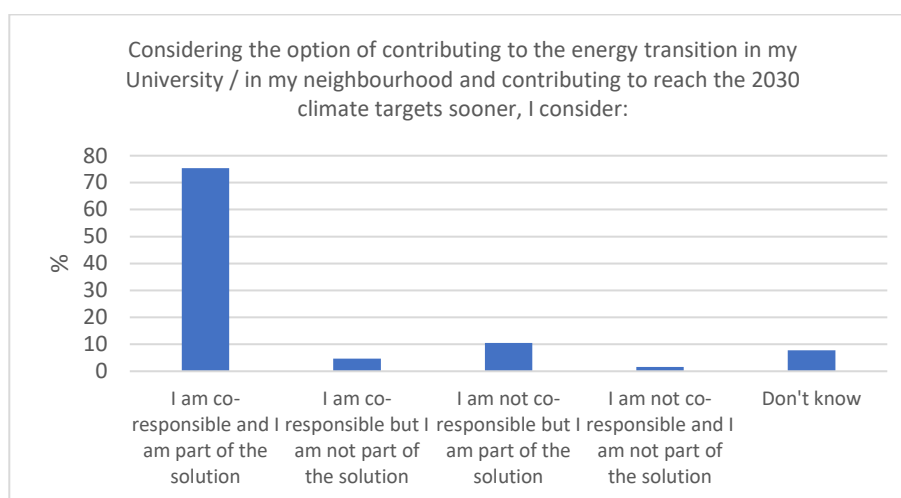


Figure 1. Contribution to the energy transition

As it can be observed, most of the respondents feel conscious about the energy transition and feel part of the solution. This is a good point to start and a driver in the participation in an EC.

### Energy communities

*“An Energy community (EC) allows citizens to invest in the community-owned energy system infrastructures, which will be used to provide part of or all of the energy usage in the community.”*





## Question 2

*“Energy communities (ECs) are a new instrument to incentivise citizens’ participation in the energy system. According to my own criteria, I would prioritise:”*

In this question, a ranking from 1 (most important) to 7 (least important) was done by every respondent. All questions are analysed individually.

47% of people think that providing monetary return on the investment done by the EC's members (Figure 2) is important (25% ranked it in level 2 and 22% in level 1). While providing non-monetary benefits to these investments (Figure 3) seems to be also important (43% for levels 1 and 2). At first sight, it seems that providing monetary value is important for the potential participants in the EC but non-monetary benefits are also important.

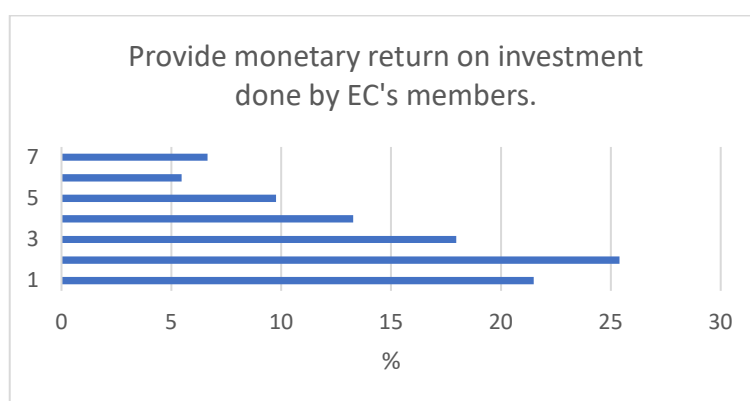


Figure 2. Provide monetary return

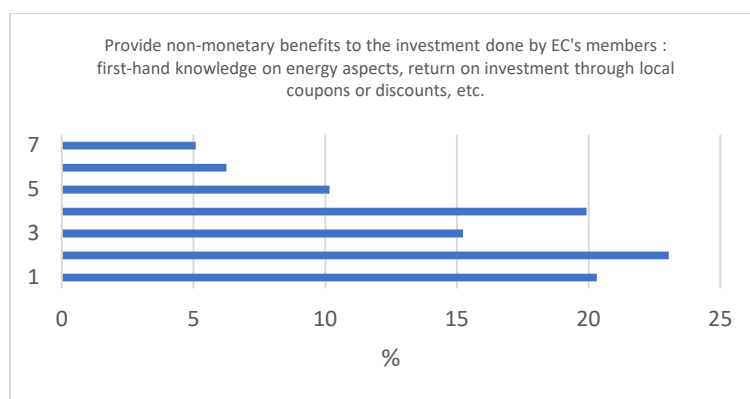


Figure 3. Provide non-monetary return

Figures 4 and 5 show that providing social and environmental benefits is especially important for them: 70% and 66% selected levels 1 and 2 for social and environmental benefits respectively. It is remarkable that 55% of the respondents rated providing environmental benefits as level 1, which is most important (Figure 5). When talking about themselves, 32% think that the EC is a good way of acting in the community according to their values (52% of the respondents selected levels 1 and 2 of importance, see Figure 6) but when they are asked about the EC as a way to challenge the rules of the traditional electricity system, the answers show a greater dispersion: 50% selected levels of importance from 1 and 2 while 29% selected levels 5 to 7 indicating low importance as criterion to take part of the EC (Figure 7). Finally, in Figure 8 we can see that, although the most





selected level of importance is level 3 (that could lead to conclude that this criterion is not so important), we observe that 39% selected levels of importance from 1 and 2, significantly more than those who selected levels 5 to 7 (27%), so to foster the social identity of the community and increase networking can be also considered a driver for the participation in the EC.

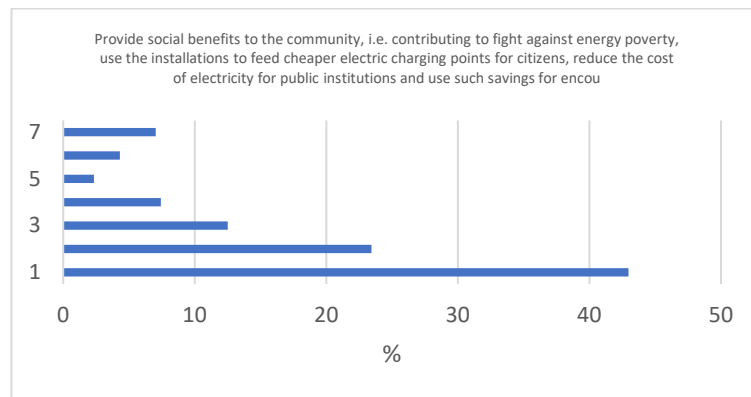


Figure 4. Provide social benefits

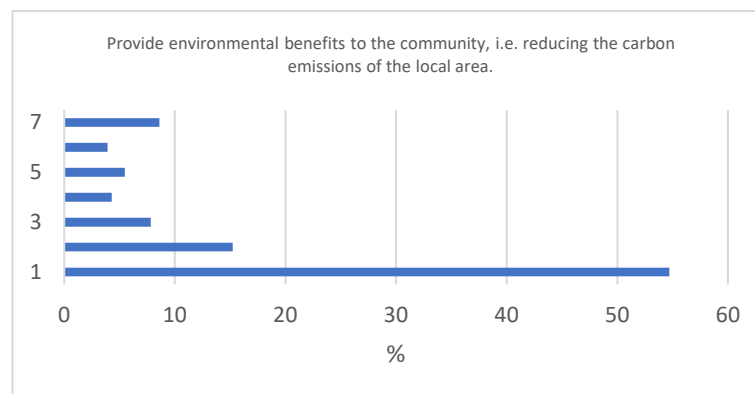


Figure 5. Provide environmental benefits

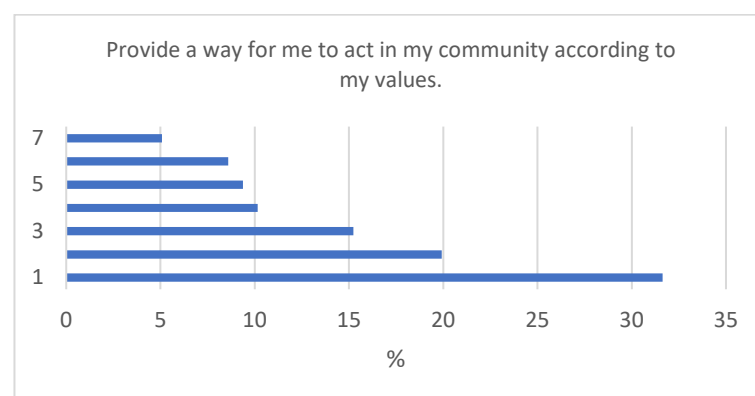


Figure 6. Provide for me to act in my community



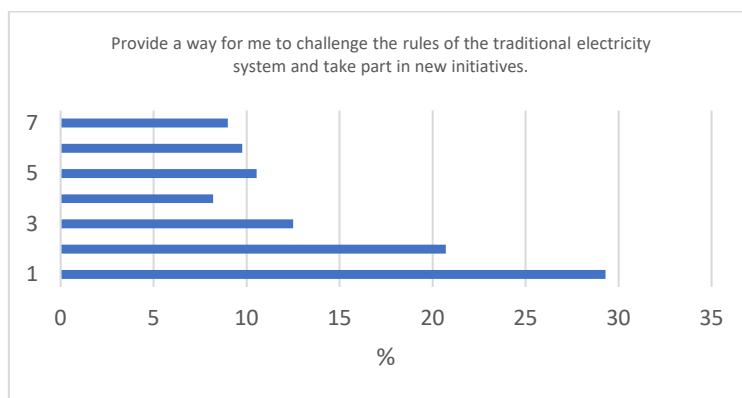


Figure 7. Provide a way for me to challenge the rules

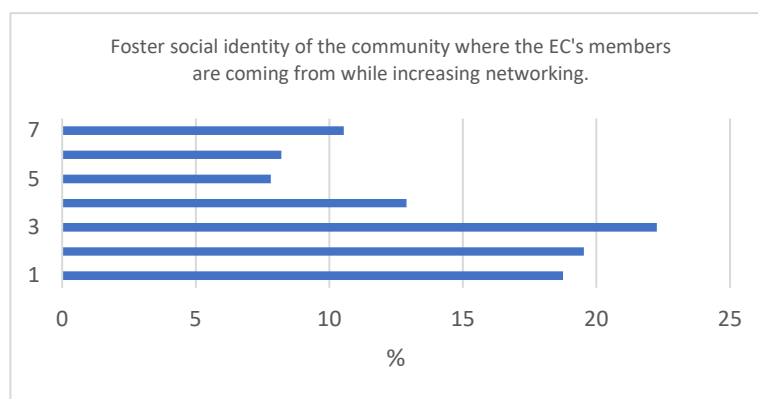


Figure 8. Foster social identity

The drivers proposed behind the questions are ordered from the most important to the least:

- 1) Provide environmental benefits to the community, i.e. reducing the carbon emissions of the local area.
- 2) Provide social benefits to the community, i.e. contributing to fight against energy poverty, use the installations to feed cheaper electric charging points for citizens, reduce the cost of electricity for public institutions and use such savings for encouraging other social actions, etc.
- 3) Provide a way for me to act in my community according to my values.
- 4) Provide a way for me to challenge the rules of the traditional electricity system and take part in new initiatives.
- 5) Provide monetary return on investment done by EC's members.
- 6) Provide non-monetary benefits to the investment done by EC's members: first-hand knowledge on energy aspects, return on investment through local coupons or discounts, etc.
- 7) Foster social identity of the community where the EC's members are coming from while increasing networking.



Most people see an EC as a way to provide environmental and social benefits to the community, while to provide non-monetary value and to foster social identity seems to have less importance to the respondents.

### Question 3

*"To consider joining a local energy community, I would need to know beforehand:"*

This question, as done with Question 2, is ranked in seven levels, 1 being the most important level and 7 being the least important.

Respondents find that knowing the financial implications (Figure 9) and legal implications of their participation (Figure 10) before deciding to join the EC is important as 38% and 49% people ranked them as most important, respectively. Adding the values of level 1 and level 2 the percentages reach 60% and 69% respectively.

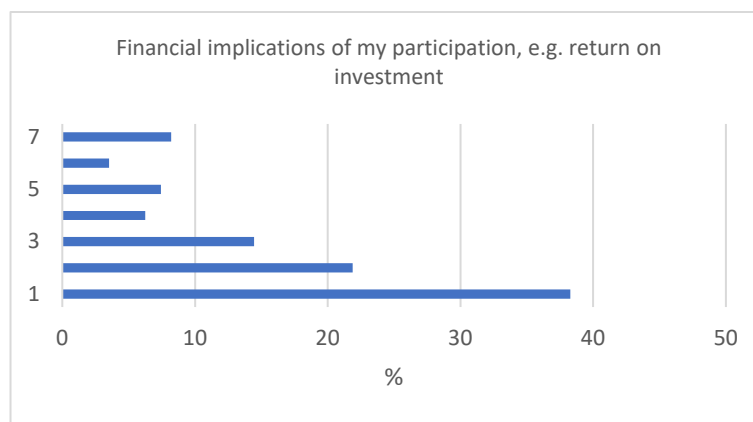


Figure 9. Financial implications

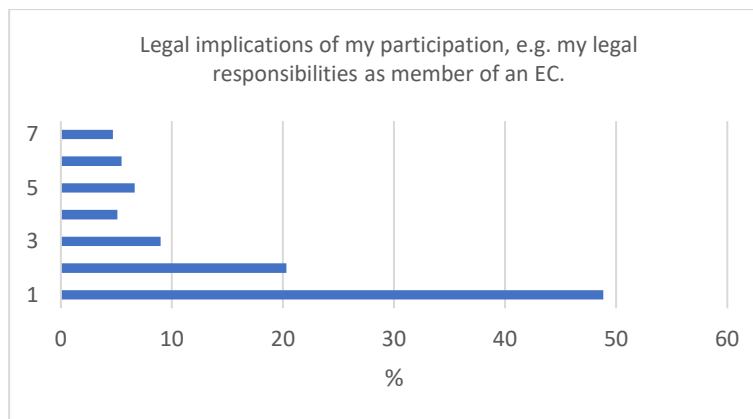


Figure 10. Legal implications

Knowing the procedures to formalize their participation is found as important for 58% (level 1= 31% + level 2= 27%) of the respondents (Figure 11) and 63% also find it important to know where and how access to all information and documentation (sum of levels 1 and 2 in Figure 12). Knowing the different activities that the EC would implement is not found as important as the previous ones (the addition of levels 1 and 2 in Figure 13 is just 48%). On the other hand, people consider that having information about the energy savings and the environmental impact of the shares of the EC (Figure



14) is important as 44% of the respondents ranked it in level 1 and 23% in level 2. Finally, in Figure 15 we can observe that knowing the ways of being more active in the EC is not so important for the potential participants to make any decision to join the EC (23% selected level 1 and 25% level 2).

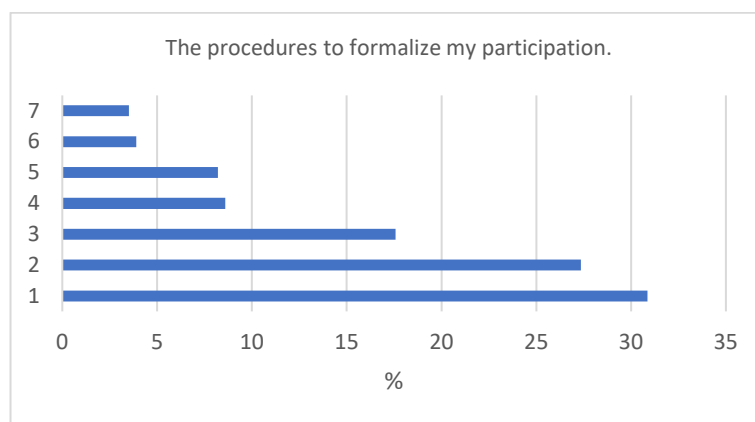


Figure 11. The procedures to participate

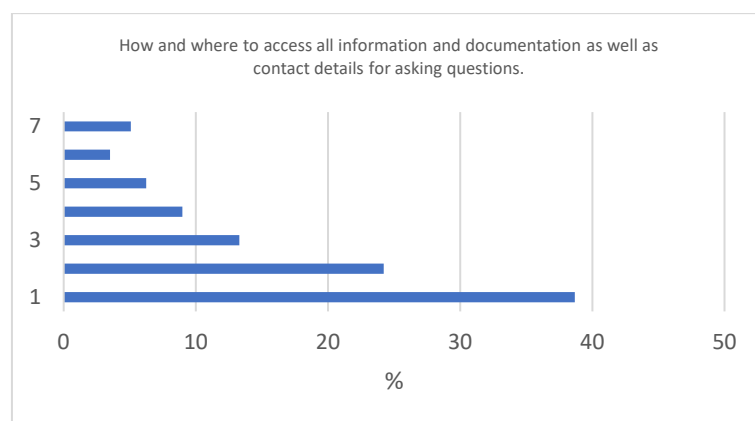


Figure 12. How and when to access the information

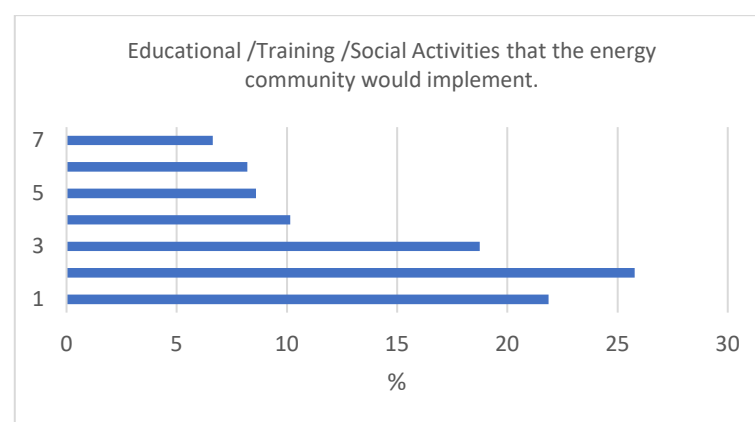


Figure 13. Activities implemented



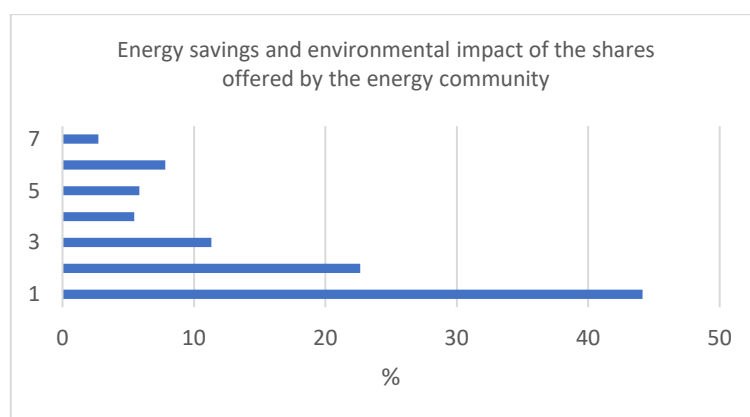


Figure 14. Energy savings and environmental impacts

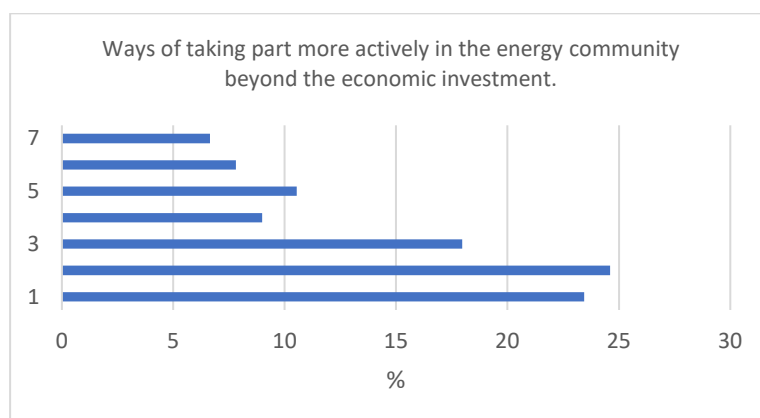


Figure 15. Ways of taking part more actively

As done in the question before, answers are ordered from most important to least important:

- 1) Legal implications of my participation, e.g. my legal responsibilities as a member of an EC.
- 2) Energy savings and environmental impact of the shares offered by the EC.
- 3) How and where to access all information and documentation as well as contact details for asking questions.
- 4) Financial implications of my participation, e.g. return on investment.
- 5) The procedures to formalize my participation.
- 6) Ways of taking part more actively in the energy community beyond the economic investment.
- 7) Educational /Training /Social Activities that the energy community would implement.

According to the answers, respondents find it more important to know the legal implications and the energy savings of the shares than the ways of taking part more active in the EC or the different activities that would be implemented by the community.



This leads to an important conclusion: the lack of clear information about financial and legal implications or about their energy savings or environmental impact can be seen as barriers by the potential participants in the EC.

#### Question 4

*“Considering that an EC should run at least one renewable energy facility, I consider:”*

As can be seen in Figure 16, the majority of the respondents (53% of them) consider the minimum investment proposed reasonable to take part on the EC, and 33% of them could consider investing even a higher amount of money.

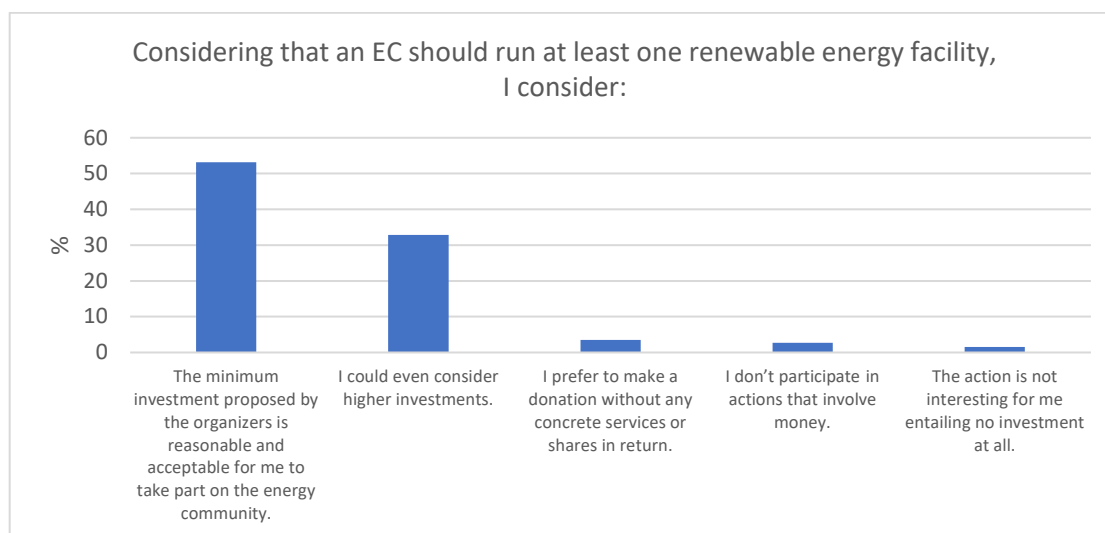


Figure 16. Considerations on the investments

As conclusions, we can draw from this question that people think that the minimum investment is reasonable for them and, as 89% of the respondents are able to invest money, the investment in photovoltaic installations is seen as a good mean of active participation.

#### Question 5

*“For me, it is important that:”*

In this question, people were asked to rank the answers in order of the most important (1) to the least important (5). 72% find important that the EC leaders show strong and continuous support to the initiative (addition of level 1= 43% and level 2= 29% in Figure 17) and 79% that the initiative should be led by technical and legal experts (addition of level 1= 60% and level 2= 19% in Figure 18). It is not particularly important that people they trust support the initiative (just 37% in levels 1 and 2 in Figure 19) but 59% consider it important to receive feedback and information from citizens that have invested in renewable facilities before (level 1= 24% and level 2= 35% in Figure 20). In Figure 21 we can see that the rest of the community members join the initiative is found not so important for respondents (46% selected levels 1 and 2).



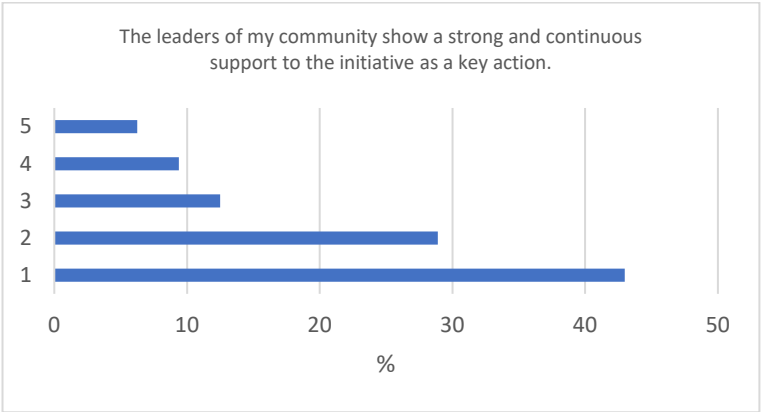


Figure 17. The leaders show strong support

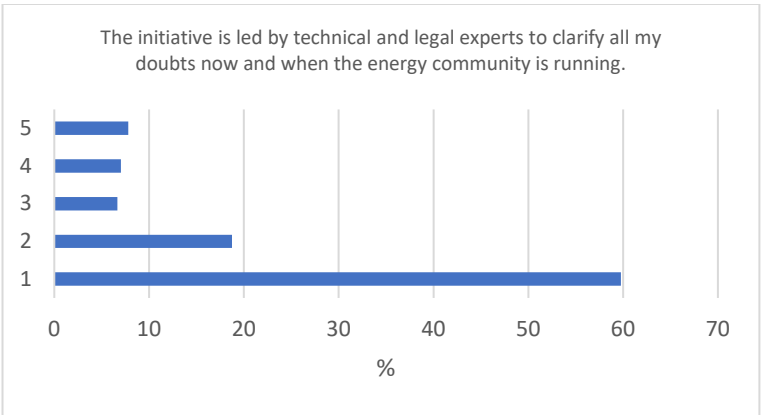


Figure 18. The initiative is led by technical and legal experts

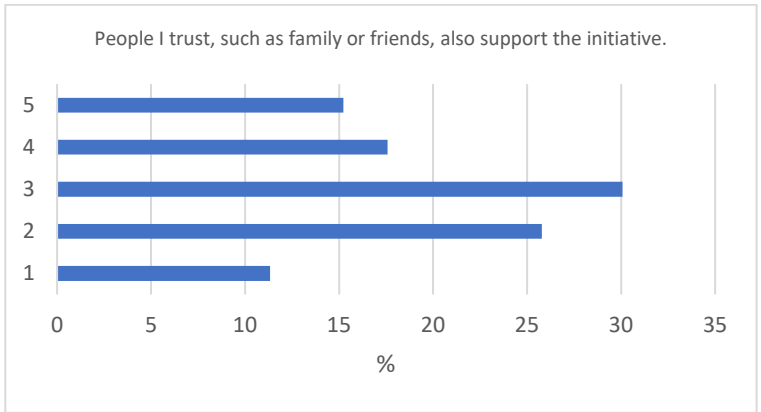


Figure 19. People I trust support the initiative



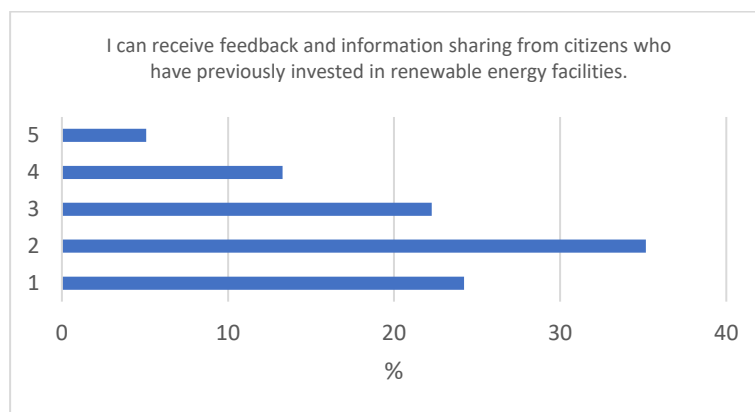


Figure 20. I receive feedback from citizens who previously invested

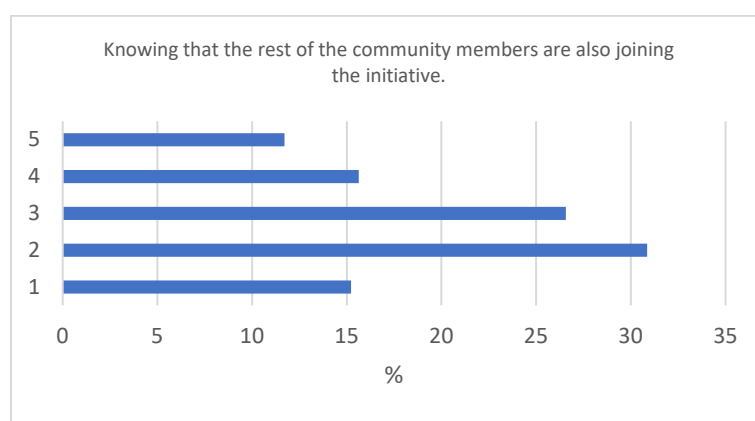


Figure 21. Knowing the rest of the members join the initiative

The same procedure that has been done with the other two ranking questions is done here, ordering from most important to least:

- 1) The initiative is led by technical and legal experts to clarify all my doubts now and when the energy community is running.
- 2) The leaders of my community show a strong and continuous support to the initiative as a key action.
- 3) I can receive feedback and information sharing from citizens who have previously invested in renewable energy facilities.
- 4) Knowing that the rest of the community members are also joining the initiative.
- 5) People I trust, such as family or friends, also support the initiative.

Analysing these answers, we can consider as barriers the lack of the appropriate support from technical and legal experts and/or from the leaders of the community. On the other hand, the participation in the dissemination and communication activities of citizens that previously invested in the PV facilities of the EC could be an interesting driver.

#### *Labels for citizens' carbon emissions*

*"AURORA team is developing a label for citizens' carbon emissions based on energy and commuting behaviour, as illustrated in the image here. By providing data regarding electricity and*



*heating consumption, and commuting patterns, citizens can obtain a result of which label their carbon emissions entail.*

*Then, by taking action through the project (becoming a member of an energy community that produces clean energy, changing his/her mobility patterns) the user can get an updated label."*

#### Questions 6 and 7

*"What do you think of the labels? Other comments to this label."*

People were asked about their opinion of the label proposed. As can be seen in Figure 22, 39% of the respondents are keen to provide data and know their label, another 39% would consider providing their data and using the label, 16% of them think the idea is interesting but they won't use it and 4% don't like the idea, and the rest 2% of the respondents think the idea is terrible. Following this question, was asked people to write down some comments about the label, shown in Table 2, a column that classifies this feedback into positive (+), negative (-), doubts (?) and suggestions (\*) has been added.

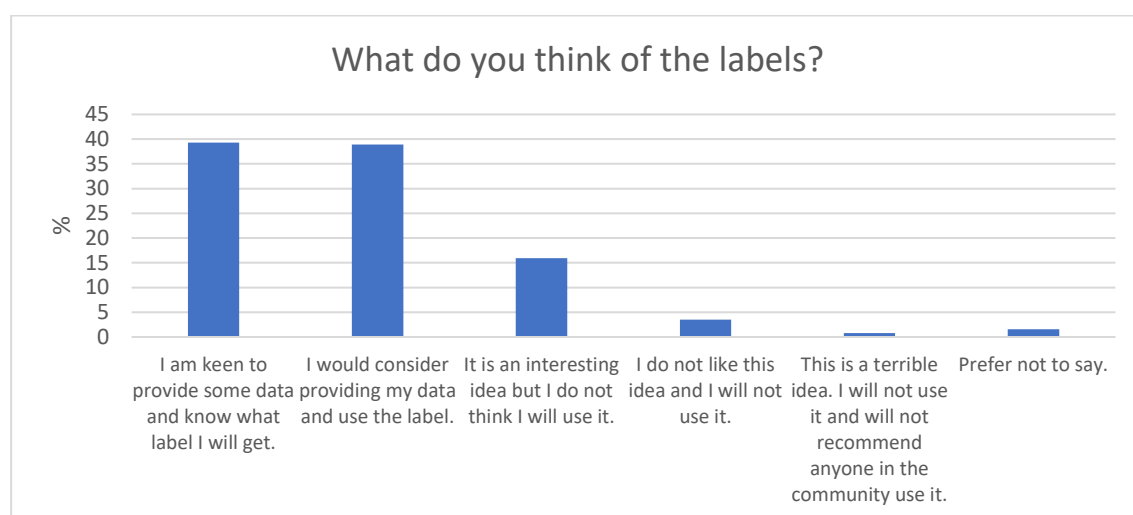


Figure 22. Feedback about the label

Table 4. Comments about the label

Feedback	Classification
If it provides an easy opportunity for people to improve their habits, it will be perfect.	+
If it considers EVERYTHING (food, all types of transport, etc.), I find it interesting. If not, no.	*, -
Interesting but potentially discriminating since it is nominal.	-
It may not be very effective	-
Confused by the kWh figures	?
Insert a QR CODE that directs to an online environment with more details of the AURORA action.	*
I like the idea of the labels, but I am not sure if I would like to input that kind of personal information	+, ?
Will they be public?	?
It should not be possible to pay for greenwashing of your label	-
What would interest me is to contribute to the community through the installation that I have in my house, 10 kW, in order to allow the use of the surplus produced by me in the community and using the surplus of others when necessary. This is the logic of "community". Labels are a service logic where we join a community but are not really part of it.	*
It is part of our daily life	+



It depends too much on the person's situation. The distance to the workplace, public transport options along the entire route, etc., must also be taken into account.	+
It would be interesting to know whether the unit of time calculation is the year, and what consumption values are entered to estimate this average consumption.	+
Looks similar to the energy-efficiency labels on refrigerators etc. This may be an advantage because it is immediately recognizable, but it may also confuse some people, because it is a somewhat different measure (carbon emissions, rather than just energy-use).	+
Very exciting initiative. Would be great if the marks were available and possibly could be displayed through the app as documentation when i.e., buying things (petrol) and it is somehow linked to your credit card, so that your score/mark is updated "live" based on what you buy and what you do.	+, *
Too complex for the average citizen to understand, especially those most in need. Relatively disorganised and difficult to read.	-
I don't think it is convenient to go through life with a label that discriminates me from the rest, for better or worse. I am aware of my ecological and social behaviour, and I think that this would be a partial measurement, there are other things such as recycling or food consumption or other goods that surely will not be taken into account and should enter into the equation.	-
Is there really that much difference between categories 1, 2, 3? I don't know. Why is "Zero" < 2178 kg CO <sub>2</sub> ? It is also hard for me to say "yay, I'm category 1", I am not sure if there is any meaning attached there.	?
I would prefer a more enlightening explanation of the purposes of the label	?
Maybe if the label comes with a few suggestions to which actions have the biggest impact to further reduce. A label alone will probably not mean very much	*
Perhaps when awarding the label, the family context, place of residence, etc., of each of us should be taken into account. If you live far away from the campus, you necessarily have a larger environmental footprint...	+, *
Real feedback should be given to consumers. I am tired of the "pats on the back" and the "well done, you look after the good of us all".	*
Good initiative!	+
Somewhat confusing, with the 2 levels on the first two labels. No need to imitate the presentation of the appliance consumption labels.	-
nice to see "blue" zero carbon emissions!	+
I find it useful to correct bad habits	+
The idea of labelling citizens seems a dictatorship to me	-

We found people who want to provide their data and use the label, some other people would consider providing data and use the label and others consider it is a good idea but they won't use it. Only 41% of the respondents are sure that they want to use it, but these people are less than half of the respondents. While 37% of them would consider using it, they are not yet sure. Here we can't conclude that the label or its use as a driver for now. In fact, as a consequence of these contributions, which coincide with one of the external experts that reviewed the label, the figure has been modified, and now it is not like the one shown in the survey, in order to make it less confusing.

The comments provided us with useful information regarding the label. On one hand, we can identify barriers like the lack of knowledge about the energy and carbon footprint data, but it could be transformed into a driver if training activities on energy aspects are offered, as proposed. Another barrier found to use the label is the possibility of being discriminated through categorization. Some of respondents see the label as ineffective, and others incomplete (not including food, for example).

On the other hand, in the positive comments, which can be seen as drivers, many respondents see the label as a way to know if their daily habits are friendly to the environment and positively value



that the label is similar to the energy-efficiency label so it is recognizable. Others think it is a good initiative and seems to be excited to start with the project. And finally, some of them made some suggestions (see \* in Table 2).

### About myself

#### Question 8

*“My potential participation in AURORA will be by:”*

This was a multi-answer question, in which respondents could choose more than one answer. When asking them what their participation in AURORA will be (Figure 23), 24% of the answers indicate that the potential participants in the EC want to invest in the community, followed by 21% who want to support research studies by providing their own data. 18% of the respondents aim to be trained on energy aspects, 14% will follow the project externally and 13% will volunteer on the initiative. On the other hand, 5% of people are considering participating but they did not yet how to, and 4% selected the option where they show interest on the topic generally but not really wanting to participate in the project.

An important conclusion can be extracted from these answers. The interest of the potential participants in investing in the EC but also in supporting the research studies as a contribution to science are very good news and in line with the objective of AURORA project: to transform a social community into a hub for citizen science using the constitution of an energy community as a driver.

To understand energy aspects to be part of the energy transition is another driver we can find while people want to be trained on energy aspects. And finally, to follow the project on the social media, newsletters, etc. and volunteering helping the organizers are other drivers, not as important for the respondents as the other commented before, but people also see those activities as a way to be part of the EC.

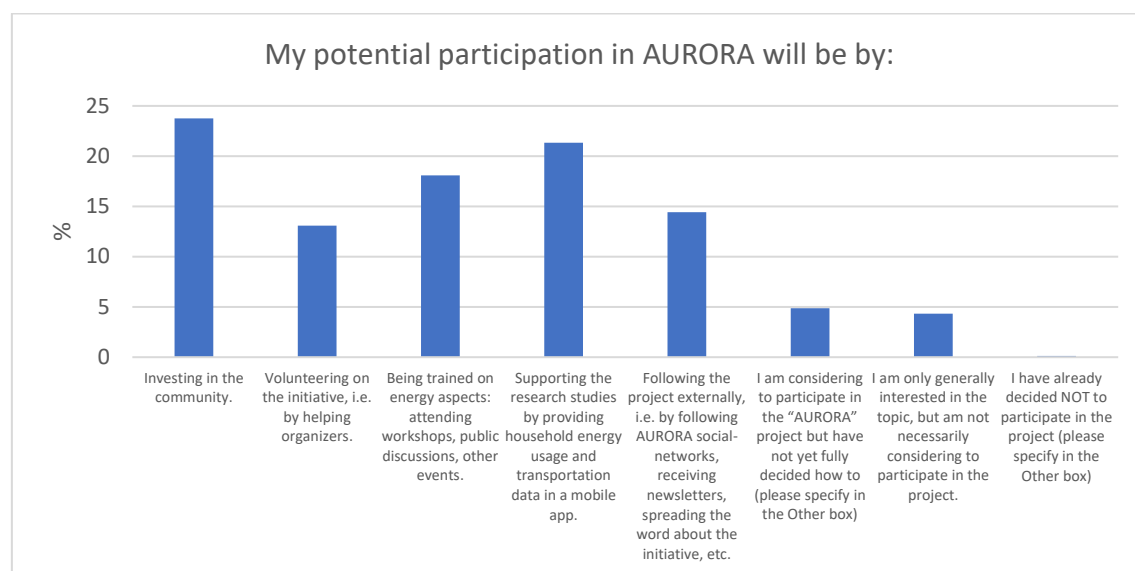


Figure 23. How respondents will participate in AURORA

#### Questions 9, 10 and 11

*“Age, gender and highest educational level:”*



Considering the age (Figure 24), 28% of the respondents are 18-25 years old, followed by 23% which belong to the 51-60 group, 15% belong to the 41-50 group, 13% to 31-40, 10% are 26-30 years old and 3% are younger than 18 years old. As shown in Figure 25, the respondents were 166 males, 89 females, and 1 non-binary person, with 65% being males and 35% being females. And finally, the highest educational level of the respondents is shown in Figure 26: 49% of the respondents have a graduate or postgraduate degree, followed by 22% which are currently studying and 16% have a college/university degree. This is coherent with the type of social communities we are working with: university communities.

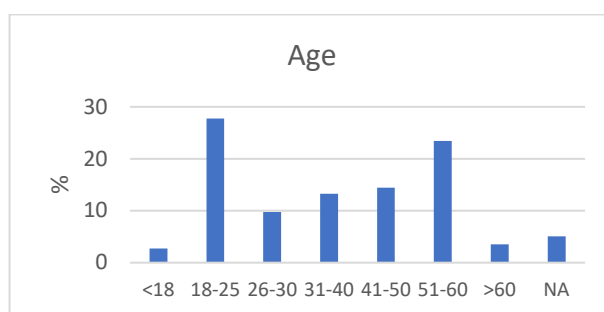


Figure 24. Age of the respondents

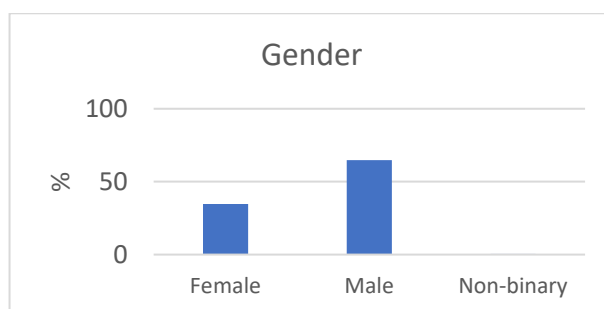


Figure 25. Gender

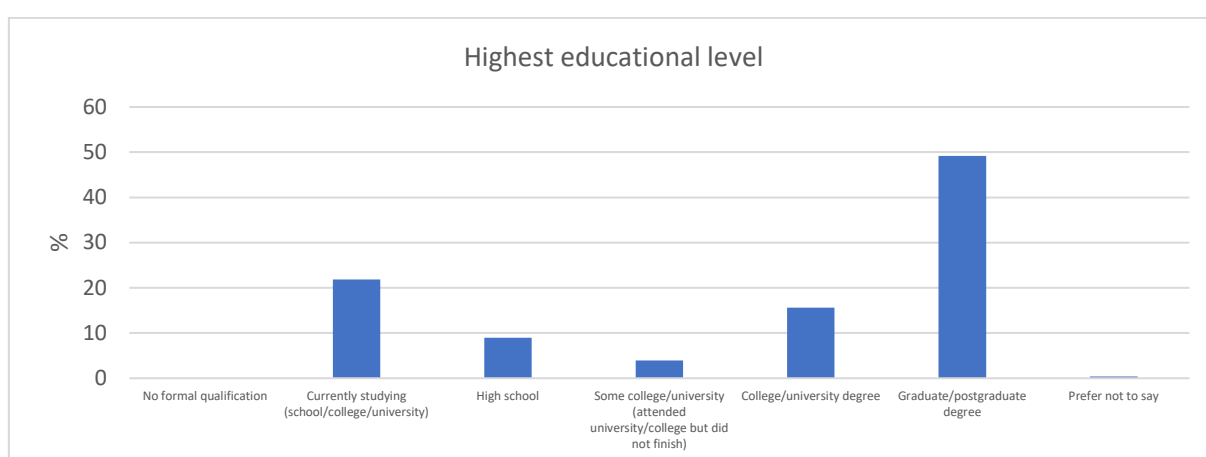


Figure 26. Highest formal qualification of the respondents



In the following subsections, a country-specific analysis is performed to find the most important drivers and barriers in every demo site.

## 2.2.2 DENMARK

We have 51 respondents, but two of them did not agree with the GDPR and informed consent and didn't participate in the survey.

### *Contributing to the energy transition*

#### Question 1

*"Considering the option of contributing to the energy transition in my University/in my neighbourhood and contributing to reach the 2030 climate targets sooner, I consider:"*

Danish people feel they are responsible and part of the solution to the energy transition (78%), as can be seen in Figure 27. Only 2% of the respondents believe they are neither part of the solution nor responsible. So, we see that this feeling is a driver also in Aarhus demo-site.

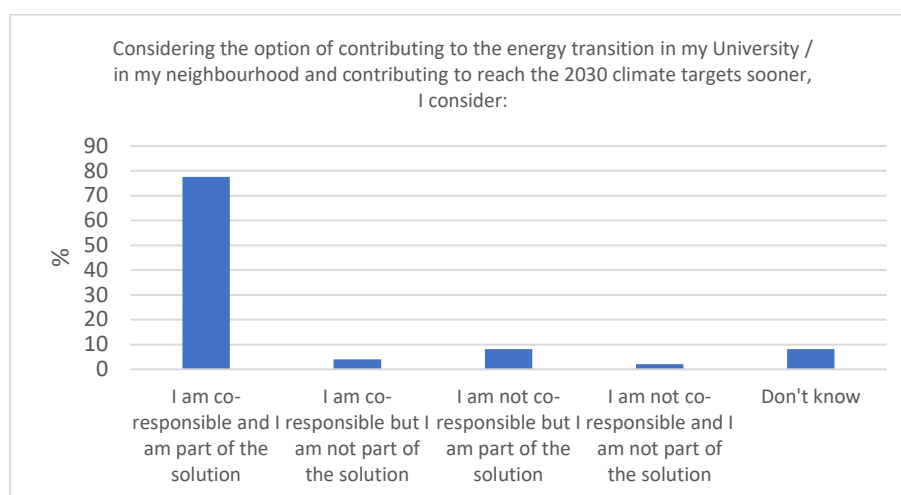


Figure 27. Contribution to the energy transition. Denmark

### *Energy communities*

*"An Energy community (EC) allows citizens to invest in the community-owned energy system infrastructures, which will be used to provide part of or all of the energy usage in the community."*

#### Question 2

*"Energy communities (ECs) are a new instrument to incentivise citizens' participation in the energy system. According to my own criteria, I would prioritise:"*

As shown in Figures 28-34, we can classify the answers in order of importance:

- 1) Provide environmental benefits to the community, i.e. reducing the carbon emissions of the local area.
- 2) Provide monetary return on investment done by EC's members.
- 3) Provide social benefits to the community, i.e. contributing to fight against energy poverty, use the installations to feed cheaper electric charging points for citizens, reduce the cost



- of electricity for public institutions and use such savings for encouraging other social actions, etc.
- 4) Provide a way for me to act in my community according to my values.
  - 5) Provide non-monetary benefits to the investment done by EC's members: first-hand knowledge on energy aspects, return on investment through local coupons or discounts, etc.
  - 6) Foster social identity of the community where the EC's members are coming from while increasing networking.
  - 7) Provide a way for me to challenge the rules of the traditional electricity system and take part in new initiatives.

People from Denmark prioritise environmental, social and monetary benefits over challenging the energy system and fostering the social identity of the community.

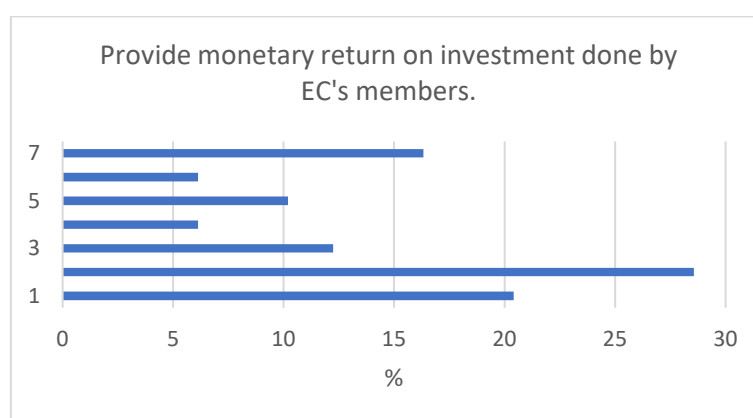


Figure 28. Provide monetary return. Denmark

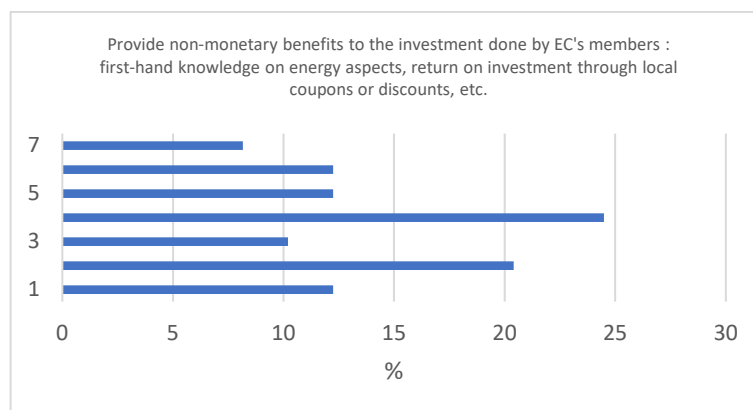


Figure 39. Provide non-monetary return. Denmark





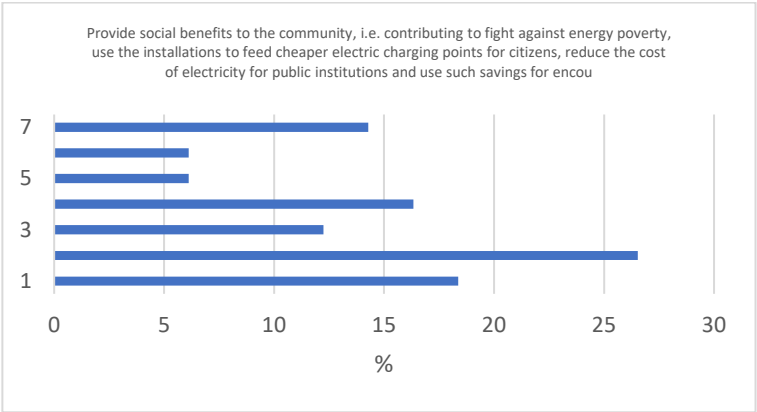


Figure 30. Provide social benefits. Denmark

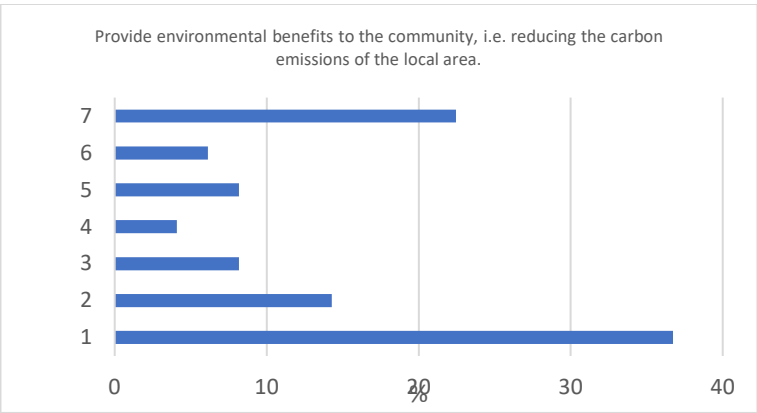


Figure 31. Provide environmental benefits. Denmark

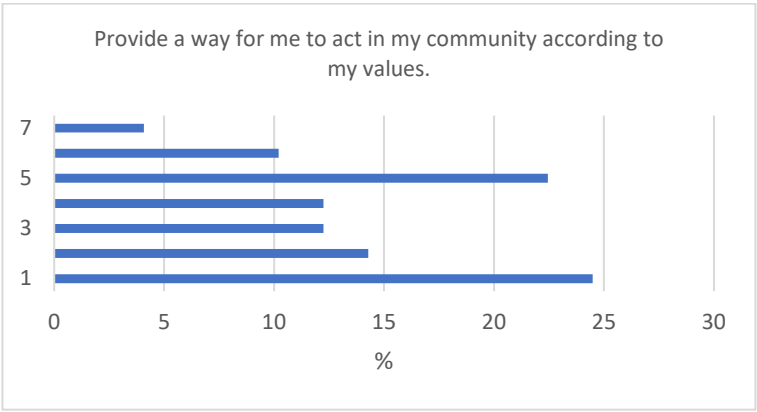


Figure 32. Provide for me to act in my community. Denmark

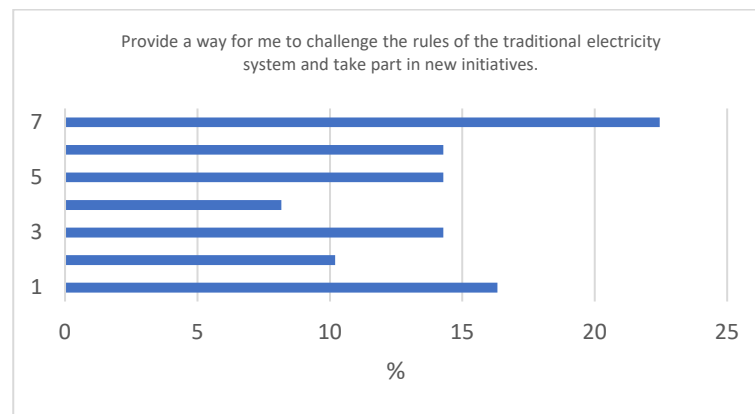


Figure 33. Provide a way for me to challenge the rules. Denmark

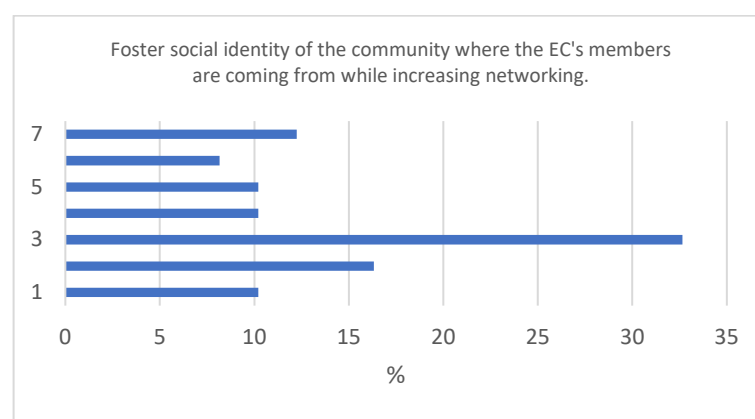


Figure 34. Foster social identity. Denmark

### Question 3

*"To consider joining a local energy community, I would need to know beforehand:"*

Following the same procedure done in Question 2, and according to Figures 35-41, in order of importance to the Danish people, we can find:

- 1) Financial implications of my participation, e.g. return on investment.
- 2) Energy savings and environmental impact of the shares offered by the energy community.
- 3) Legal implications of my participation, e.g. my legal responsibilities as member of an EC.
- 4) How and where to access all information and documentation as well as contact details for asking questions.
- 5) The procedures to formalize my participation.
- 6) Ways of taking part more actively in the energy community beyond economic investment.
- 7) Educational /Training /Social Activities that the energy community would implement.

As can be seen, for Danish people it is more important to know the financial implications and the energy savings than the activities implemented and the ways of being more active in the EC.



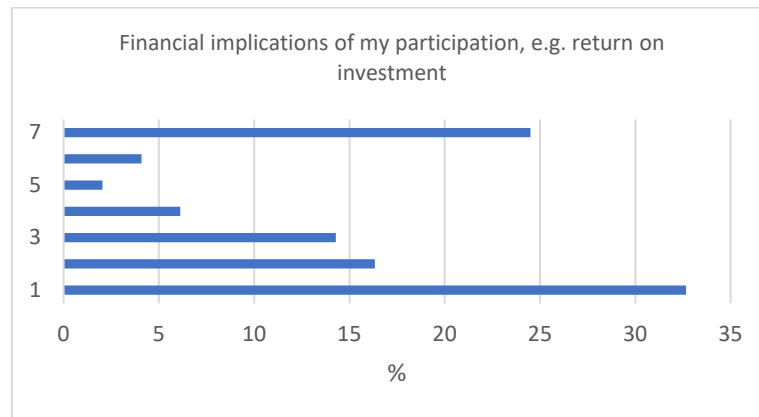


Figure 35. Financial implications. Denmark

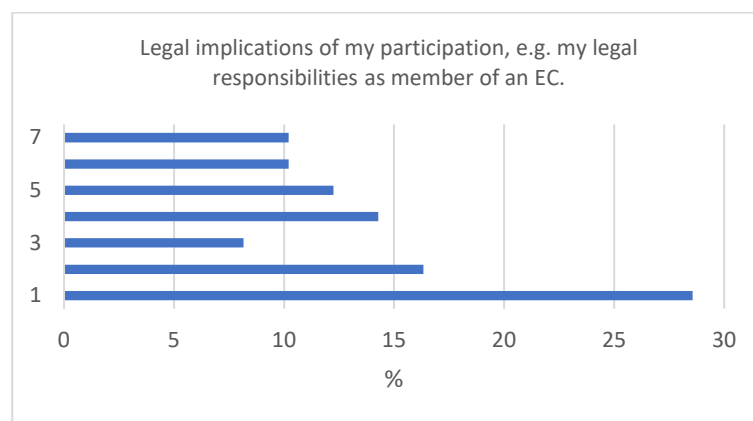


Figure 36. Legal implications. Denmark

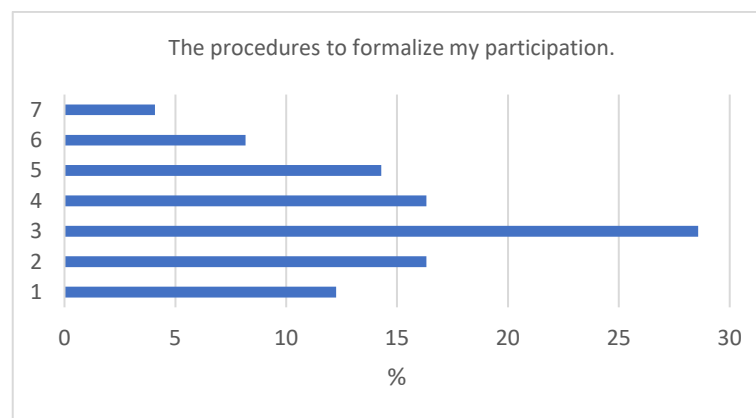


Figure 37. The procedures to participate. Denmark



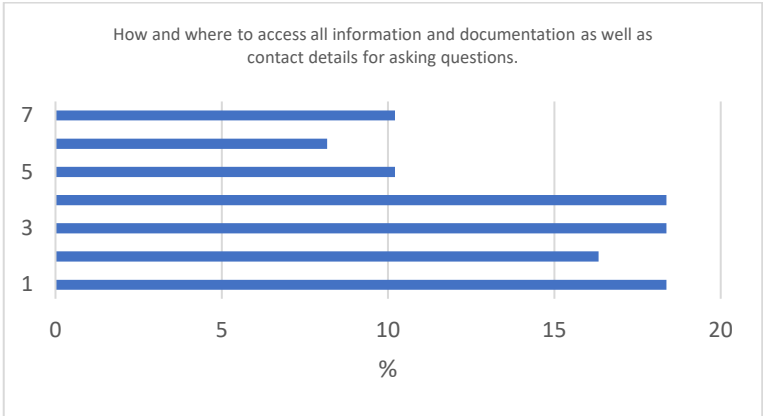


Figure 38. How and when to access the information. Denmark

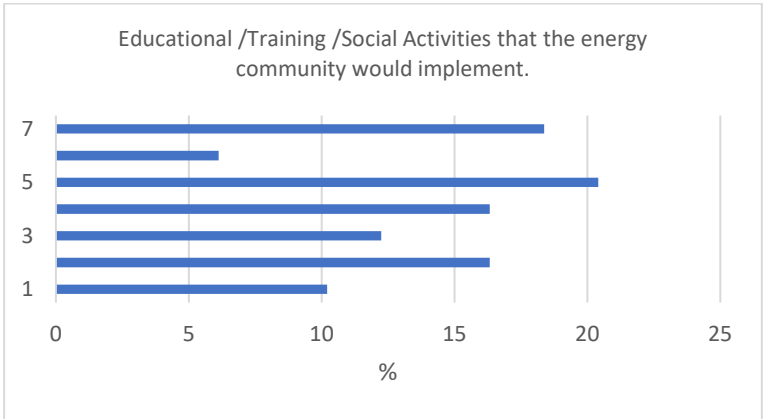


Figure 39. Activities implemented. Denmark

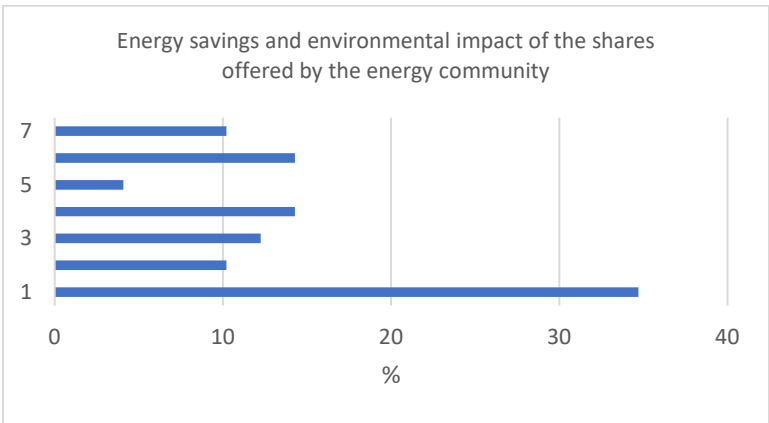


Figure 40. Energy savings and environmental impacts. Denmark



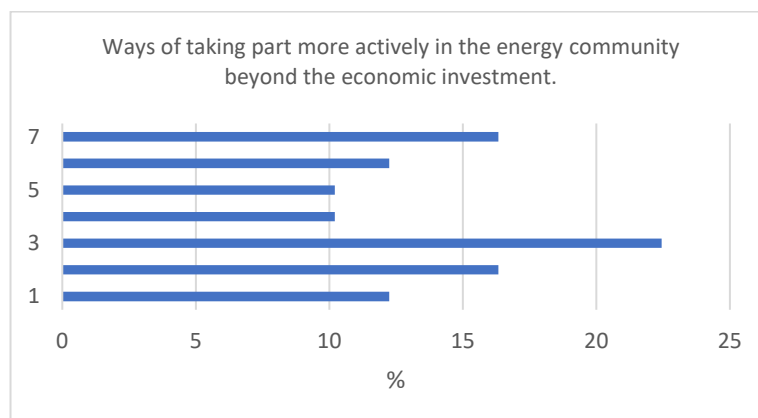


Figure 41. Ways of taking part more actively. Denmark

#### Question 4

*“Considering that an EC should run at least one renewable energy facility, I consider:”*

Figure 42 shows the considerations that people from Aarhus have when investing in the energy facility. 58% of the respondents agreed that the minimum investment is reasonable, 33% could consider higher investments and 8% prefer to donate. None of the respondents selected the “negative” options, so a driver is found in Aarhus when talking about money.

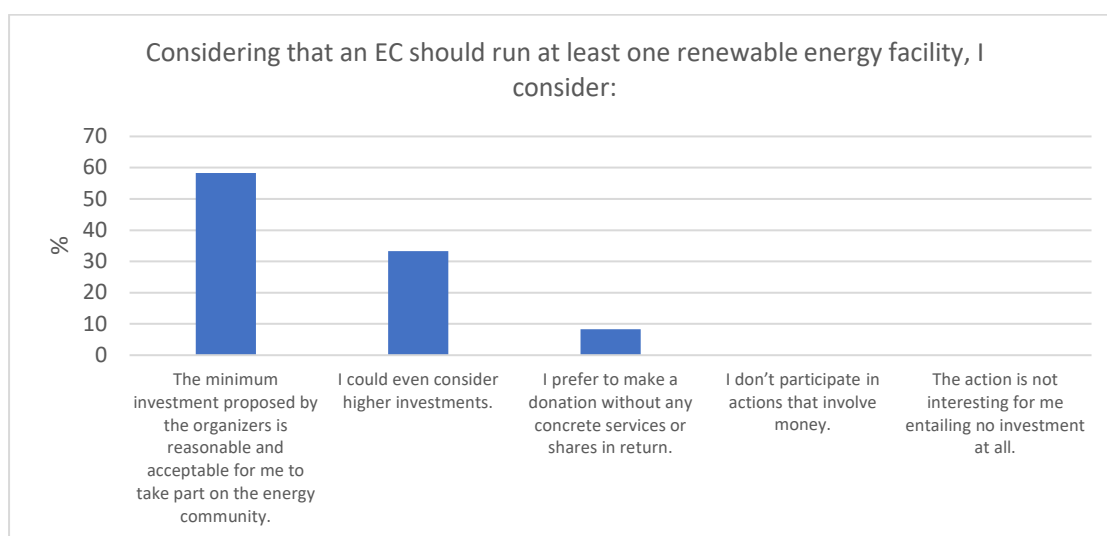


Figure 42. Considerations on the investments. Denmark

#### Question 5

*“For me, it is important that:”*

Analysing Figure 43-47, the following order was found from most to least important:

- 1) The leaders of my community show a strong and continuous support to the initiative as a key action.
- 2) People I trust, such as family or friends, also support the initiative.



- 3) The initiative is led by technical and legal experts to clarify all my doubts now and when the energy community is running.
- 4) I can receive feedback and information sharing from citizens who have previously invested in renewable energy facilities.
- 5) Knowing that the rest of the community members are also joining the initiative.

In Aarhus it is more important that the leaders show support and to have people they trust joining the initiative than to have feedback from people that invested in renewable facilities before or knowing the rest of the community join the initiative.

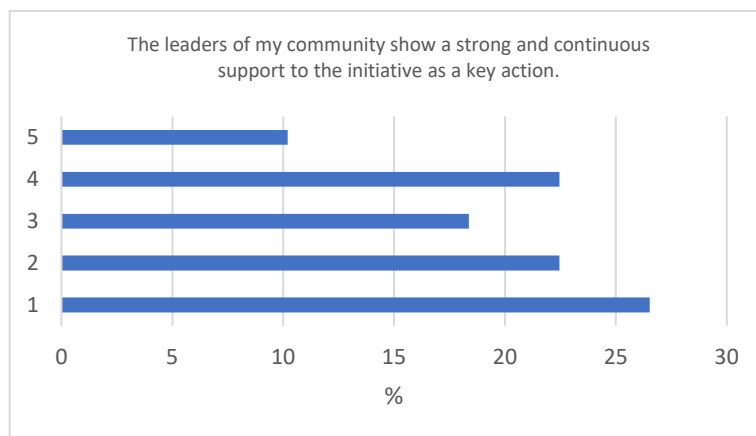


Figure 43. The leaders show strong support. Denmark

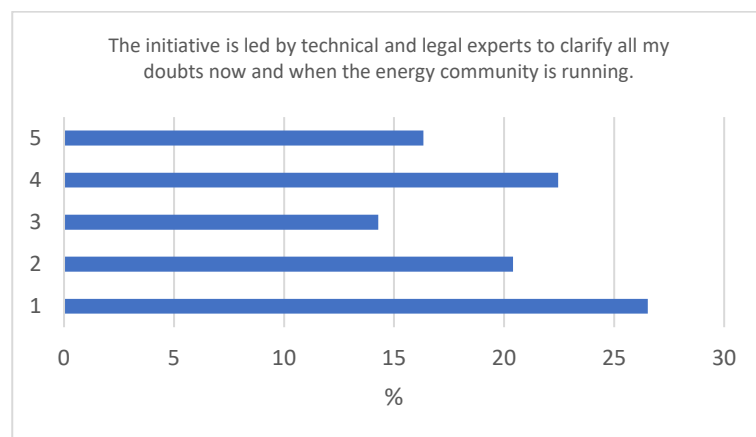


Figure 44. The initiative is led by technical and legal experts. Denmark



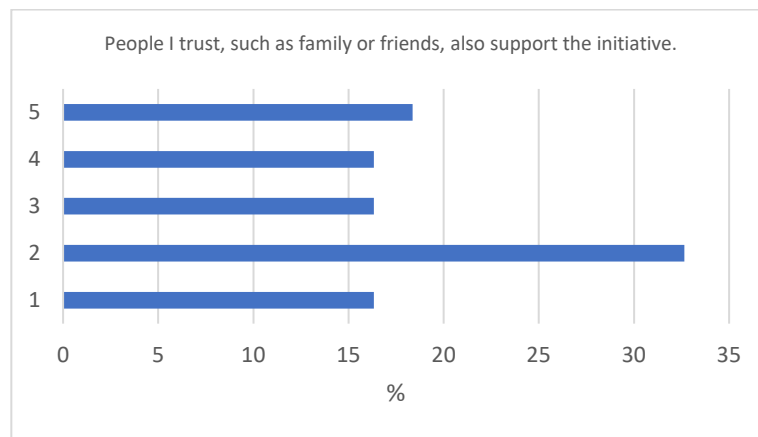


Figure 45. People I trust support the initiative. Denmark

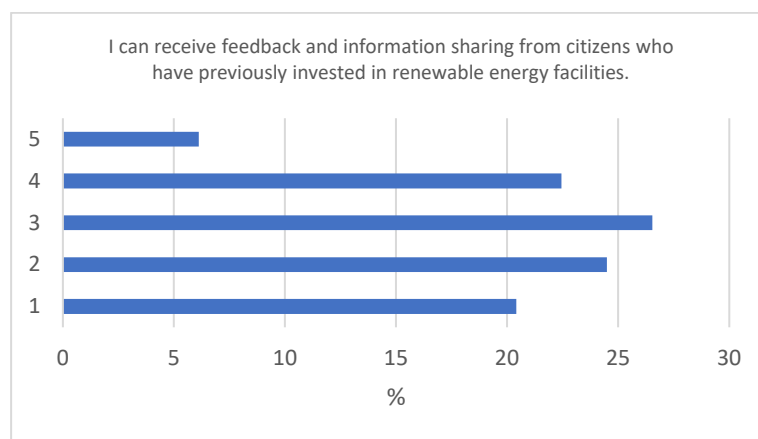


Figure 46. I receive feedback from citizens who previously invested. Denmark

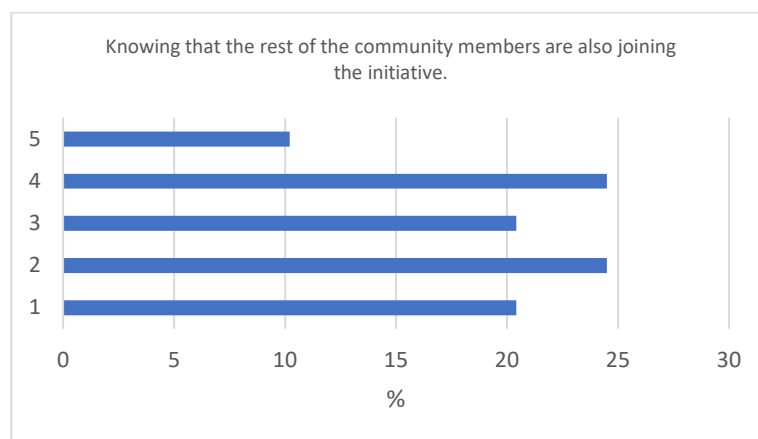


Figure 47. Knowing the rest of the members join the initiative. Denmark

#### Labels for citizens' carbon emissions

"AURORA team is developing a label for citizens' carbon emissions based on energy and commuting behaviour, as illustrated in the image here. By providing data regarding electricity and heating consumption, and commuting patterns, citizens can get a result of which label their carbon emissions entail.





*Then, by taking action through the project (becoming a member of an energy community that produces clean energy, changing his/her mobility patterns) the user can get an updated label."*

#### Questions 6 and 7

*"What do you think of the labels? Other comments to this label."*

According to Figure 48, 45% would consider providing their data, 31% of the respondents consider that using the label is interesting but they won't use it, and 21% really want to use the label and know to which level they belong. 2% see the label as a terrible idea and don't recommend it. At this point, in Aarhus we can see that the use of the label may be a barrier to some of the respondents because when using it, they don't seem to be comfortable with it. However, the comments received about the label are all positives and suggestions (see Table 3).

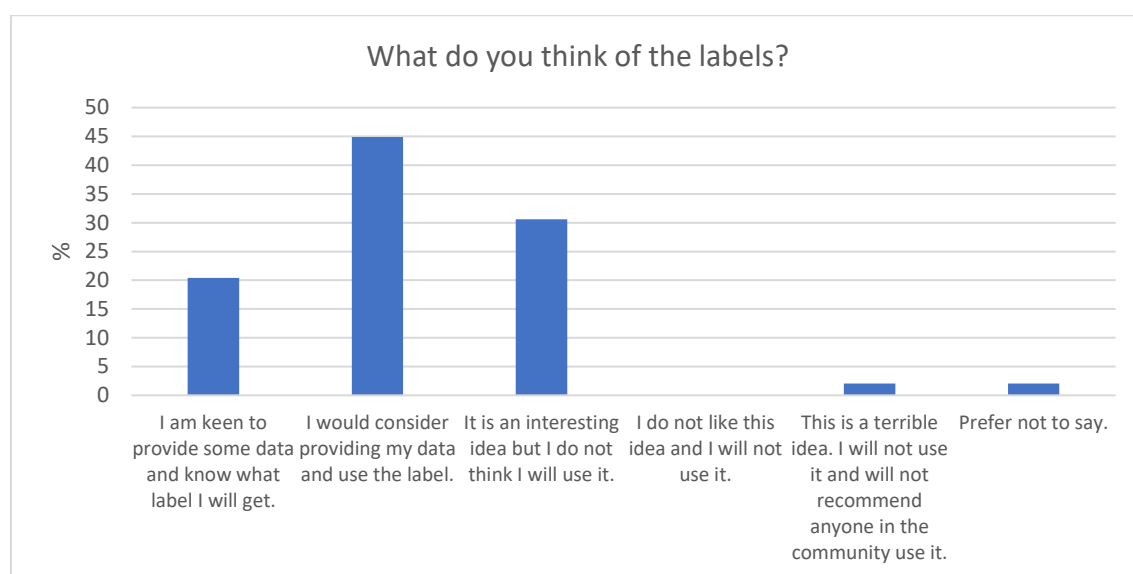


Figure 48. Feedback about the label. Denmark

Table 5. Comments about the label. Denmark

Feedback	Classification
If it provides an easy opportunity for people to improve their habits, it will be perfect.	+
Looks similar to the energy-efficiency labels on refrigerators etc. This may be an advantage because it is immediately recognizable, but it may also confuse some people, because it is a somewhat different measure (carbon emissions, rather than just energy-use).	+
Very exciting initiative. Would be great if the marks were available and possibly could be displayed through the app as documentation when i.e., buying things (petrol) and it is somehow linked to your credit card, so that your score/mark is updated "live" based on what you buy and what you do.	+, *
Is there really that much difference between categories 1, 2, 3? I don't know. Why is "Zero" < 2178 kg CO <sub>2</sub> ? It is also hard for me to say "yay, I'm category 1", I am not sure if there is any meaning attached there.	?
Maybe if the label comes with a few suggestions to which actions have the biggest impact to further reduce. A label alone will probably not mean very much	*
Good initiative!	+



## About myself

### Question 8

*"My potential participation in AURORA will be by:"*

Danish people will participate in AURORA (Figure 49) by investing in the community (27%), supporting research studies (23%), being trained on energy aspects (11%), following the project externally (11%) and volunteering (11%). 5% of the respondents are interested but not sure of participating.

This information shows that in Aarhus people are open to invest in the EC and to support research studies by providing data; those are drivers that make people want to participate in the project.

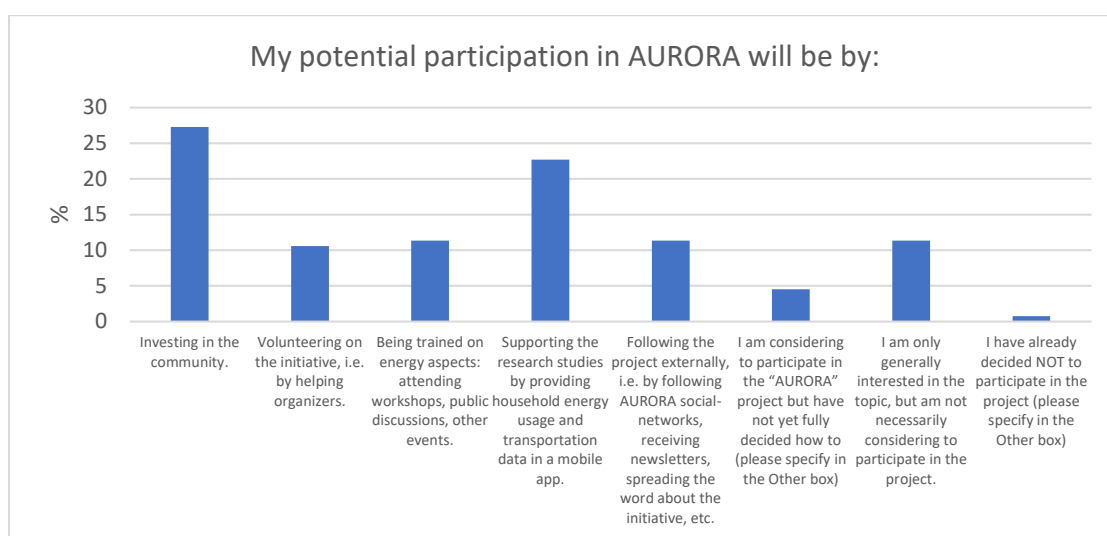


Figure 49. How respondents will participate in AURORA. Denmark

### Questions 9, 10 and 11

*"Age, gender and highest educational level:"*

Most of the respondents (53%) belong to the group of 18-25 years old and 26-30 (23%) (Figure 50). The respondents are mostly men (76%) (Figure 51). And finally, from Figure 52 we can see that 29% have a high school diploma, 27% are currently studying, 25% have a postgraduate degree and 21% have a college degree.

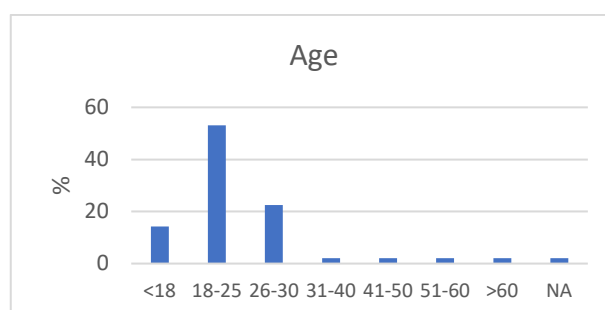


Figure 50. Age of the respondents. Denmark



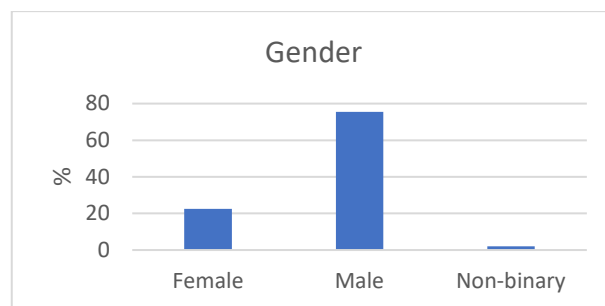


Figure 51. Gender. Denmark

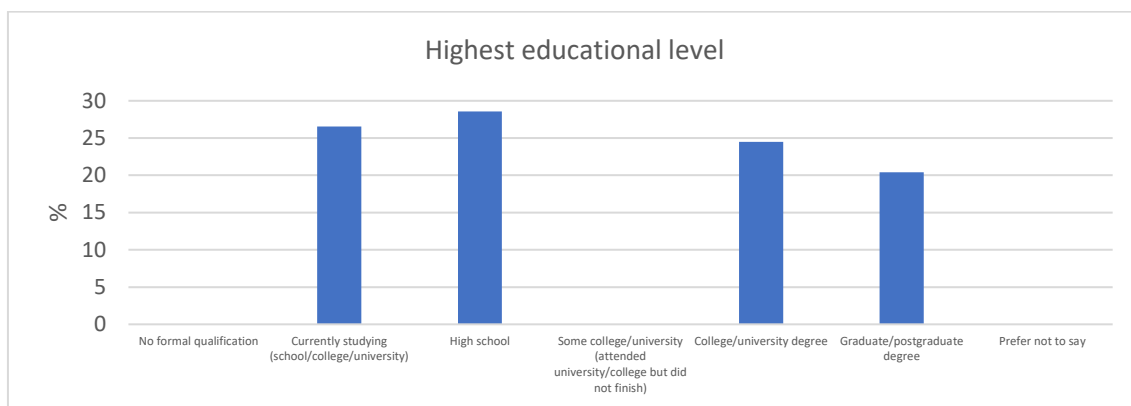


Figure 52. Highest formal qualification of the respondents. Denmark

## 2.2.3 PORTUGAL

### *Contributing to the energy transition*

#### Question 1

*“Considering the option of contributing to the energy transition in my University/in my neighbourhood and contributing to reach the 2030 climate targets sooner, I consider:”*

As shown in Figure 53, 75% of the respondents from Portugal see themselves as co-responsible and part of the solution of the energy transition, so Portuguese people are conscious about it.

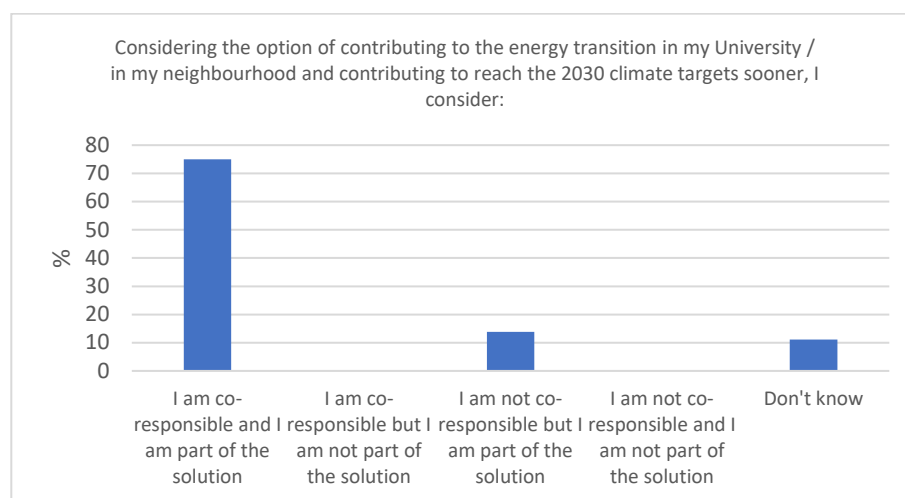


Figure 53. Contribution to the energy transition. Portugal

### Energy communities

*“An Energy community (EC) allows citizens to invest in the community-owned energy system infrastructures, which will be used to provide part of or all of the energy usage in the community.”*

### Question 2

*“Energy communities (ECs) are a new instrument to incentivise citizens' participation in the energy system. According to my own criteria, I would prioritise:“*

In order of importance (from most to least) these are the priorities for people in Évora when participating in the project (Figure 54-60):

- 1) Provide environmental benefits to the community, i.e. reducing the carbon emissions of the local area.
- 2) Provide social benefits to the community, i.e. contributing to fight against energy poverty, use the installations to feed cheaper electric charging points for citizens, reduce the cost of electricity bills for public institutions and use savings for encouraging other social actions, etc.
- 3) Provide a way for me to act in my community according to my values.
- 4) Provide a way for me to challenge the rules of the traditional electricity system and take part in new initiatives.
- 5) Foster social identity of the community where the EC's members are coming from while increasing networking.
- 6) Provide non-monetary benefits to the investment done by EC's members: first-hand knowledge on energy aspects, return on investment through local coupons or discounts, etc.
- 7) Provide monetary return on investment done by EC's members.

In Évora, it is more important the environmental and social benefits and to act in the community according to their own values than to provide monetary and non-monetary return on the investments.

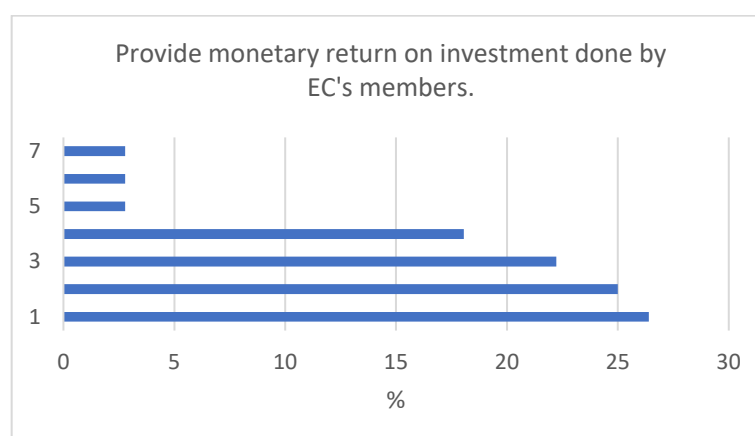


Figure 54. Provide monetary return. Portugal



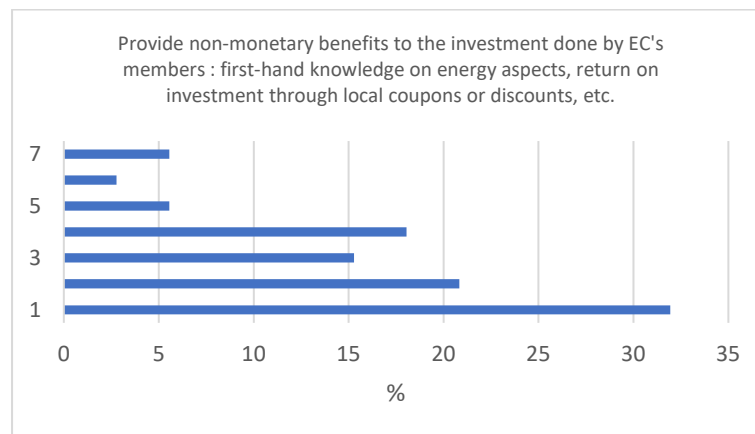


Figure 55. Provide non-monetary return. Portugal

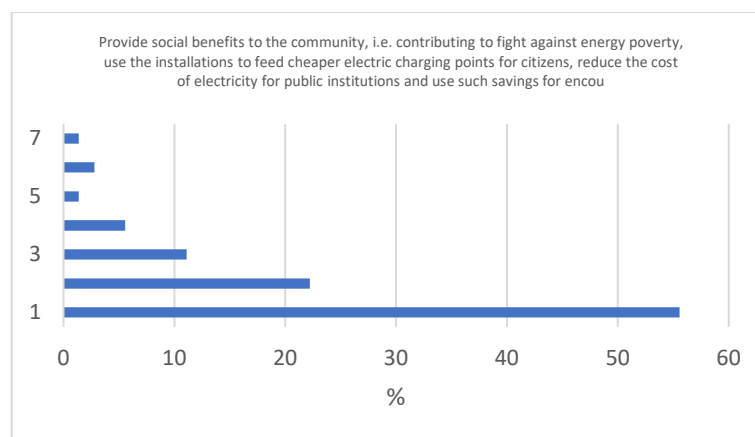


Figure 56. Provide social benefits. Portugal

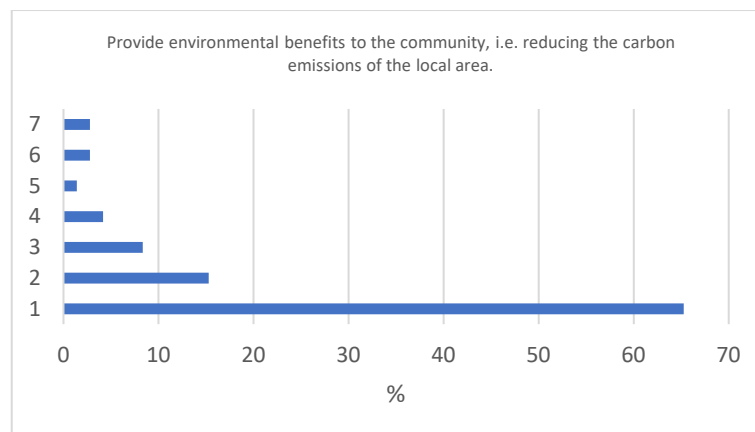


Figure 57. Provide environmental benefits. Portugal



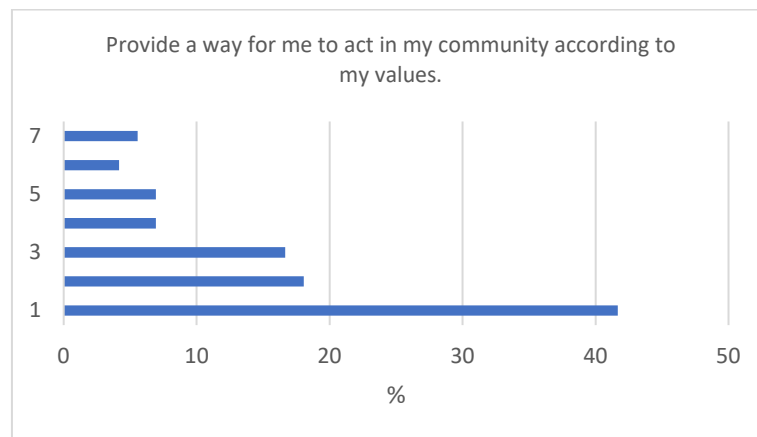


Figure 58. Provide for me to act in my community. Portugal

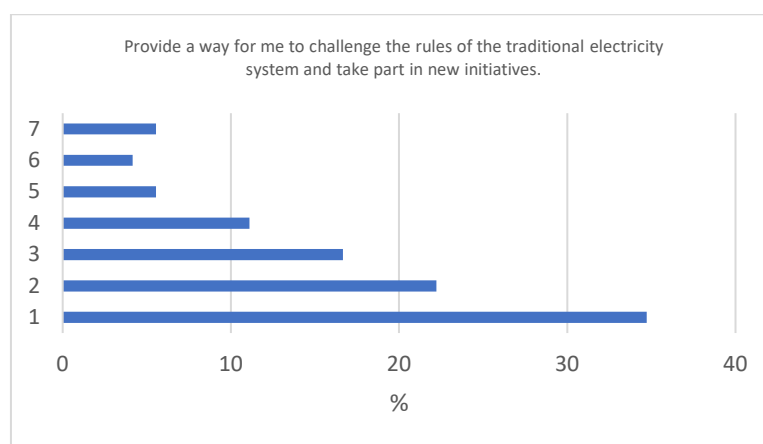


Figure 59. Provide a way for me to challenge the rules. Portugal

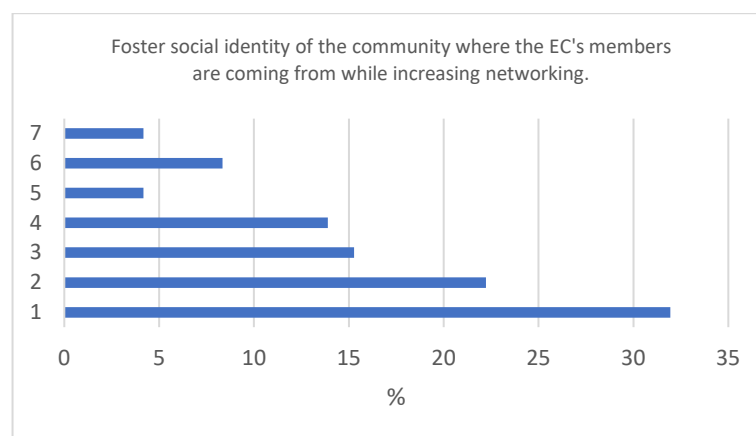


Figure 60. Foster social identity. Portugal

### Question 3

*"To consider joining a local energy community, I would need to know beforehand:"*

As done in Question 2, what people from Portugal want to know to consider their participation on the EC (Figure 61-67) is ordered in the following lines:



- 1) Legal implications of my participation, e.g. my legal responsibilities as a member of an EC.
- 2) How and where to access all information and documentation as well as contact details for asking questions.
- 3) Energy savings and environmental impact of the shares offered by the energy community.
- 4) The procedures to formalize my participation.
- 5) Financial implications of my participation, e.g. return on investment.
- 6) Ways of taking part more actively in the energy community beyond economic investment.
- 7) Educational /Training /Social Activities that the energy community would implement.

Portuguese respondents find it more important to know the legal implications and how to access the information more than knowing the different activities that would be implemented or how to take part in the EC.

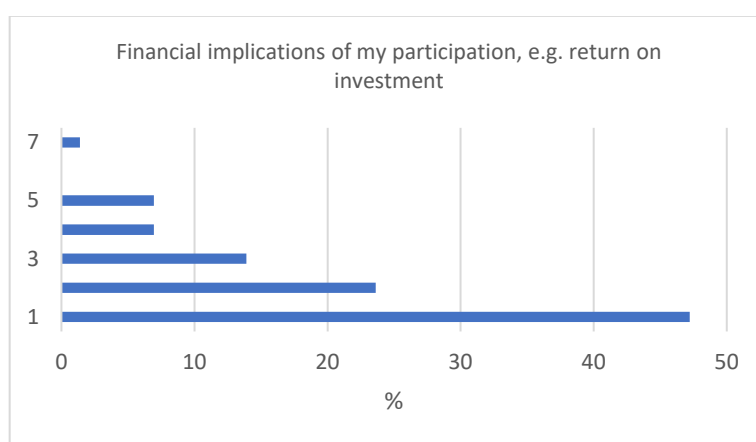


Figure 61. Financial implications. Portugal

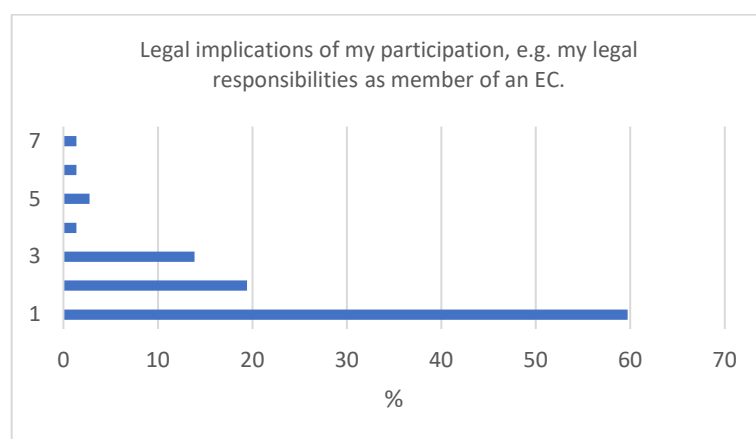


Figure 62. Legal implications. Portugal





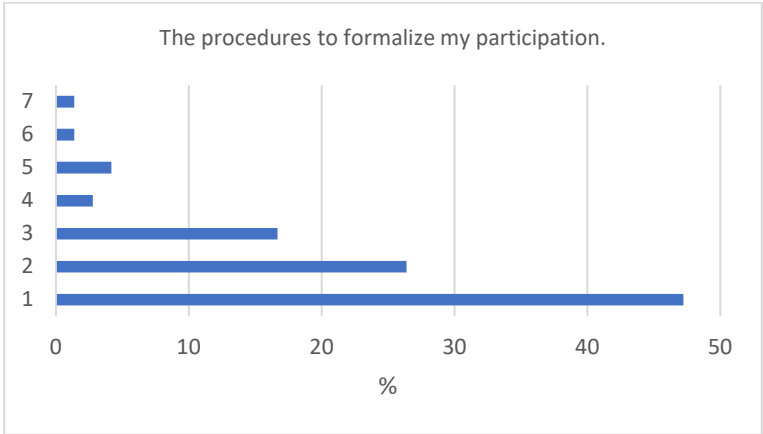


Figure 63. The procedures to participate. Portugal

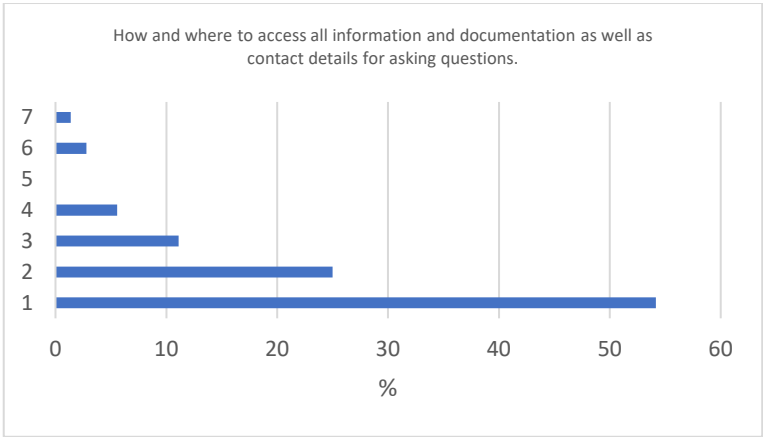


Figure 64. How and when to access the information. Portugal

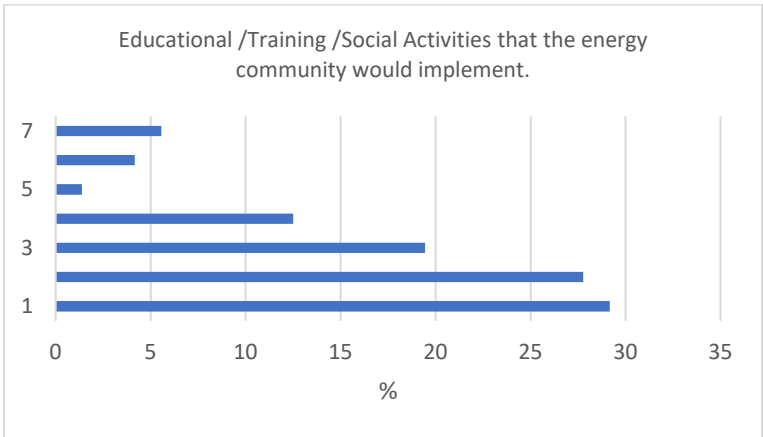


Figure 65. Activities implemented. Portugal



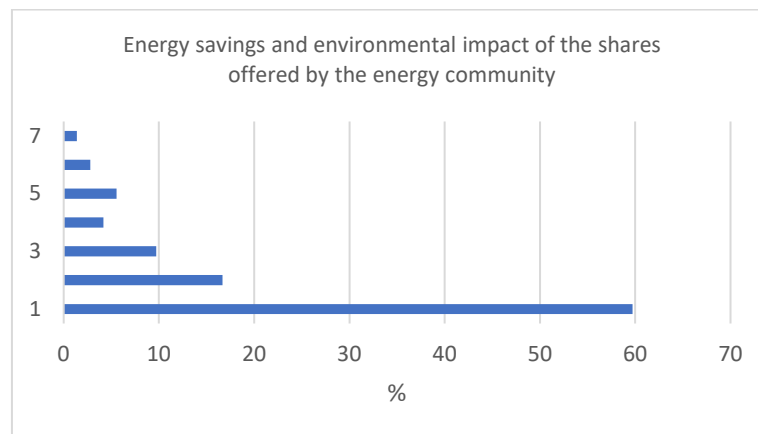


Figure 66. Energy savings and environmental impacts. Portugal

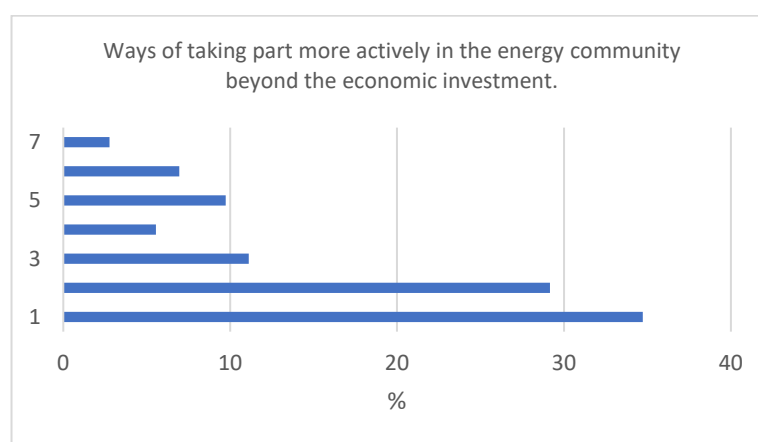


Figure 67. Ways of taking part more actively. Portugal

#### Question 4

*“Considering that an EC should run at least one renewable energy facility, I consider:”*

From Évora (Figure 68), 68% of the respondents find the minimum investment acceptable for participating in the EC and 15% could invest higher amounts of money. On the other hand, 8% of the respondents won't participate if the initiative involves money and another 7% is not interested, so 15% of the Portuguese respondents aren't willing to participate.



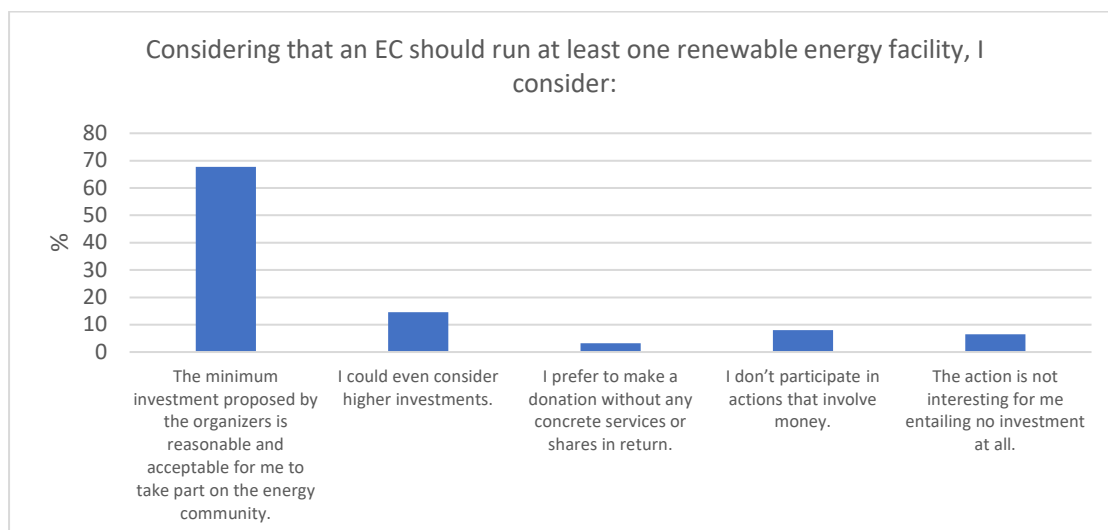


Figure 68. Considerations on the investments. Portugal

### Question 5

*"For me, it is important that:"*

The following order is found when asking Portuguese respondents what they find important to join the EC (Figure 69-73).

- 1) The initiative is led by technical and legal experts to clarify all my doubts now and when the energy community is running.
- 2) The leaders of my community show a strong and continuous support to the initiative as a key action.
- 3) I can receive feedback and information sharing from citizens who have previously invested in renewable energy facilities.
- 4) Knowing that the rest of the community members are also joining the initiative.
- 5) People I trust, such as family or friends, also support the initiative.

Technical and legal experts leading the EC is the most important Portugal respondents find when joining an EC project and that the leaders show strong support to the initiative. While if people they trust support the initiative seems to be not important.

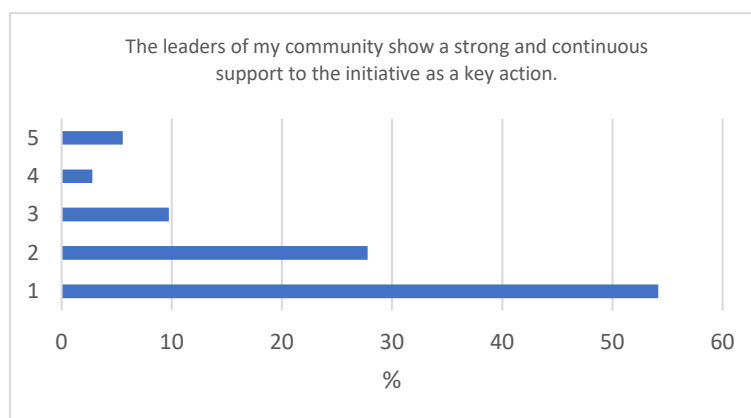


Figure 69. The leaders show strong support. Portugal

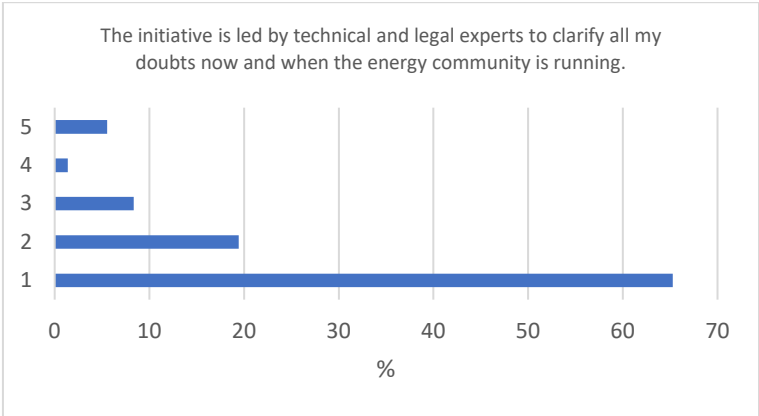


Figure 70. The initiative is led by technical and legal experts. Portugal

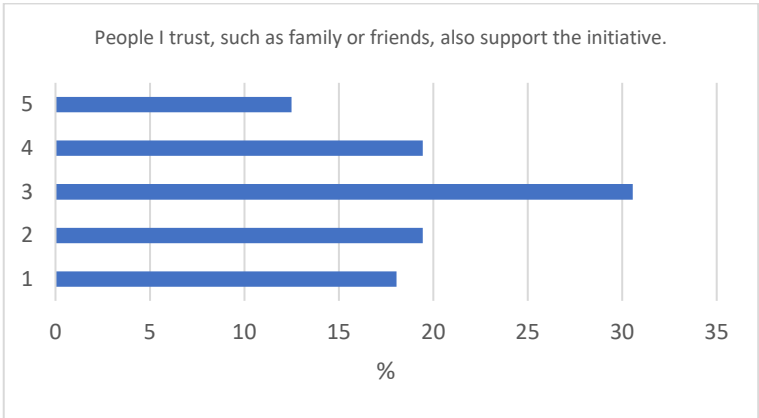


Figure 71. People I trust support the initiative. Portugal

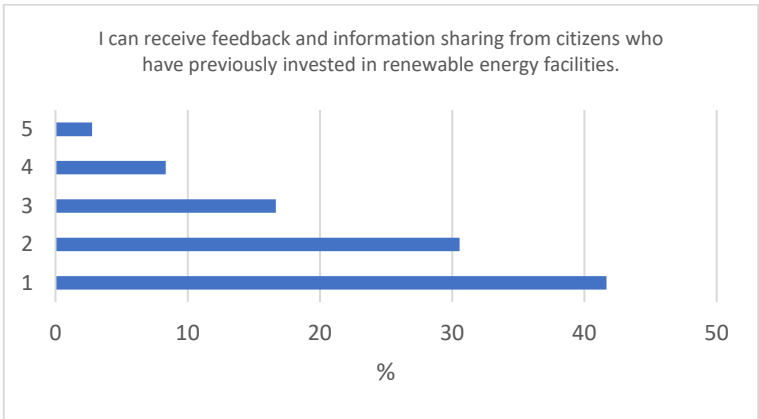


Figure 72. I receive feedback from citizens who previously invested. Portugal

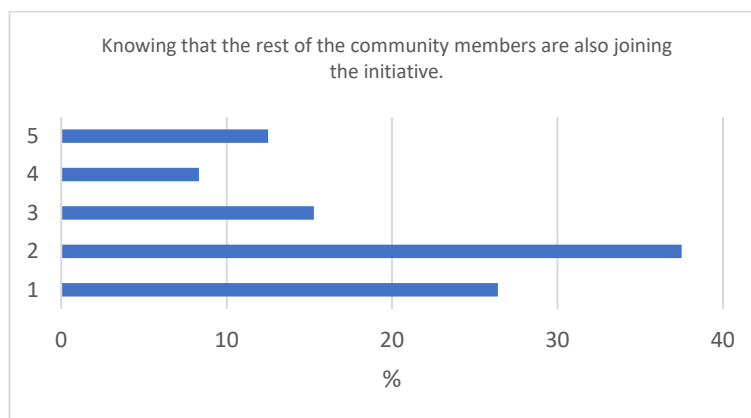


Figure 73. Knowing the rest of the members join the initiative. Portugal

#### Labels for citizens' carbon emissions

*"AURORA team is developing a label for citizens' carbon emissions based on energy and commuting behaviour, as illustrated in the image here. By providing data regarding electricity and heating consumption, and commuting patterns, citizens can get a result of which label their carbon emissions entail.*

*Then, by taking action through the project (becoming a member of an energy community that produces clean energy, changing his/her mobility patterns) the user can get an updated label."*

#### Questions 6 and 7

*"What do you think of the labels? Other comments to this label."*

Figure 74 shows the opinion on the label from Portuguese respondents. 44% of them are keen to provide data and 32% would consider doing it. 17% think it's interesting but don't consider using it. From this information we can conclude that people from Portugal really want to use the label. However, the comments received about the label (Table 4) are mostly negative, and some of them are also suggestions.

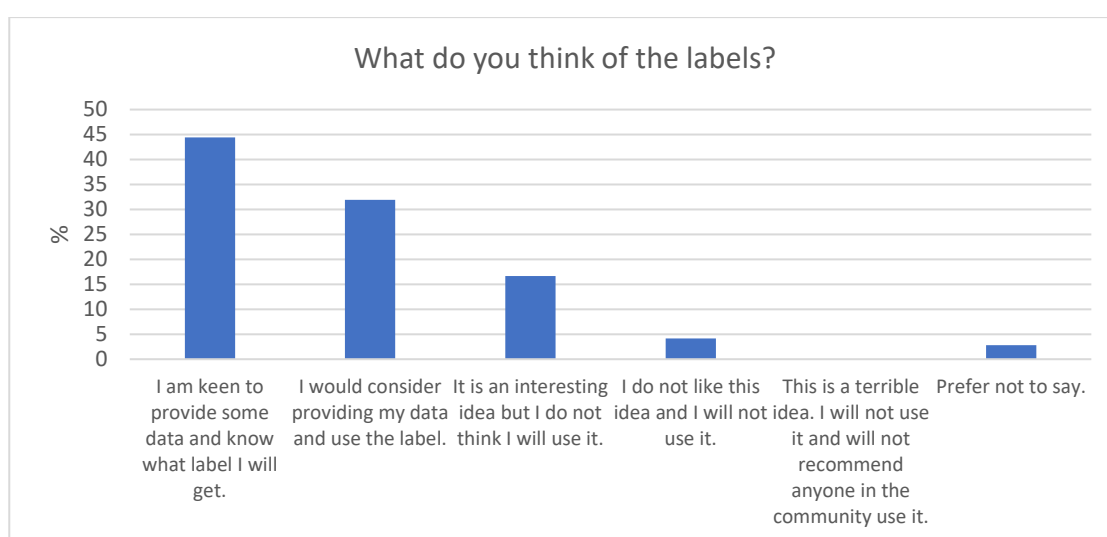


Figure 74. Feedback about the label. Portugal



Table 6. Comments about the label. Portugal

Feedback	Classification
Interesting but potentially discriminating since it is nominal.	-
It may not be very effective	-
Confused by the kWh figures	?
Insert a QR CODE that directs to an online environment with more details of the AURORA action.	*
Will they be public?	?
What would interest me is to contribute to the community through the installation that I have in my house, 10 kW, in order to allow the use of the surplus produced by me in the community and using the surplus of others when necessary. This is the logic of "community". Labels are a service logic where we join a community but are not really part of it.	*
It is part of our daily life	+
Too complex for the average citizen to understand, especially those most in need. Relatively disorganised and difficult to read.	-
I would prefer a more enlightening explanation of the purposes of the label	?
Real feedback should be given to consumers. I am tired of the "pats on the back" and the "well done, you look after the good of us all".	*
Somewhat confusing, with the 2 levels on the first two labels. No need to imitate the presentation of the appliance consumption labels.	-

## About myself

### Question 8

*"My potential participation in AURORA will be by:"*

Analysing this question in the case of Portugal, the findings show (Figure 75) that 21% of the respondents want to support research studies, 19% will follow the project externally, 18% want to invest in the community, 16% want to be trained on energy aspects and 15% want to volunteer on the initiative. Finally, 10% of the respondents are considering participating but are not fully decided yet.

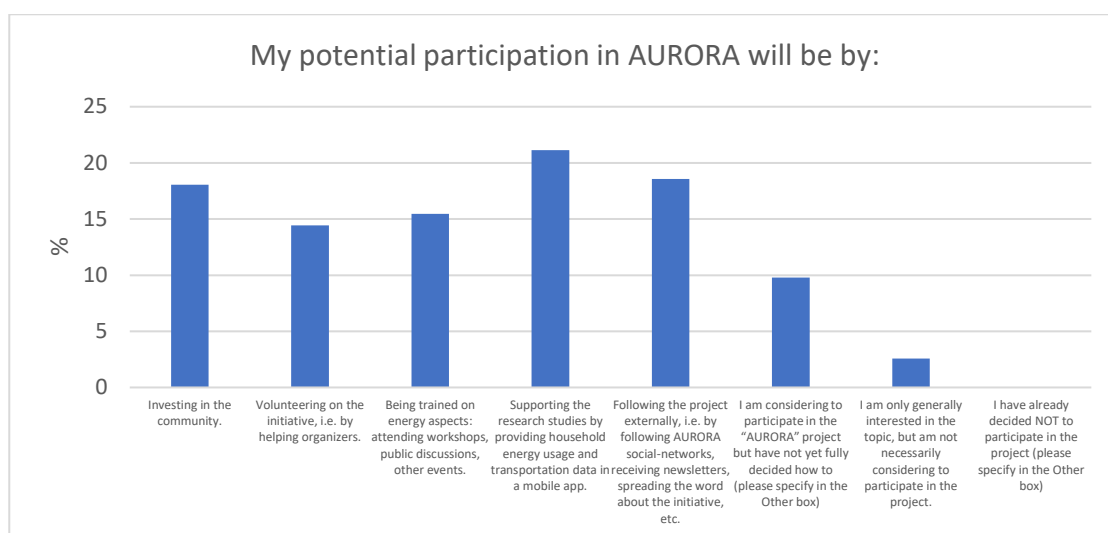


Figure 75. How respondents will participate in AURORA. Portugal

### Questions 9, 10 and 11

*"Age, gender and highest educational level:"*



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101036418.

Finally, personal data is asked. People from the Évora demo-site belong mostly (31%) to 18-25 years old group and 51-60 group (24%), according to Figure 76. Figure 77 shows the respondents are males in their majority (58%). When analysing the highest level of studies (Figure 78), 56% have a postgraduate degree and 21% are currently studying.

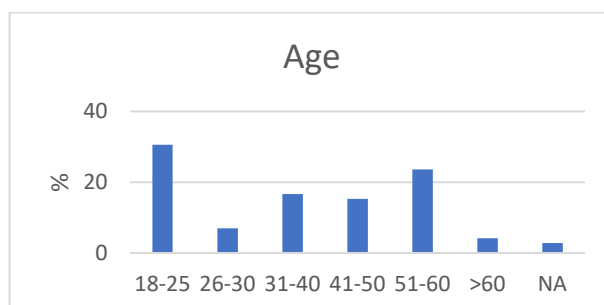


Figure 76. Age of the respondents. Portugal

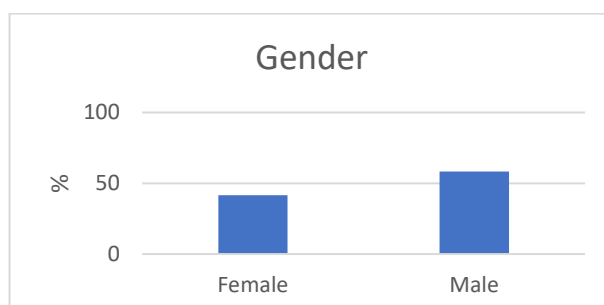


Figure 77. Gender. Portugal

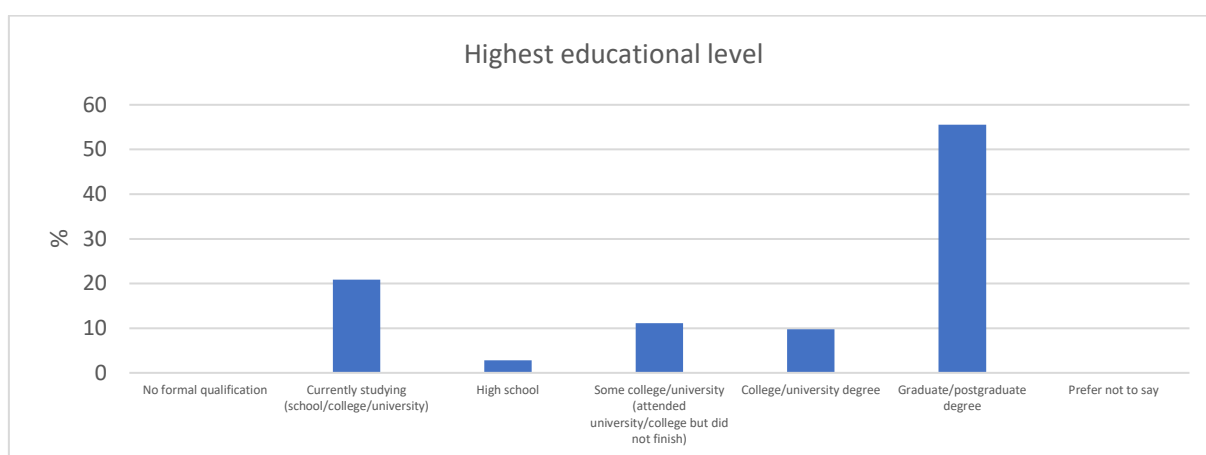


Figure 78. Highest formal qualification of the respondents. Portugal

## 2.2.4 SLOVENIA

### *Contributing to the energy transition*

#### Question 1

*“Considering the option of contributing to the energy transition in my University/in my neighbourhood and contributing to reach the 2030 climate targets sooner, I consider:”*



Figure 79 shows how people from Slovenia consider their contribution to the energy transition. 38% of the respondents feel responsible and part of the solution while 31% feel responsible but not part of the solution and another 31% don't feel responsible but see themselves as part of the solution. As can be seen, there is a variety of answers where the Slovenian community recognize themselves as responsible and not responsible, part of the solution and not part of the solution, but in general, they don't feel both co-responsible and part of the solution, the majority of the respondents don't consider that they belong to one part of the question: they are co-responsible but not part of the solution or part of the solution but not co-responsible.

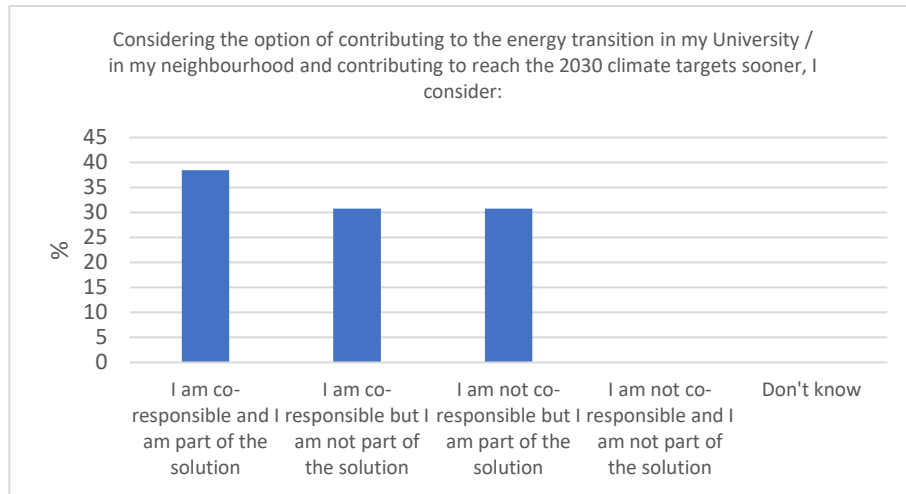


Figure 79. Contribution to the energy transition. Slovenia

### Energy communities

*“An Energy community (EC) allows citizens to invest in the community-owned energy system infrastructures, which will be used to provide part of or all of the energy usage in the community.”*

### Question 2

*“Energy communities (ECs) are a new instrument to incentivise citizens' participation in the energy system. According to my own criteria, I would prioritise:”*

The priorities for Slovenian when participating in an EC, according to Figure 80-86 are the following ones (1 most important, 7 least important):

- 1) Provide environmental benefits to the community, i.e. reducing the carbon emissions of the local area.
- 2) Provide non-monetary benefits to the investment done by EC's members: first-hand knowledge on energy aspects, return on investment through local coupons or discounts, etc.
- 3) Provide a way for me to challenge the rules of the traditional electricity system and take part in new initiatives.
- 4) Provide a way for me to act in my community according to my values.
- 5) Provide monetary return on investment done by EC's members.
- 6) Provide social benefits to the community, i.e. contributing to fight against energy poverty, use the installations to feed cheaper electric charging points for citizens, reduce the cost





of electricity for public institutions and use such savings for encouraging other social actions, etc.

- 7) Foster social identity of the community where the EC's members are coming from while increasing networking.

A variety of answers were found, because, as can be seen in Figures 80-86, Slovenian people find important to provide environmental benefits and non-monetary return while to provide social benefits and to foster social identity are not important.

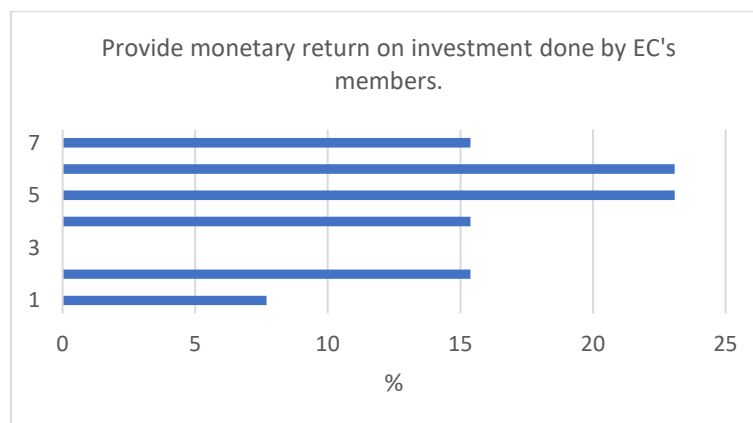


Figure 80. Provide monetary return. Slovenia

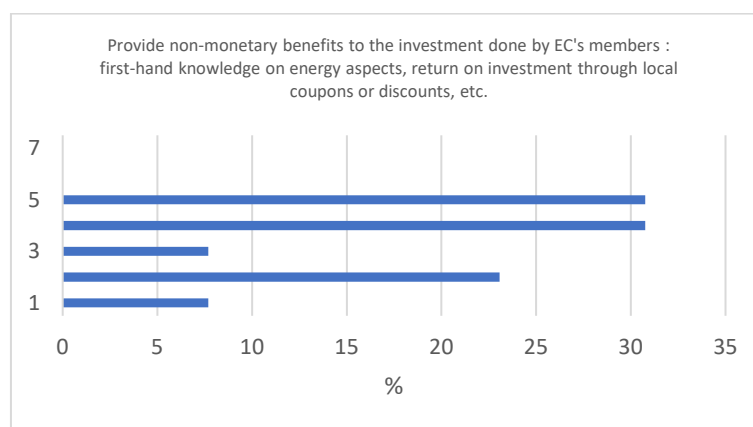


Figure 81. Provide non-monetary return. Slovenia



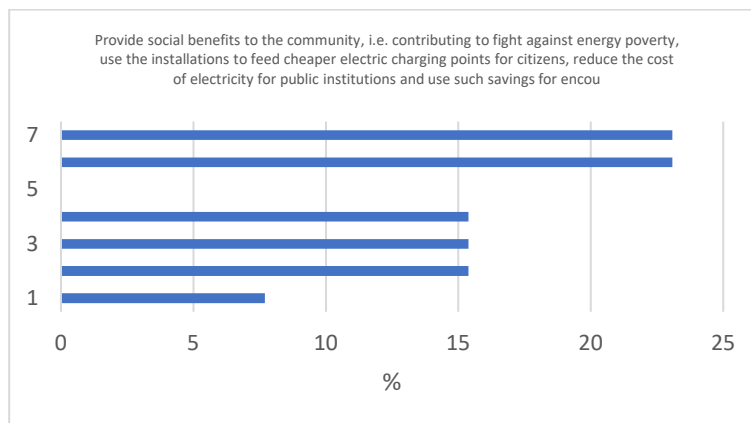


Figure 82. Provide social benefits. Slovenia

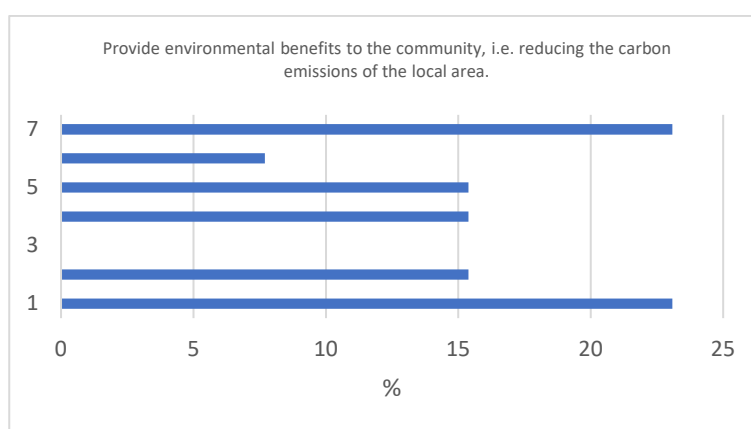


Figure 83. Provide environmental benefits. Slovenia

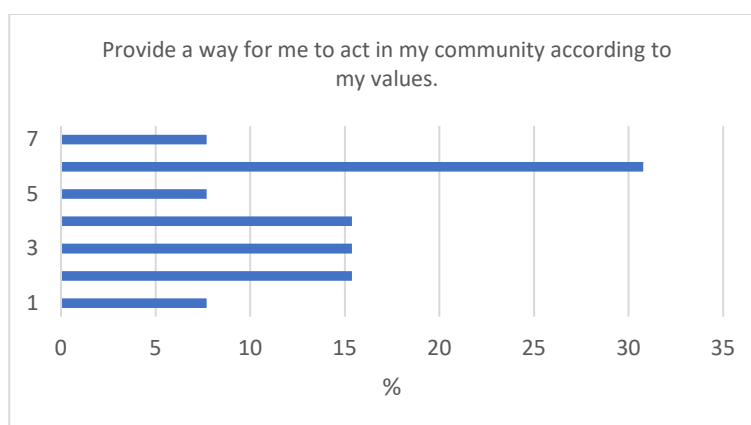


Figure 84. Provide for me to act in my community. Slovenia



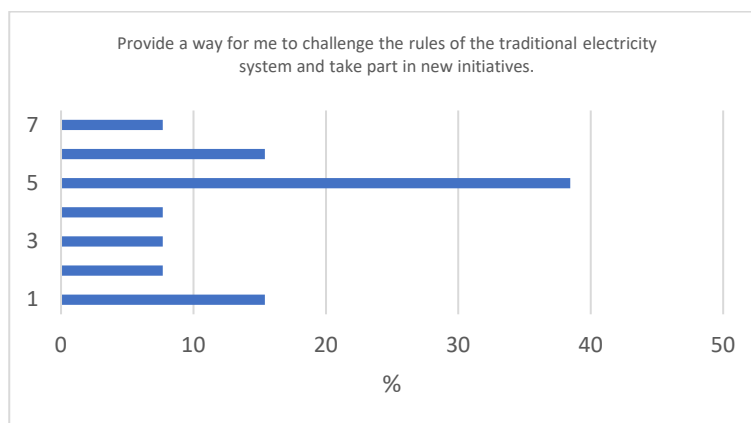


Figure 85. Provide a way for me to challenge the rules. Slovenia

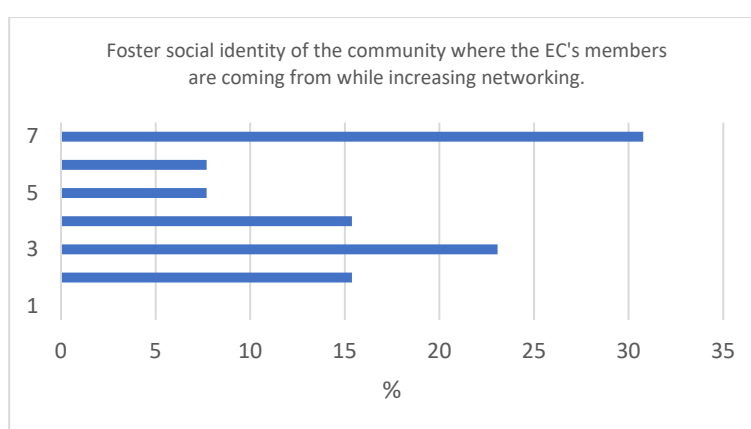


Figure 86. Foster social identity. Slovenia

### Question 3

*"To consider joining a local energy community, I would need to know beforehand:"*

As done with Question 2, the following order is found when analysing what Slovenian respondents would know to join an EC (Figure 87-93):

- 1) Financial implications of my participation, e.g. return on investment.
- 2) The procedures to formalize my participation.
- 3) How and where to access all information and documentation as well as contact details for asking questions.
- 4) Energy savings and environmental impact of the shares offered by the energy community.
- 5) Legal implications of my participation, e.g. my legal responsibilities as a member of an EC.
- 6) Educational /Training /Social Activities that the energy community would implement.
- 7) Ways of taking part more actively in the energy community beyond the economic investment.

As happened in Question 2, the distribution of the answers is notable. Respondents from Slovenia find it more important to know the financial implications and which are the procedures to formalize their participation than to know the activities that would be implemented and how to be more active in the EC.



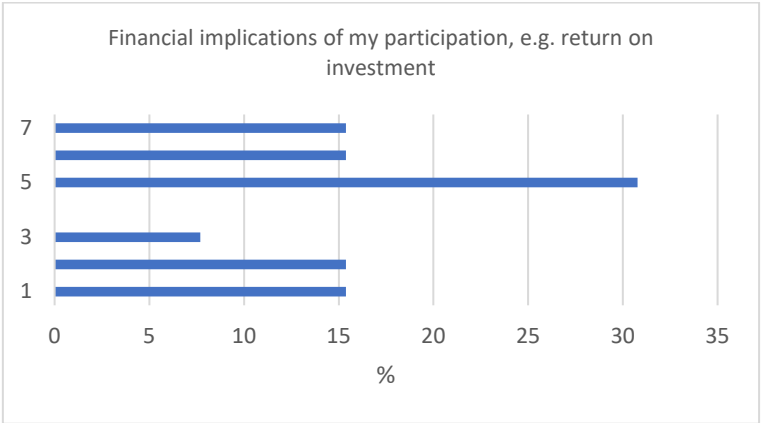


Figure 87. Financial implications. Slovenia

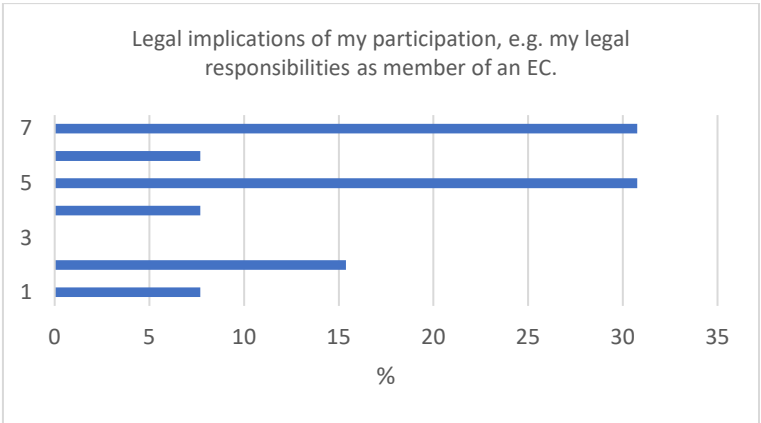


Figure 88. Legal implications. Slovenia

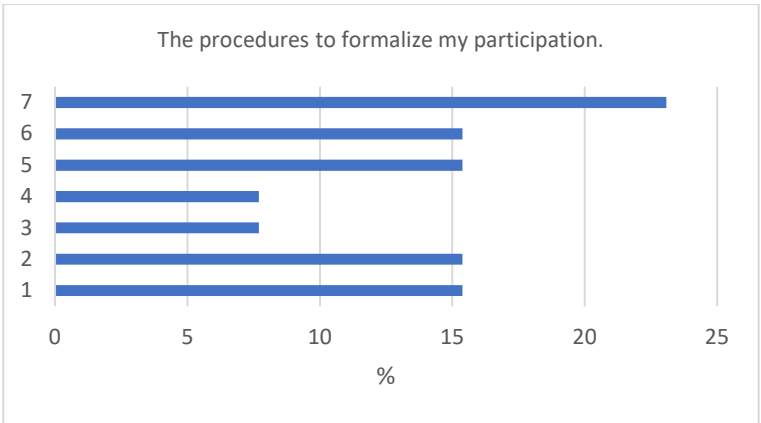


Figure 89. The procedures to participate. Slovenia



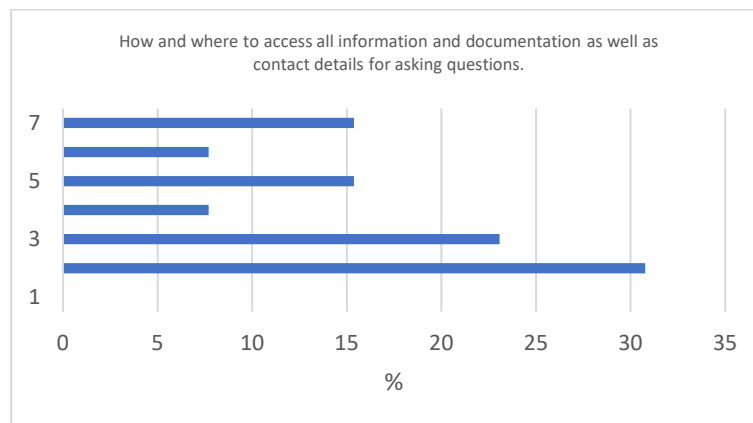


Figure 90. How and when to access the information. Slovenia

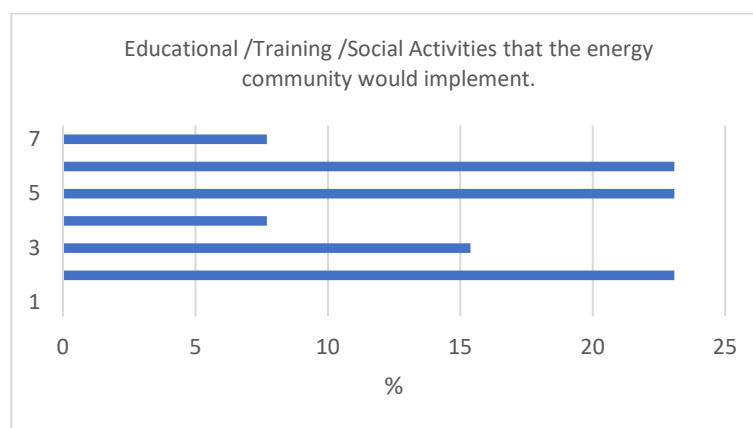


Figure 91. Activities implemented. Slovenia

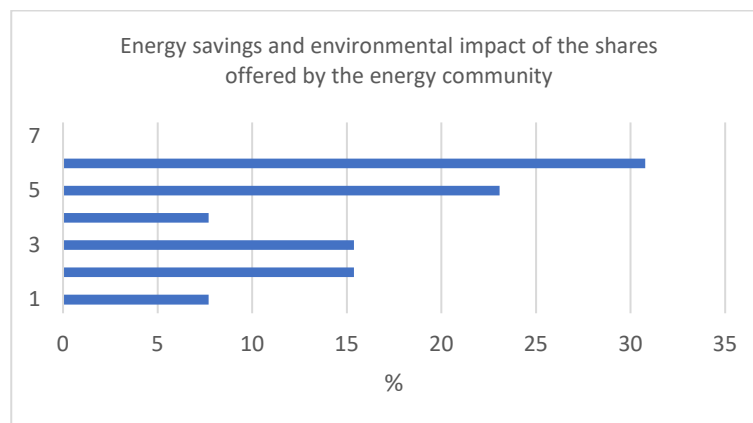


Figure 92. Energy savings and environmental impacts. Slovenia



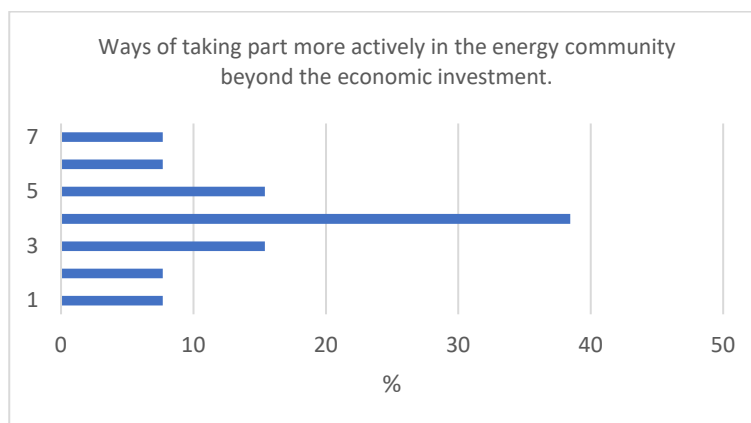


Figure 93. Ways of taking part more actively. Slovenia

#### Question 4

*“Considering that an EC should run at least one renewable energy facility, I consider:”*

According to Figure 94, the minimum investment for 69% of the Slovenian respondents is reasonable to participate on the EC and the rest of the respondents could consider higher amounts of money. We can draw a conclusion based on this information that Slovenian people want to invest in the EC and this is a driver, because none of them seem to have doubts about this monetary question.

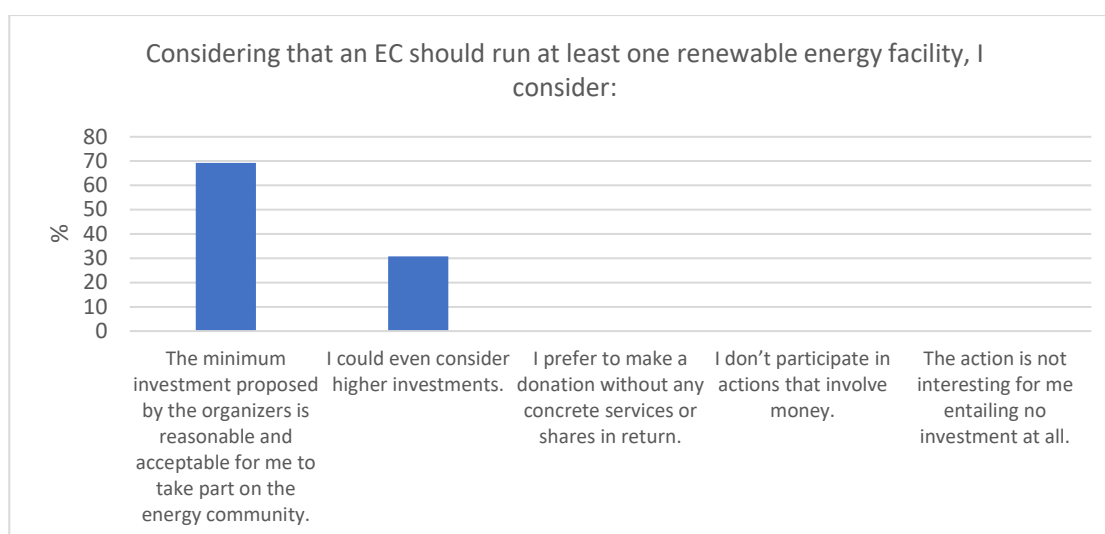


Figure 94. Considerations on the investments. Slovenia

#### Question 5

*“For me, it is important that:”*

Based on the information from Figure 95-99, people from Ljubljana find, from most to least important, the following aspects:

- 1) People I trust, such as family or friends, also support the initiative.
- 2) The initiative is led by technical and legal experts to clarify all my doubts now and when the energy community is running.



- 3) I can receive feedback and information sharing from citizens who have previously invested in renewable energy facilities.
- 4) The leaders of my community show a strong and continuous support to the initiative as a key action.
- 5) Knowing that the rest of the community members are also joining the initiative.

As it was found in Question 2 and 3, the distribution of the answers when ranking is varied. It is not clear for Slovenian respondents to find any of the answers as important. But there are some differences with other countries because it seems that, in this case, to have trusting people supporting the initiative is important and, on the other hand, the leaders showing support is not important for them.

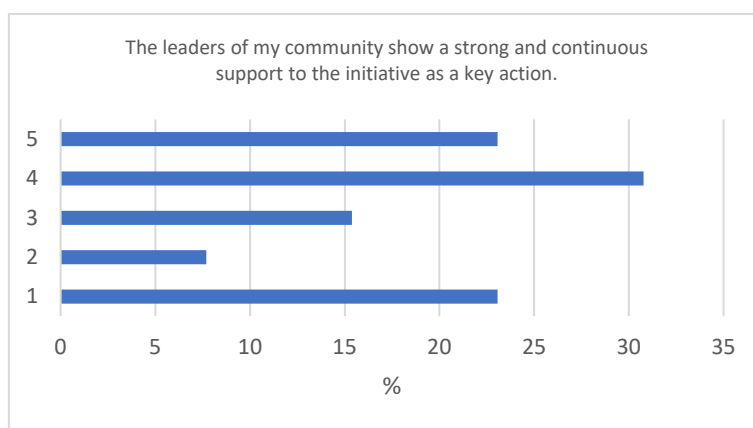


Figure 95. The leaders show strong support. Slovenia

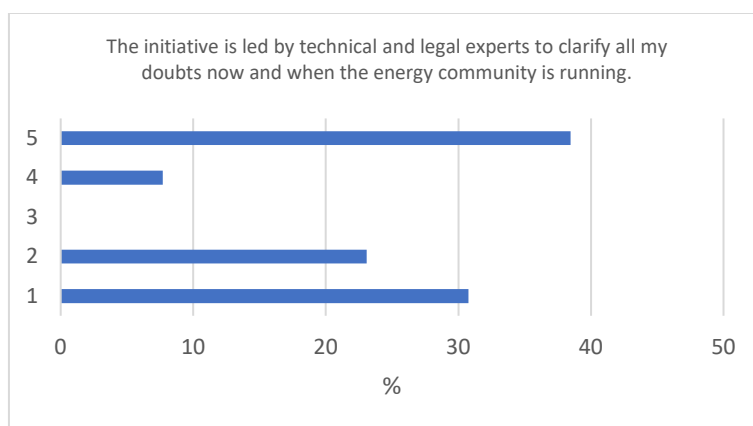


Figure 96. The initiative is led by technical and legal experts. Slovenia



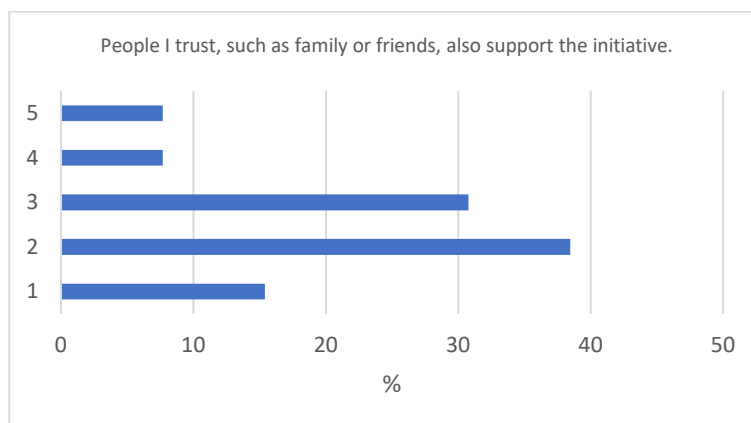


Figure 97. People I trust support the initiative. Slovenia

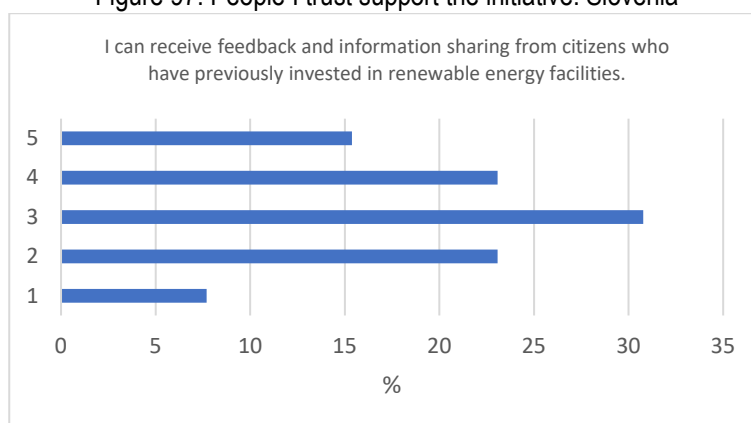


Figure 98. I receive feedback from citizens who previously invested. Slovenia

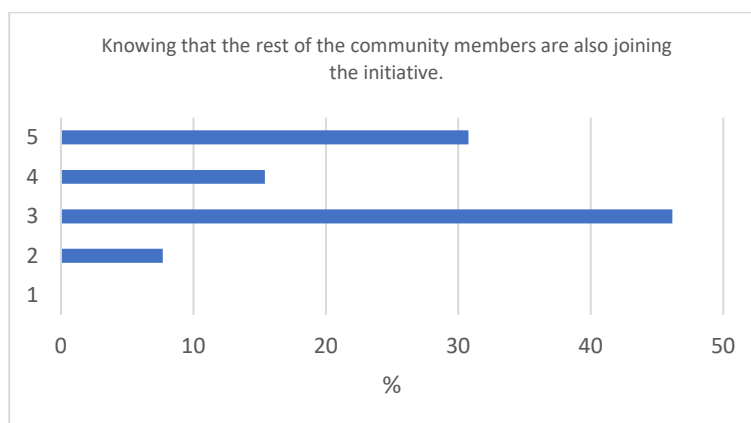


Figure 99. Knowing the rest of the members join the initiative. Slovenia

#### *Labels for citizens' carbon emissions*

*“AURORA team is developing a label for citizens' carbon emissions based on energy and commuting behaviour, as illustrated in the image here. By providing data regarding electricity and heating consumption, and commuting patterns, citizens can get a result of which label their carbon emissions entail.*

*Then, by taking action through the project (becoming a member of an energy community that produces clean energy, changing his/her mobility patterns) the user can get an updated label.”*





## Questions 6 and 7

*“What do you think of the labels? Other comments to this label.”*

When analysing this question (Figure 100) we can see that 72% of the respondents want or would consider providing data and use the label (36% for each of the answers), 21% don't like the idea and 7% like the idea but won't use the label. Table 7 shows the comment received from the respondents about the label, it is positive as what it says is already considered in the calculation.

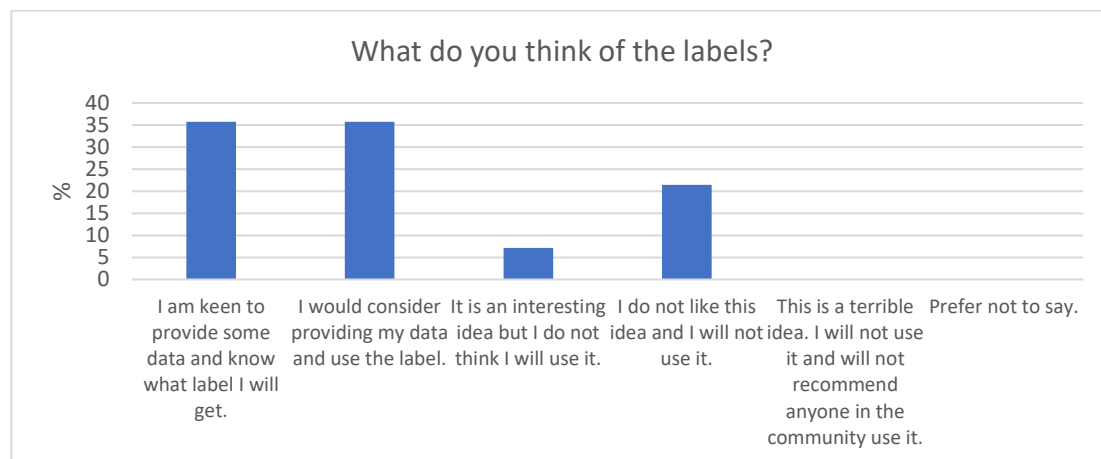


Figure 100. Feedback about the label. Slovenia

*To note: one of the respondents chose two options, even if this wasn't a multi-answer question.*

Table 7. Comments about the label. Slovenia

Feedback	Classification
It depends too much on the person's situation. The distance to the workplace, public transport options along the entire route, etc., must also be taken into account.	+

## About myself

### Question 8

*“My potential participation in AURORA will be by:”*

Respondents from Slovenia will participate in AURORA as shown in Figure 101. 57% will invest in the community, 19% want to be trained on energy aspects and another 19% will follow the project externally, 17% of the respondents will support research studies by providing their data and 11% will be volunteering. Another 11% show interest in the scope but is not considering joining the project.



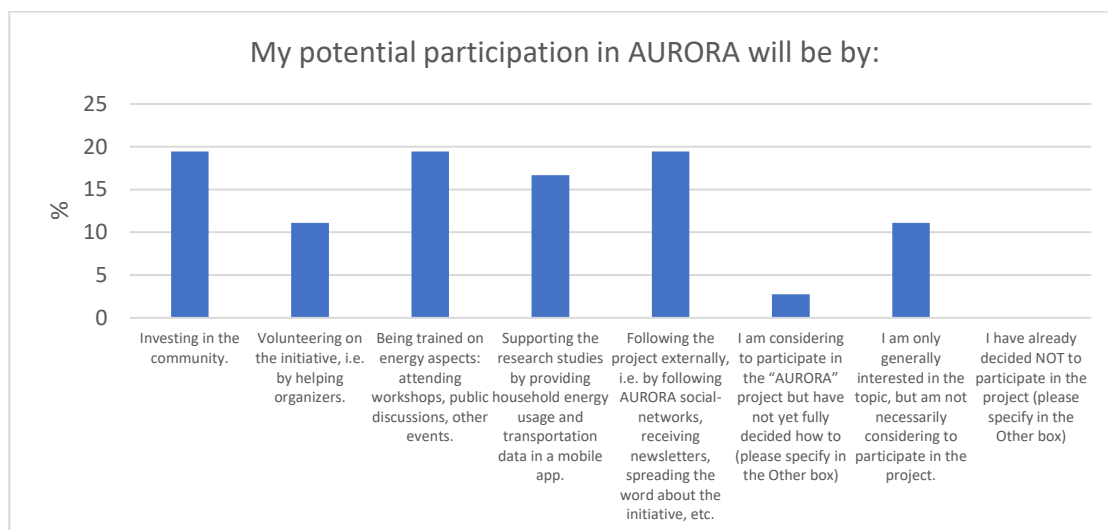


Figure 101. How respondents will participate in AURORA. Slovenia

#### Questions 9, 10 and 11

*"Age, gender and highest educational level:"*

According to Figure 102, 31% of the respondents belong to 31-40 group, followed by 23% who belong to 41-50 and 15% to each of the groups of 18-25 and 26-30. In Figure 103 is shown the gender, 85% of the Slovenian respondents are males. And from Figure 104, we can see that many of the respondents (54%) have a postgraduate degree, and only 15% are currently studying.

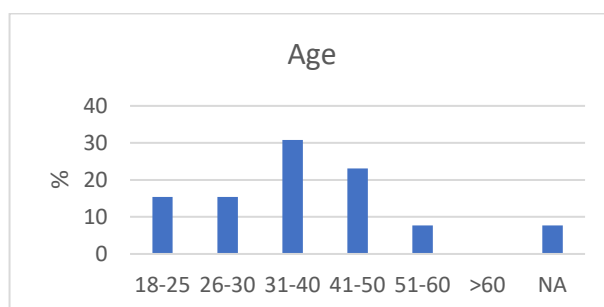


Figure 102. Age of the respondents. Slovenia

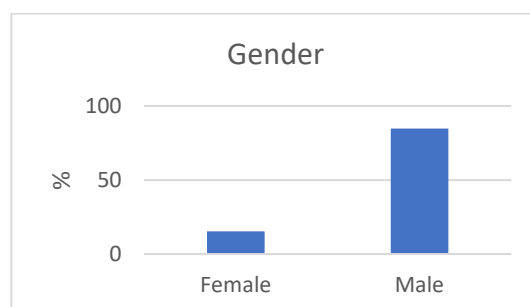


Figure 103. Gender. Slovenia



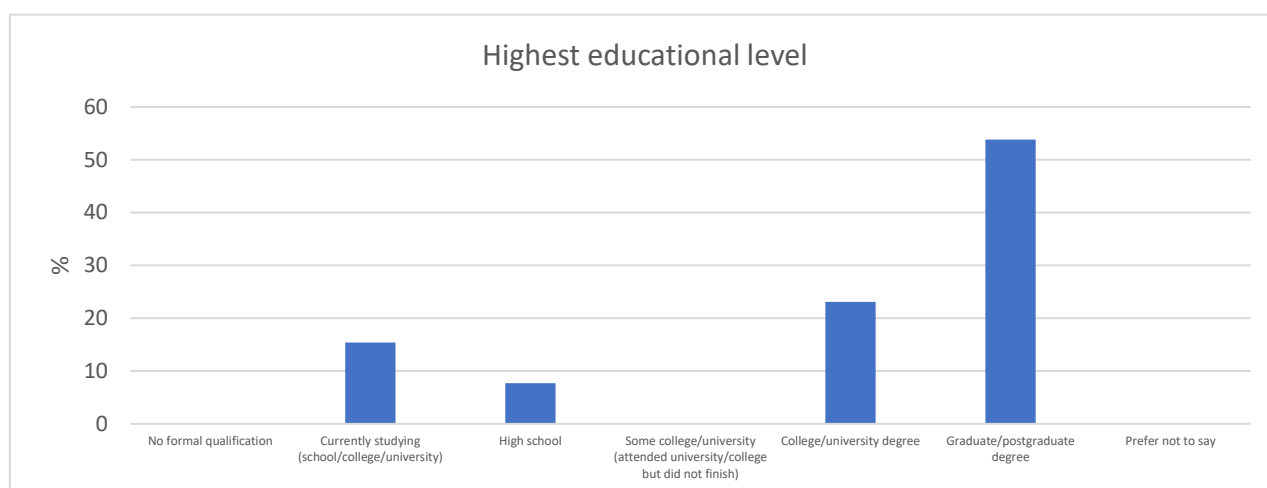


Figure 104. Highest formal qualification of the respondents. Slovenia

## 2.2.5 SPAIN

### Contributing to the energy transition

#### Question 1

*“Considering the option of contributing to the energy transition in my University/in my neighbourhood and contributing to reach the 2030 climate targets sooner, I consider:”*

According to Figure 105, Spanish respondents feel co-responsible and part of the solution to the energy transition in their majority (80%) and 7% of the respondents see themselves as part of the solution but do not feel responsible. Here, we have a strong community feeling about the responsibility and to be part of the solution to the climate emergency.

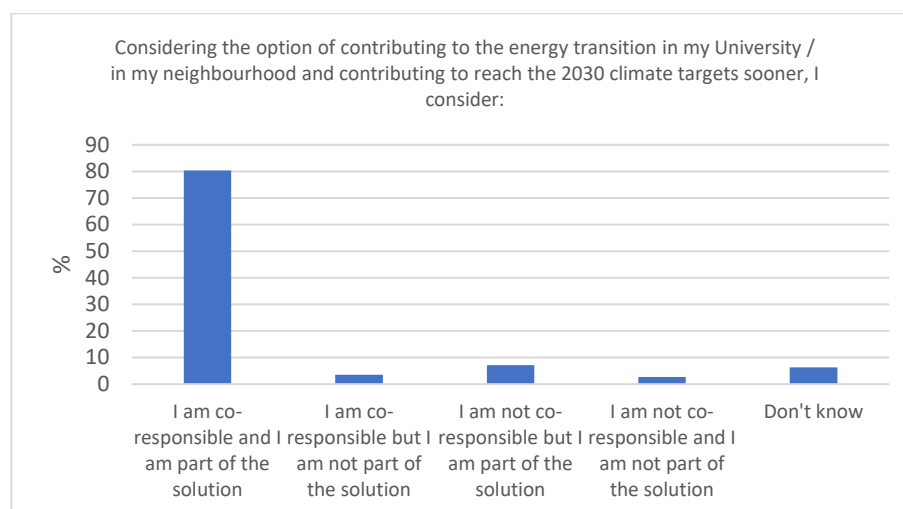


Figure 105. Contribution to the energy transition. Spain

### Energy communities

*“An Energy community (EC) allows citizens to invest in the community-owned energy system infrastructures, which will be used to provide part of or all of the energy usage in the community.”*



## Question 2

*“Energy communities (ECs) are a new instrument to incentivise citizens’ participation in the energy system. According to my own criteria, I would prioritise.”*

According to Figures 106-112, the following order is found when prioritizing these questions in an EC project, from 1 (most important) to 7 (least important):

- 1) Provide social benefits to the community, i.e. contributing to fight against energy poverty, use the installations to feed cheaper electric charging points for citizens, reduce the cost of electricity for public institutions and use such savings for encouraging other social actions, etc.
- 2) Provide environmental benefits to the community, i.e. reducing the carbon emissions of the local area.
- 3) Provide a way for me to challenge the rules of the traditional electricity system and take part in new initiatives.
- 4) Provide a way for me to act in my community according to my values.
- 5) Provide monetary return on investment done by EC's members.
- 6) Provide non-monetary benefits to the investment done by EC's members: first-hand knowledge on energy aspects, return on investment through local coupons or discounts, etc.
- 7) Foster social identity of the community where the EC's members are coming from while increasing networking.

People from Spain find it more important to provide environmental and social benefits to the EC than to provide non-monetary benefits and to foster social identity.

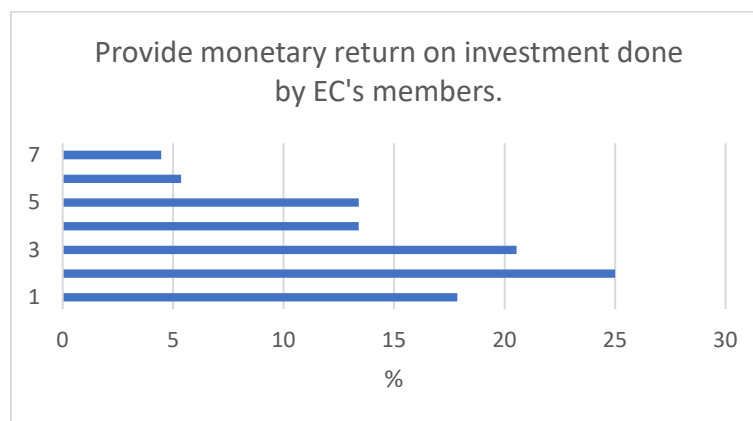


Figure 106. Provide monetary return. Spain



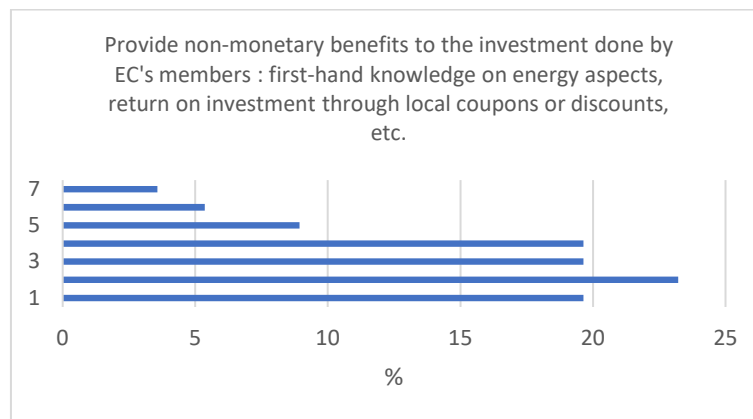


Figure 107. Provide non-monetary return. Spain

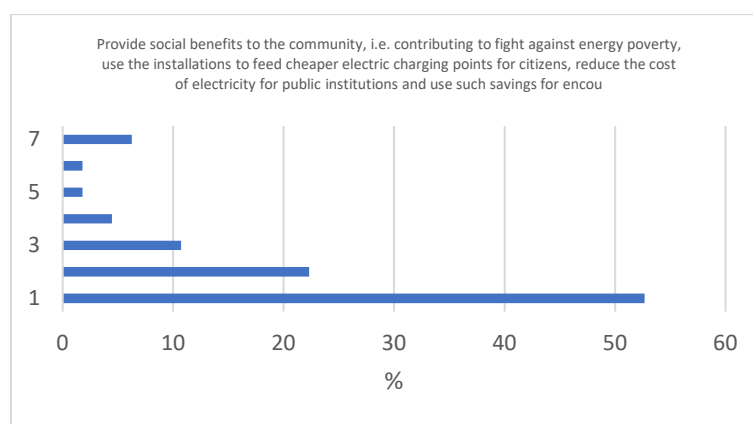


Figure 108. Provide social benefits. Spain

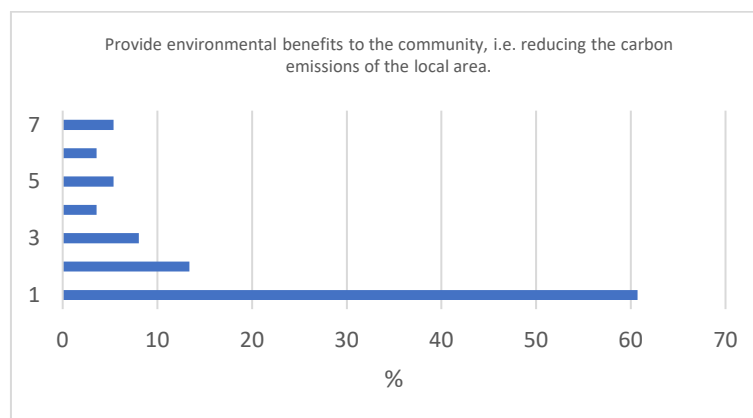


Figure 109. Provide environmental benefits. Spain



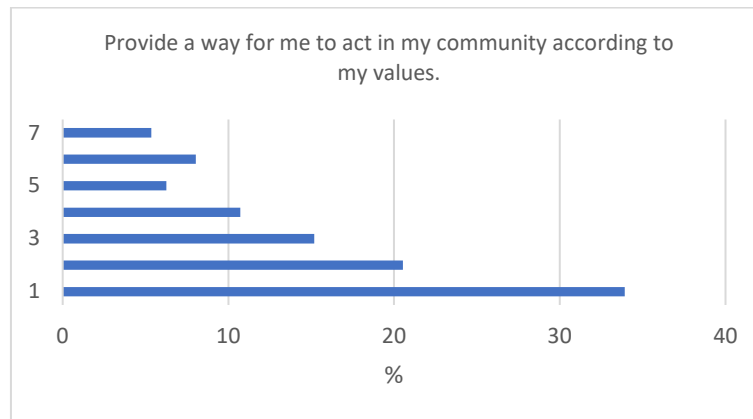


Figure 110. Provide for me to act in my community. Spain

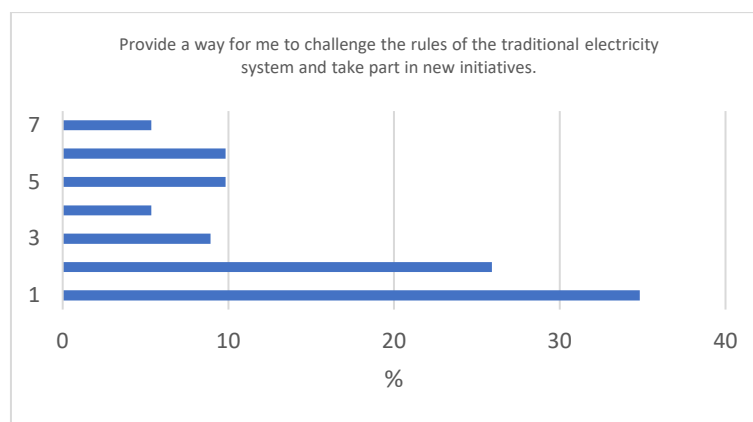


Figure 111. Provide a way for me to challenge the rules. Spain

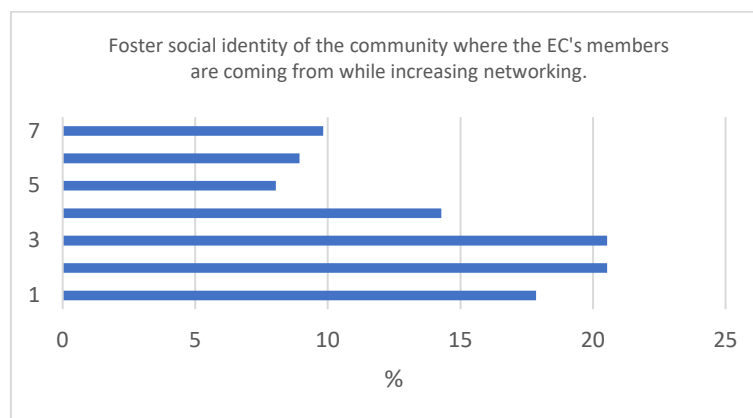


Figure 112. Foster social identity. Spain

### Question 3

*"To consider joining a local energy community, I would need to know beforehand:"*

Following the same procedure as was done in Question 2, what Spanish respondents need to know before joining an EC are ordered based on Figure 113-119:

- 1) Legal implications of my participation, e.g. my legal responsibilities as a member of an EC.



- 2) Energy savings and environmental impact of the shares offered by the energy community.
- 3) How and where to access all information and documentation as well as contact details for asking questions.
- 4) The procedures to formalize my participation.
- 5) Financial implications of my participation, e.g. return on investment.
- 6) Educational /Training /Social Activities that the energy community would implement.
- 7) Ways of taking part more actively in the energy community beyond the economic investment.

In this case, respondents from Madrid find it more important to know what their legal implications are when participating in an EC project and how to access all the information and contact details than the different educational or social activities that would be implemented as well as how to be more active in the EC.

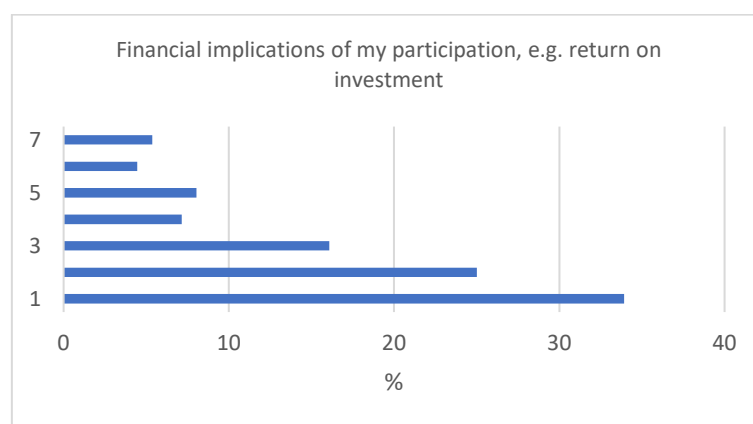


Figure 113. Financial implications. Spain

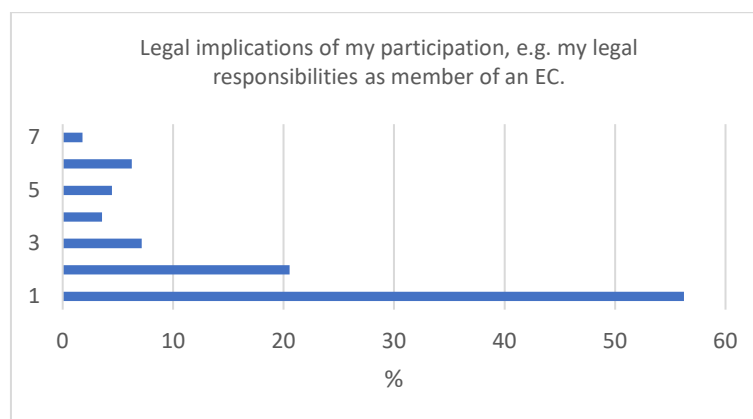


Figure 114. Legal implications. Spain



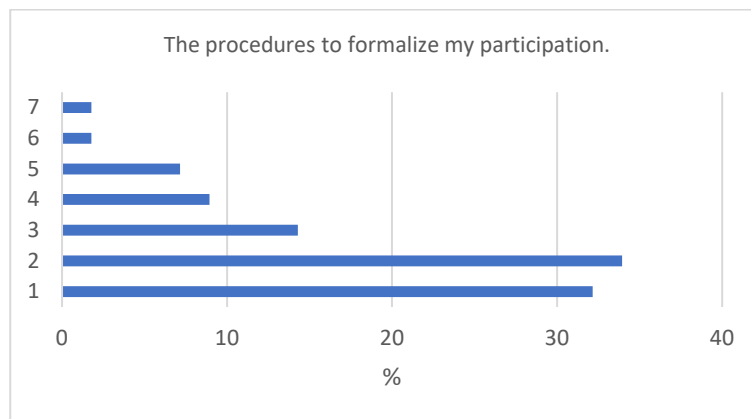


Figure 115. The procedures to participate. Spain

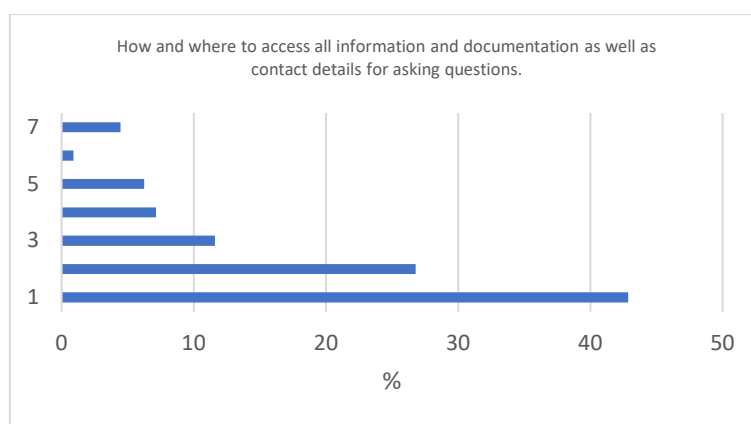


Figure 116. How and when to access the information. Spain

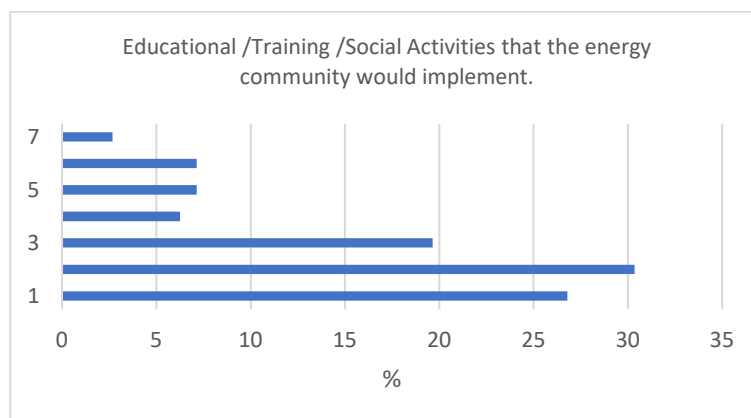


Figure 117. Activities implemented. Spain





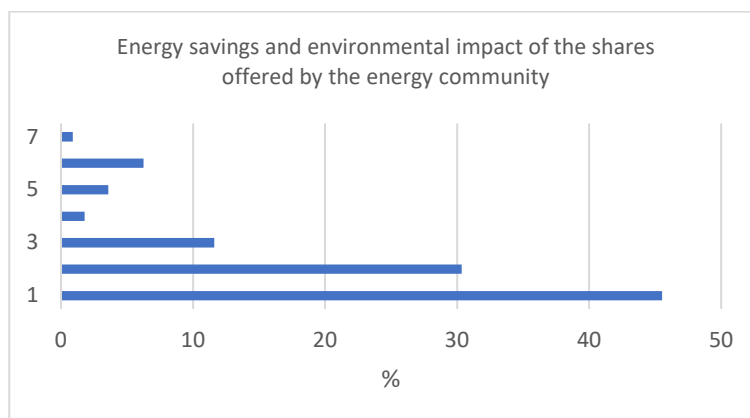


Figure 118. Energy savings and environmental impacts. Spain

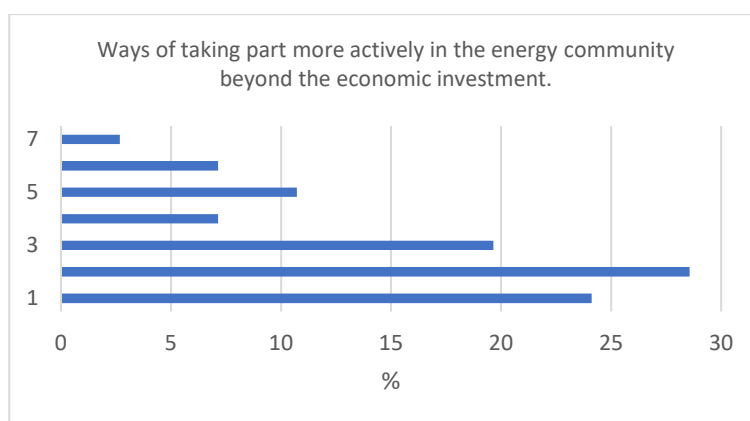


Figure 119. Ways of taking part more actively. Spain

#### Question 4

*“Considering that an EC should run at least one renewable energy facility, I consider:”*

According to Figure 120, the minimum investment proposed is reasonable for many Spanish respondents (47%) and most of them could invest higher amounts of money (48%). 2% don't want to participate because the action involves money.

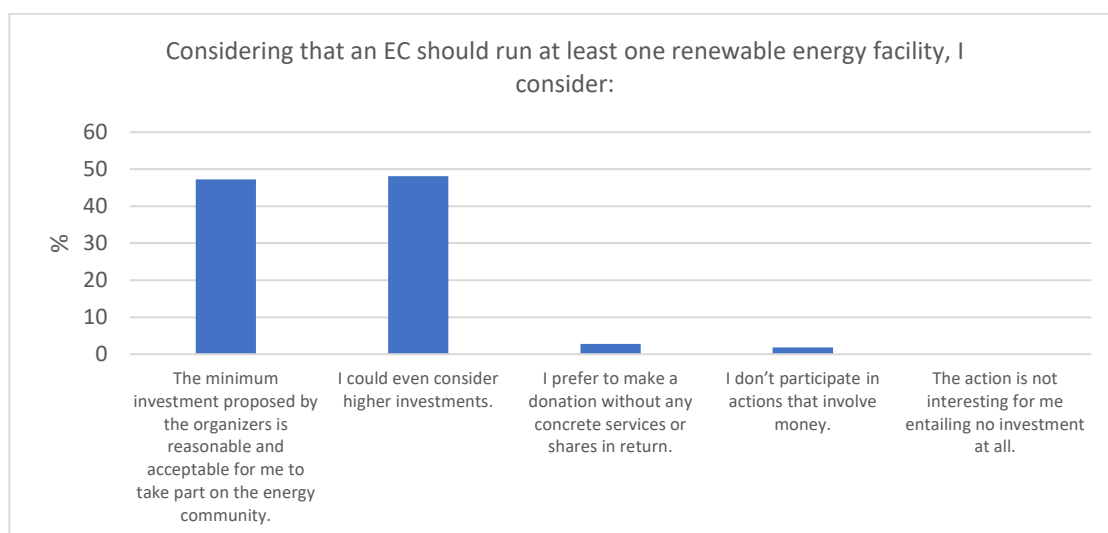


Figure 120. Considerations on the investments. Spain

#### Question 5

*"For me, it is important that:"*

Based on Figure 121-125, the following questions are ordered from most to least important for the Spanish respondents:

- 1) The initiative is led by technical and legal experts to clarify all my doubts now and when the energy community is running.
- 2) The leaders of my community show a strong and continuous support to the initiative as a key action.
- 3) I can receive feedback and information sharing from citizens who have previously invested in renewable energy facilities.
- 4) Knowing that the rest of the community members are also joining the initiative.
- 5) People I trust, such as family or friends, also support the initiative.

As can be seen, Spanish people think that it is important that the leaders of the initiative are technical and legal experts and they show strong support. On the other hand, they don't find it important that the people they trust support the initiative or knowing that the rest of the community members join the initiative too.

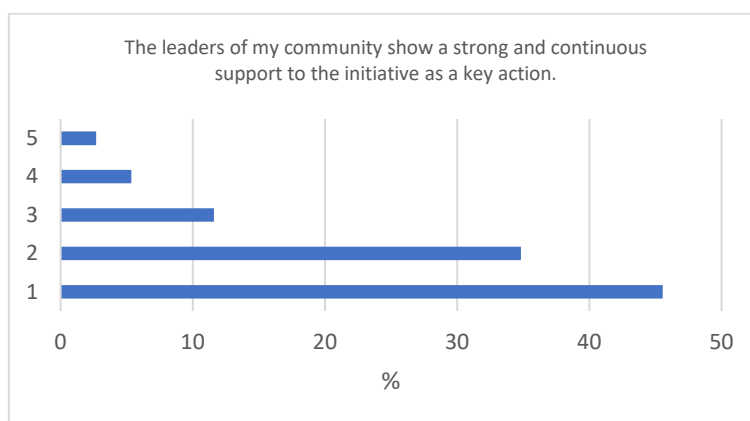


Figure 121. The leaders show strong support. Spain

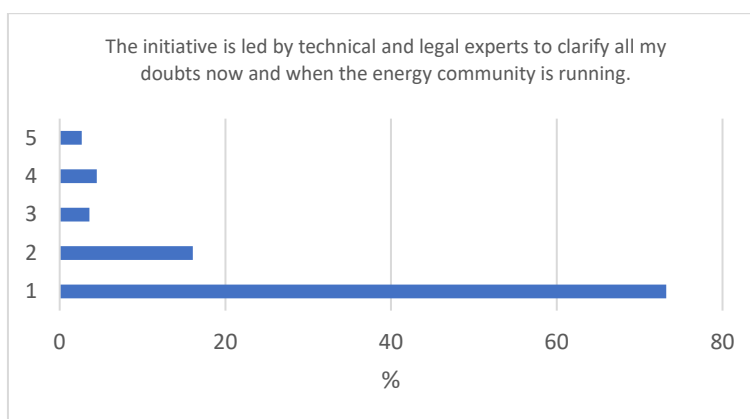


Figure 122. The initiative is led by technical and legal experts. Spain

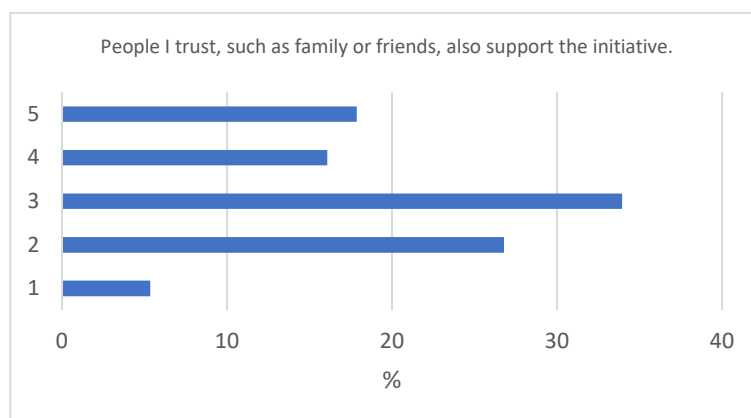


Figure 123. People I trust support the initiative. Spain

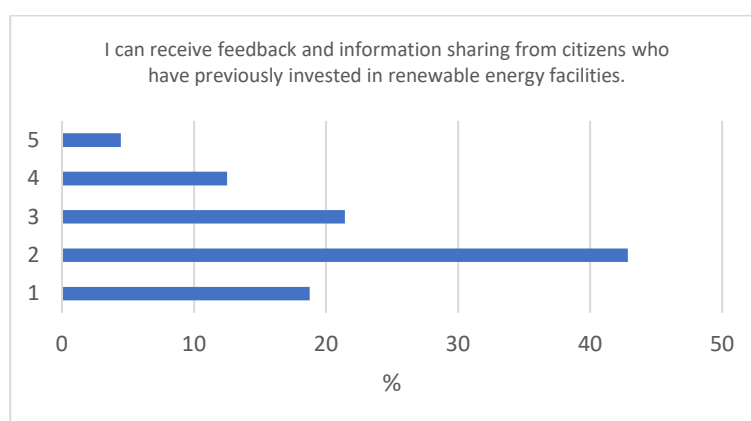


Figure 124. I receive feedback from citizens who previously invested. Spain

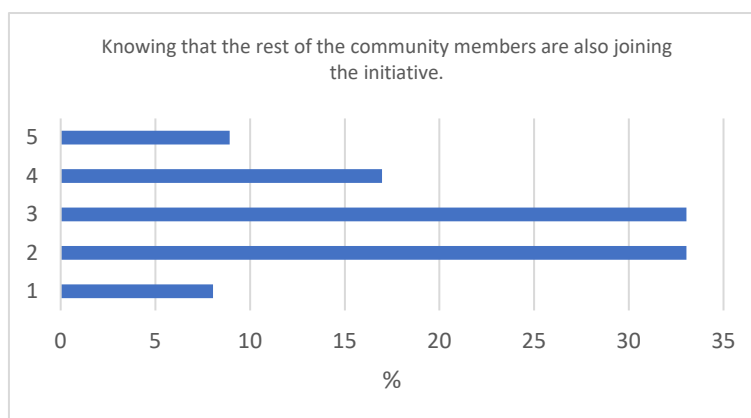


Figure 125. Knowing the rest of the members join the initiative. Spain

#### Labels for citizens' carbon emissions

*"AURORA team is developing a label for citizens' carbon emissions based on energy and commuting behaviour, as illustrated in the image here. By providing data regarding electricity and*



*heating consumption, and commuting patterns, citizens can get a result of which label their carbon emissions entail.*

*Then, by taking action through the project (becoming a member of an energy community that produces clean energy, changing his/her mobility patterns) the user can get an updated label."*

#### Questions 6 and 7

*"What do you think of the labels? Other comments to this label."*

Analysing Figure 126, 47% of the Spanish respondents want to provide data and use the label, 39% would consider using it and 10% like the idea but do not think of using it. Just 2% don't like the idea and won't use it. A considerable number of people from Madrid want or would consider using the label, this information draws a driver in Spanish people. Table 6 shows the comments received from Spain about the label. We find the same number of suggestions, positive and negative comments.

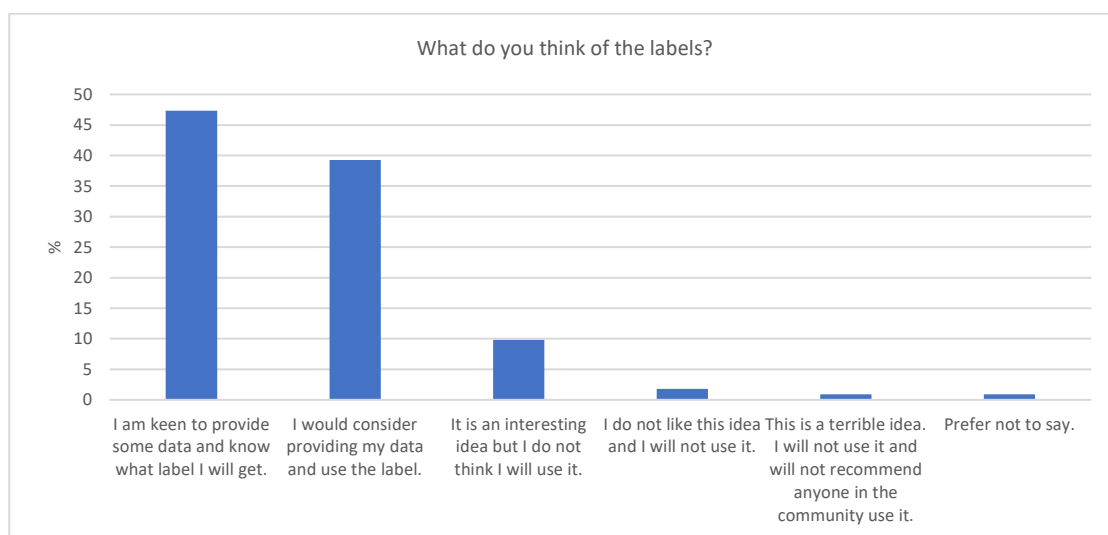


Figure 126. Feedback about the label. Spain

Table 8. Comments about the label. Spain

Feedback	Classification
If it considers EVERYTHING (food, all types of transport, etc.), I find it interesting. If not, no.	*, -
It would be interesting to know whether the unit of time calculation is the year, and what consumption values are entered to estimate this average consumption.	+
I don't think it is convenient to go through life with a label that discriminates me from the rest, for better or worse. I am aware of my ecological and social behaviour, and I think that this would be a partial measurement, there are other things such as recycling or food consumption or other goods that surely will not be taken into account and should enter into the equation.	-
Is there really that much difference between categories 1, 2, 3? I don't know. Why is "Zero" < 2178 kg CO <sub>2</sub> ? It is also hard for me to say "yay, I'm category 1", I am not sure if there is any meaning attached there.	?
I would prefer a more enlightening explanation of the purposes of the label	?
Perhaps when awarding the label, the family context, place of residence, etc., of each of us should be taken into account. If you live far away from the campus, you necessarily have a larger environmental footprint...	+, *
nice to see "blue" zero carbon emissions!	+



I find it useful to correct bad habits	+
The idea of labelling citizens seems a dictatorship to me	-

## About myself

### Question 8

*"My potential participation in AURORA will be by:"*

From Figure 127 we can see that some of the respondents will support the research studies by providing their data (22%), investing in the EC (26%), being trained on energy aspects (22%), and volunteering on the initiative (14%). A difference found when comparing to other demo-sites is that only 13% of the responses are for following the project externally.

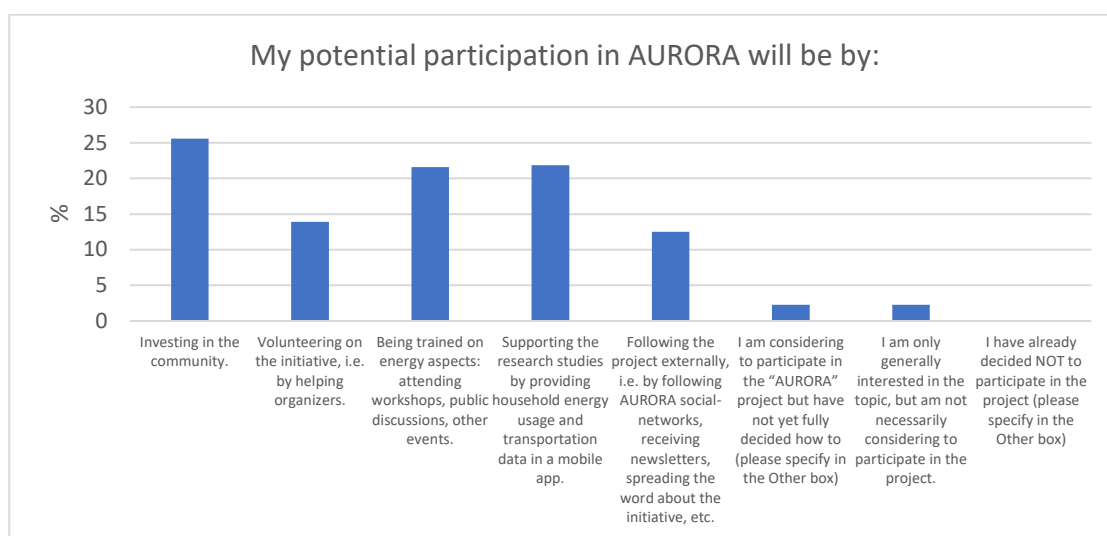


Figure 127. How respondents will participate in AURORA. Spain

### Questions 9, 10 and 11

*"Age, gender and highest educational level:"*

Finally, Figure 128 shows the diverse groups of age respondents from Spain belong to. 37% of them belong to the 51-60 group, 19% to the 41-50 and 13% to the 18-25 group. When analysing the gender (Figure 129), in Spain was found a more equal distribution of the answers, females account for 39% and males for 61% of the respondents. And in Figure 130 we can see the highest educational qualification, 60% of the respondents have a postgraduate degree and 21% of them are currently studying.

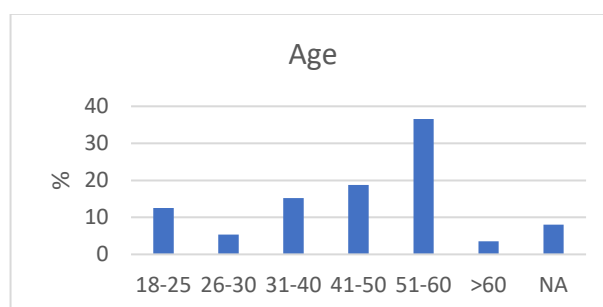


Figure 128. Age of the respondents. Spain

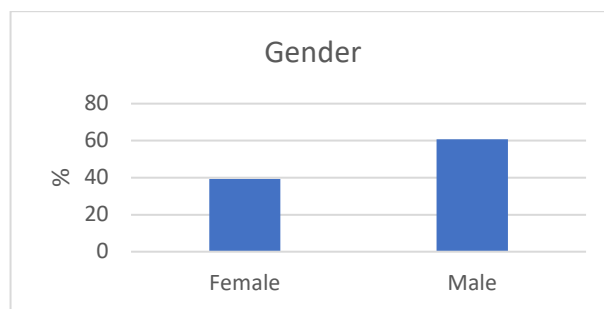


Figure 129. Gender. Spain

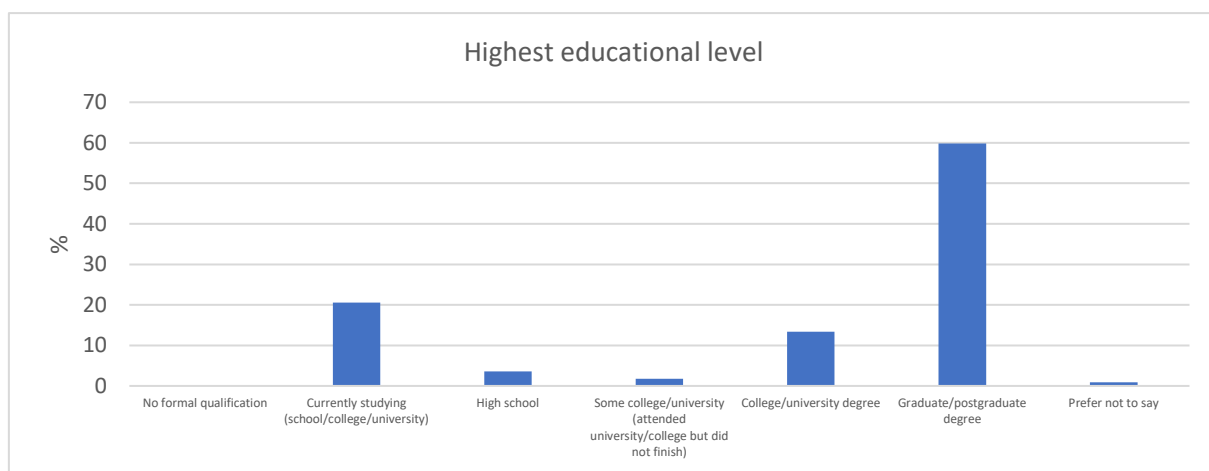


Figure 130. Highest formal qualification of the respondents. Spain

## 2.2.6 CONCLUSIONS

Tables 9 and 10 show the different drivers and barriers found when analysing the general results of the survey.

Table 9. Drivers found in the analysis

Drivers
Feel conscious about the energy transition and feel part of the solution
Provide environmental benefits to the community
Provide social benefits to the community
The participation in the dissemination and communication activities of citizens that previously invested in renewable facilities
The label as a way to know if their daily habits are friendly to the environment
The label is recognizable as is similar to the energy-efficiency label
Interest of the participants in investing in the EC
Interest in supporting the research studies to contribute to science
To understand and being trained on energy aspects to be part of the energy transition
To follow the project on social media, newsletters, etc.
To volunteer helping the organizers



Table 10. Barriers found in the analysis

Barriers
The lack of clear information about financial and legal implications
The lack of information about their energy savings of the environmental impact
The lack of appropriate support from technical and legal experts
The lack of support from the leaders of the community
The unknowledge about the energy and carbon footprint data
Discrimination by using the label

The drivers should be carefully considered when designing energy community demonstrator activities and associated communication campaigns. By reinforcing the drivers perceived by the potential members of the energy communities, we will maximize the number of people who want to embark on the journey towards citizen science platforms on energy issues using energy communities as a motivation.

In relation to the barriers, in the following section we analyse appropriate measures to mitigate them.

## 2.2.7 HOW TO OVERCOME THOSE BARRIERS

Attending to the barriers found when asking people to participate in an EC project, this section proposes some practical suggestions to overcome them.

### *The lack of clear information about financial and legal implications*

As observed in the survey, respondents find it important to have information about the legal and financial implications of their participation in the EC. A lack of this information or to have this information unclear is found as a barrier to join the EC. How could we overcome this barrier?

The most important aspect to consider is that very clear information about the legal and financial implications of their participation should be given at the very early stage of the communication of the project. In case the potential participants in the EC have any doubts or questions, appropriate answers are necessary to try to avoid any sort of confusion so that people leave the meetings with clear ideas. A list of FAQs in the website dealing with this type of doubt is highly recommended.

### *The lack of information about their energy savings of the environmental impact*

Respondents find it important to know about their energy savings and the environmental impact of their shares of the PV system of the EC. A lack of this information is found to be a barrier to join the EC. How could we overcome this barrier?

The potential participants in the EC should participate in the design of the PV systems, in the calculation of their productivity in order to know first-hand the expected annual production and its corresponding impact in terms of saving CO<sub>2</sub> emissions. It should also take part in translating these results in terms of carbon footprint reduction and in terms of their impact on the proposed label categorization. The participation from the early stages of design does not replace the wide dissemination of the expected results among all potential stakeholders, for example, making them available on the project website.



*The lack of appropriate support from technical and legal experts and the lack of support from the leaders of the community*

The lack of support from legal and technical experts is found to be a barrier since the potential participants are not specialists in photovoltaic technology or in the legal-economic apparatus associated with the new form of energy community proposed by the European Commission. They want to be informed about the legal and tax implications their participation in the EC has. Another important barrier is the lack of the support of the leaders of the community, in this case, mainly the rector teams of the respective universities. How could we overcome this barrier?

It would be highly recommended to have, during the dissemination and communication campaign for the adherence of the members of the university community in the energy community, the participation of external experts in engineering of photovoltaic systems and in the legal and fiscal aspects of the energy communities and of economic investments in renewable energy systems. Their participation would allow the potential participants in the EC to feel confident and that they have sufficient support in these aspects that are unknown to them.

On the other hand, it is necessary to visualize the support of community leaders, in this case, the university rector's office and campus directors. It could be achieved through actions such as invitations to these leaders to open the different communication events, as well as for the leaders themselves to participate in the energy community and share their motivation in the communication channels of the energy community.

*The unknowledge about the energy and carbon footprint data*

The unknowledge about energy and carbon footprint data are a barrier to the survey respondents to join the EC. Some people demonstrated doubts regarding energy aspects. How could we overcome this barrier?

If participants have any doubts or questions, they will be answered in a way that does not create any confusion and that technical terms can be understood by the general public. Participants need to be informed and trained in energy aspects, and this barrier can be transformed into a driver when explaining energy aspects to participants.

It should not be forgotten that one of the objectives of the energy communities within the framework of the AURORA Project is the training of its potential participants in energy issues. It would be convenient to organize training sessions on energy issues that include not only theoretical aspects but also practical ones. The use of everyday examples and practical type cases helps the correct understanding of complex concepts by non-specialists. As mentioned above, training is necessary to understand the production of a photovoltaic system and its corresponding savings in CO<sub>2</sub> emissions and reduction of the carbon footprint. It would also be necessary to relate these concepts to the proposed label. Again, practical examples of how a person can progress through the different levels of the label through concrete actions, for example, micro-investing in the solar panels of the energy community, would be very useful.

*Discrimination by using the label*

Question 6 asked respondents their opinion about the label. Some of them see the label as a way to be discriminated. How could we overcome this barrier?





For these respondents, clearly communicating the purpose of the labelling system is key. We should stress that the label is a good methodology for our own understanding of our daily emissions/consumption choices and how we can reach a better level when modifying our energy consumption habits. It should be clearly explained in the dissemination and communication activities that the personal information about the point in the label of a specific person won't be public unless the participant wants to share it. Practical training sessions with simple and illustrative examples would help citizens to better understand how the labelling system works without compromising personal data or leading to discrimination, as only aggregated data will be used for the research. Any personal data will be anonymised.

### 2.2.8 HOW TO OVERCOME THE SPECIFIC BARRIERS OF SOME COUNTRIES

Table 11 shows some specific barriers found in some of the countries participating in AURORA project.

*Table 11. Barriers found in specific countries*

Barriers
Lack of interest (Slovenia)
Lack of trusting people supporting the initiative (Slovenia)

#### *Lack of interest (Slovenia)*

Respondents from Slovenia don't show much interest when answering those ranking questions (Question 2,3 and 5). Most of them don't consider important (6-7 on the ranking) the topics asked or ranked them in the middle level (4-5 on the ranking). This leads us to ask ourselves a question: the topics are not important for Slovenians, or they don't want to rank these questions because they don't care? How could we overcome this barrier?

One solution we find is to modify those questions where people have to choose from more to least important, making it mandatory to not repeat the number selected once it is chosen in another answer in that question. This way, everyone must choose one answer as most important, another one as not important, and so on, and there won't be any cases showing this kind of indifference when choosing.

#### *Lack of trusting people supporting the initiative (Slovenia)*

People from Slovenia find it important to have trusting people supporting the EC initiative, so a lack of this support will be a barrier for them. How could we overcome this barrier?

It would be very convenient to identify which people are seen by the rest of the university community as "trusting people" and involve them in dissemination and communication activities, involve them in the energy community and propose them to communicate their experience through the channels of the energy community.



## 2.2.9 FINAL RECOMMENDATION

This section's final recommendation is to encourage the demo-sites to keep asking the potential participants to answer this survey when communicating the project. This analysis in the ongoing of the project is essential to study the changes on the drivers and barriers: some new could emerge or/and some of them could be overcome. The more surveys are filled in, the more real data from potential participants is obtained and the better will be the analysis of the drivers and barriers.

## 3. INITIAL ENERGY BEHAVIOUR OBSERVED IN THE PARTICIPANTS

This section of the report will analyse initial data collected from the AURORA application. The application uses a 'labelling' method (as described in D1.1) to inform citizens at each demo site about how their energy behaviour compares to the average energy consumption and CO2 emissions in their respective countries. The beta-version of the AURORA application (described in more detail in D2.2) was launched in February 2023 to be tested by project partners for usability. A final list of suggestions collected from partners was then compiled to be implemented in the main version of the application. The main update features regarding labels and data collection to be implemented in the application were the following:

- The A-G labelling with colours would be translated in local language, using words that would resonate with the local users instead of direct translation of the English names. The last round of discussions concluded the label names in English to be: Ambassador, Big Achiever/Believer, Champion, Driver, Explorer, First Mover, Ground Breaker. The label name would be shown along the label in the application, i.e., E (Explorer).
- Each user would be able to see 3 labels, one for each of the sectors: electricity, heat, and transport; plus one overall label, all calculated based on the user's carbon emissions. The user would also be able to access all labels expressed with kWh (refer to D1.1 for detailed calculation methodology), which would be useful to inform citizens about which sector has higher emission factors.
- It was observed during initial testing that users might not be able to find information regarding their consumption for all 3 sectors. After discussion it was decided that for those users who provide data in only one or two categories, the overall label will be calculated dividing the total carbon budget between the categories. This division of carbon budget will also apply to the timeframe of the information that the users provide. So, for example each month will have 1/12th of the yearly carbon budget.
- Regarding users who found it difficult to find certain information, It was decided that no 'default' value would be provided automatically for users in any sector. Instead, the application would redirect curious users to relevant web pages explaining how to find their data, and how much is the average consumption in their country. This strategy is meant to encourage citizens to put some time and energy into learning about their own energy behaviour and how it compares to others in their community or country.



### 3.1. ANALYSIS OF INITIAL DATA

There were a total of 33 users who registered to test the beta-version of the AURORA application. This number is too small to make any conclusions regarding citizens' energy behaviour, so only an initial analysis is presented here, and the same analysis will be repeated and presented in future revisions of this report. The geographical distribution of the users is shown in Table 12.

Table 12. Number of AURORA app's beta-version users in each country

Country	NO. of users
Denmark	21
Portugal	4
Slovenia	1
Spain	1
UK	2
EU	4

#### 3.1.1 DENMARK

Table 13 shows the number of users who filled in their data for each sector, plus the average period of time that they tracked their consumption. From the 21 registered users, 3 entered data for all three sectors and 6 did not enter any data. The overall average time period for which users entered data was 75 days.

Table 13. AURORA app users in Denmark

Category	No. of users who provided input	Average tracking time-period
Electricity	8	100 days
Heat	3	80 days
Transportation	13	45 days

Figure 131 shows the average energy consumption in the 3 sectors from the data that was collected through the application, vs. baseline values (as calculated in D1.1) for Denmark. The transport sector average is much lower than the baseline values. It should be noted that most of the participants from Denmark belong to a class of students that were introduced to the project and the application during a Citizen Researcher Meeting as part of WP1. As many students' primary mode of transportation is a bicycle, the average transport consumption is lower than the baseline. The electricity and heat sectors show good agreement with the baseline values but are also lower overall. Figure 132 shows the box plot for energy consumption in each sector. The heat and electricity sector both show small deviations from average consumption, but the transport sector shows 2 outliers with very high consumptions.



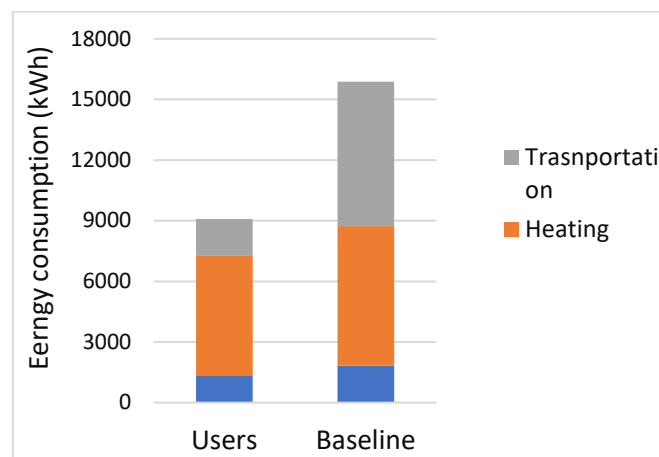


Figure 131. Energy consumption data from AURORA application users vs. baseline values. Denmark.

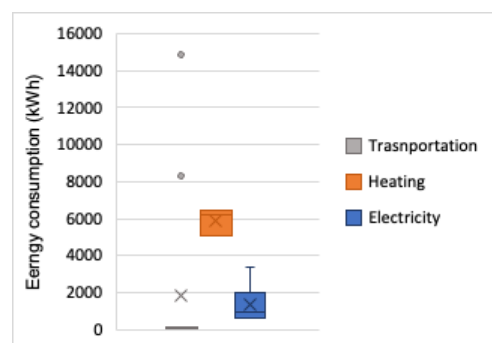


Figure 132. Box plot for energy consumption data collected from AURORA application users. Denmark

Figure 133.a shows the distribution of different heating methods for users in Denmark. Due to the low number of inputs, no conclusion can be made here. Figure 133.b shows the distribution of different transportation methods for the users in Denmark. About 40% of users input 'bike' as their primary transport method.



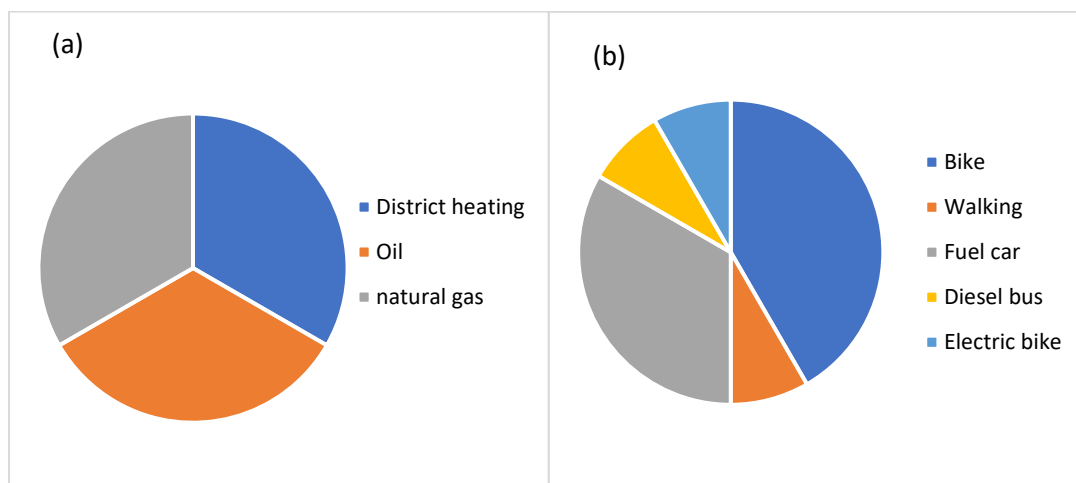


Figure 133. (a) Distribution of heating methods and (b) distribution of primary transportation methods for users. Denmark

In addition to the results from the app, the emissions of Aarhus city as calculated by the municipality are represented here. This data will be part of the citizen researcher meetings conducted for section 4 to show citizens the contributions of other sectors in the environmental impact of the community. Figure 134 shows that there is a large share of renewables in energy generation in the municipality in Aarhus, and the overall carbon emissions are steadily decreasing.

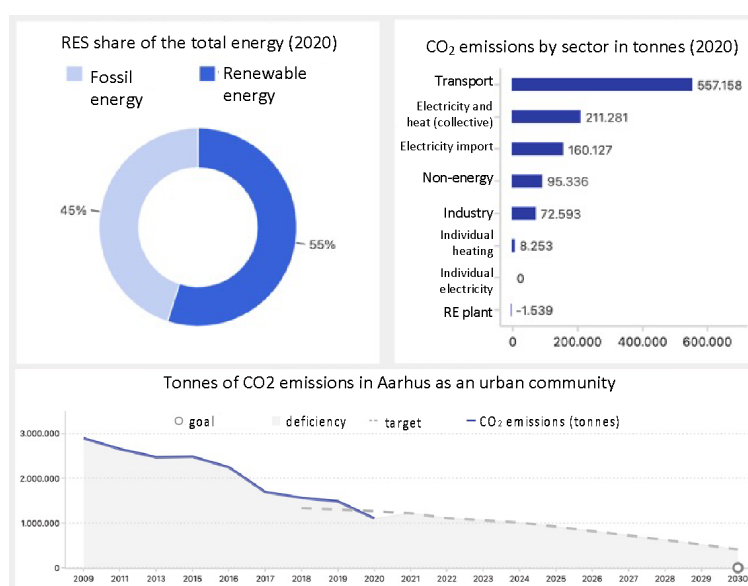


Figure 134 – Summary of the energy production and carbon emissions of the demo-site's municipality (Aarhus Kommune)

### 3.1.2 PORTUGAL

Due to the small number of users, this section will be revised and re-submitted after more data is collected.



### 3.1.3 SLOVENIA

Due to the small number of users, this section will be revised and re-submitted after more data is collected.

### 3.1.4 SPAIN

Due to the small number of users, this section will be revised and re-submitted after more data is collected.

### 3.1.5 UK

Due to the small number of users, this section will be revised and re-submitted after more data is collected.

### 3.1.6 EU

Due to the small number of users, this section will be revised and re-submitted after more data is collected.

## 4. INITIAL APPROACH TO BEHAVIOUR INTERVENTION

As mentioned in D1.1, a review of carbon footprint calculators showed that a major challenge for the developers is to motivate individuals to return to the app continuously after they use it for the first time, and to try and replace their high emissions energy habits for more sustainable behaviours. After the testing of AURORA's beta-version, a list of suggestions was compiled to encourage behavioural change within users. It would be the decision of the project partners leading WP2 which suggestions would be implemented in later versions of the app based on the project resources and time available. The main suggestions were:

- Data from the PVGIS, an open data portal that contains data about solar radiation and Photovoltaic (PV) system performance, could be used to calculate how much are the savings citizens would obtain with the installation of 1kW of PV. These savings could motivate people further to invest in renewable energy sources. There could also be an option for people who buy renewable electricity to have a better label based on their consumption. This is already being implemented in the newer version of the AURORA app.
- Separation of consumption and labelling for professional and private activities could be a useful tool for people to gauge how much their work impacts their carbon footprint. This could then lead users to start implementing changes in their workplace as well as their homes.
- There could be an option for people to calculate their emission using another country's emission factors. This option would not change consumption data, but simply show users how much their carbon emissions from their current consumption would have been if they lived in another country. The goal would be to prompt 'institutional changes' by informing people about the effects of electricity grids with more renewable sources or a newer public transportation infrastructure on carbon footprint.



## 5. PLAN FOR NEXT REVISION

After the official launch of the AURORA application, the data obtained in the first 6 months will be used to re-do the analysis of energy behaviour from section 3 of this deliverable. During this time, each demo site will host citizen research meetings within their community to discuss the energy behaviour observed in their community, what are the impacts of this energy behaviour within the community, and which interventions could motivate citizens to change their energy behaviour. The results of these meetings will be used to revise section 4 of this deliverable to show what strategies are developed for each demo site.



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