Baseline community, market and ecosystem assessment

Deliverable 3.1

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No. 957843 (MAESHA). This output reflects only the author's view and the European Union cannot be held responsible for any use that may be made of the information contained therein.

Deliverable D3.1

Baseline community, market and ecosystem assessment

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DEM	Websites, patents filing, press & media actions, videos, etc.	
O	Software, technical diagram, etc.	

Dissemination level		
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CO	Confidential, restricted under conditions set out in Model Grant Agreement	
CI	Classified, information as referred to in Commission Decision 2001/844/EC	

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More information on the project can be found at https://www.maesha.eu

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Executive Summary

The goal of this document is to present the results of the baseline-assessment carried out in Mayotte. The study explored the general awareness, priorities, and motives of the local population to get involved in the energy transition.

This document first gives a general introduction to the local context before presenting the methodology used and the data obtained. It then provides the results of questionnaire and interview data structured by the following three thematic fields:

- Energy- and Ecosystem
- Community Spirit
- Support for Renewable Energy Technology (RET)

Finally, the report sums up the results and discusses the implications for the further implementation process. Overall, the data obtained from key-informants and the local population leave us very optimistic that when following appropriate strategies of communication, stakeholder-interaction and citizen participation, the project can be a great success

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1. INTRODUCTION

Supportive communities and carefully designed, context specific institutions are deemed crucial for the successful transition to renewable energy systems. This includes a paradigm shift which enables passive consumers to become energy-citizens and to actively get involved in production, distribution and management of local green energy infrastructure and regulation (Wirth, 2014; Koirala, 2016). As a response to the growing desire of rethinking established models of organization and governance, the European Union legally introduced Local Energy Communities (LEC) as possibilities for citizens to collectively organize and engage in the energy system (Frieden, 2019). Fostering the establishment of LECs as one way to empower citizens to actively become part of the energy system is a proclaimed goal of the Horizon 2020 MAESHA project.

1.1. ABOUT MAESHA

There are more than 2 200 inhabited islands in the European Union, many of which depend on expensive fossil fuel imports for their energy supply. The large-scale deployment of local renewable energy sources and storage systems would contribute to decarbonizing the energy system. However, this endeavour requires flexible solutions, new tools and efficient frameworks that can be adapted to local needs. The EU-funded MAESHA project will develop smart and flexible methods of storage and energy management as well as modelling tools and technical systems with the aim of promoting the transition towards sustainable energy. Designed with respect to the interests of the local communities, adapted to the market and ready to be disseminated, the new approaches will serve as a demonstration for the future decarbonization of Mayotte and other European islands.

1.2. SCOPE OF THIS DOCUMENT

The following document presents the results of an extensive baseline assessment including questionnaires, semi-structured interviews and direct observations from the field. We explored the general awareness of the local population on environmental and energy topics as well as their support for renewable energy technology (RET with a particular interest in people's perspectives on a community renewable energy project and their active involvement. Our investigation revealed that the attitudes, concerns and priorities related to the energy system and the proclaimed energy transition differ drastically depending on the socio-economic background of the participants. The paper gives important insights into the heterogeneous society of Mayotte and its relationship to energy.

These findings will not only serve as a basis for the upcoming work with local communities but further expands the existing scientific body of literature on the social pre-conditions for the emergence of LECs and community energy initiatives. We can conclude that, despite substantial challenges, Mayotte offers great opportunities to explore and demonstrate new technologies while fostering the participation of the local population in the implementation process and beyond.

2. MAYOTTE

The following chapter gives a brief introduction to the island of Mayotte, its geography and demography as well as the peculiarities of the local energy system.

2.1. GEOGRAPHY AND DEMOGRAPHY

Geographically, Mayotte belongs to the Comoros. Due to its colonial history and a referendum in 2009, it is officially considered a department of France. These circumstances and the resulting social and cultural dynamics have a significant impact on life in Mayotte. The island is situated in the Indian Ocean near Madagascar and the coast of Mozambique. It is composed of two main islands, Petite Terre and Grande Terre, and is locally administrated by the elected Departmental Council.

Despite officially being part of the European Union, existing socio-economic differences should be considered when implementing a technological innovation project such as MAESHA in Mayotte. Official statistics illustrate the contextual differences of the island compared to mainland Europe. With an annual population-growth of 3.8 per cent, on average 5 children per woman, and a Gross Domestic Product (GDP) comparable to that of Djibouti, Mayotte stands out compared to many other European regions. In comparison, the GDP of La Réunion, another European oversea department, is more than double of the GDP of Mayotte (Mayotte ann. GDP p.c.: 13 000 $, Réunion: 27 000$). The economy is at the same time very dynamic with an annual growth rate of 9% in recent years but at the same time has a high unemployment rate of around 35%. Compared to France with 16 per cent, a staggering 70-84 per cent of people in Mayotte live below the poverty line. Half of the population is younger than 18 years old (INSEE.fr).

People with different cultural backgrounds from East Africa, Europe and the Arab world live together. Nevertheless, this unique and diverse society is confronted with enormous social, economic and ecological challenges: increasing economic inequality, high unemployment, environmental destruction, post-colonial tendencies and struggles for resources are part of everyday life. While the island is extremely poor, it is yet by far the most prosperous region among its immediate neighbours. This has made Mayotte a major destination for illegal migration. It is estimated that about half of the 500 000 inhabitants have no valid legal status and are at constant risk of being deported. Ultimately, the society in Mayotte is split in half between the better-off and people with very little income, often migrants. One of our study participants stated:

> *"There are two kinds of people who live in our neighbourhood: the rich (kabayila in Mahorais) who are a bit well off, and the average citizens who have little money (foreigners), who come from elsewhere like me."*

2.2. ENERGY SYSTEM OF MAYOTTE

The following four paragraphs, including the information on the Programmation Pluriannuelle de l'Energie" is drawn from the deliverable D1.1 "Use-Case definition". It is included to give a more detailed description of the energy system to better understand the context of this study.

The distribution on the island is managed entirely by Electricité de Mayotte (EDM), who is in a situation of monopole. 95% of the electricity production comes from Diesel generators, and the remaining 5% come from recently installed RE plants, mainly solar (23MWp with a 4% annual growing rate). The potential for PV development is high as opposed to wind, because the wind deposit is very low, and not workable with the actual wind power technologies. Land availability is one of the main limits for large-scale expansion of solar PV plants. As for the grid, it is not conforming to European standards and illegal connection is a severe issue. The share of the population without access to electricity was indeed of 10% in 2017. All this results in a very polluting energy sector and in very high electricity generation prices, which, however, do not directly impact the local population as the electricity tariffs proposed by EDM are aligned with those proposed in metropolitan France. (This should however be qualified by taking into account that the GDP of Mayotte is three times lower compared to metropolitan France.)

Regarding the transport system, which is the primary source of GHG emissions on the territory, it is almost exclusively based on thermal vehicles although the first slow EV charging stations have recently been installed, and only one car dealership offers electric vehicles. However, given the size of the island, the electric vehicles, if they are recharged with non-carbonized electricity, could provide significant reductions in CO2 emissions and air pollutants.

In April 2017 the current "Programmation Pluriannuelle de l'Energie" for Mayotte was released; a document setting the objectives as well as listing the challenges for the energy policy of the island at different time horizons. To help Mayotte in its energy transition and its decarbonization, the document recommends the following:

- To promote a significant development of RES, especially PV plants, with a multiplication by almost 10 of their share in the electricity mix. Electricité de Mayotte has currently received many requests from stakeholders for connection of new PV plants to the grid, for a total capacity of 43,9 MWp (8% of which for a connection to the MV grid).
- To promote the development of thermal renewable energy, which are likely to avoid nearly 20 GWh of electricity consumption annually. The measures include an ambitious development of individual and collective solar water heaters.
- To install storage systems for a total capacity of 29,4 MW by 2023. In this context, two batteries of 7,4 MW and 4 MW for load transfer and frequency control respectively will be installed in 2021.
- To develop innovative projects based on renewable energy coupled with storage facilities
- To secure the electricity supply of the island, by:

  - Keeping a non-intermittent power plant in Petite Terre, as the island hosts sensitives facilities such as the airport and the hospital
  - Diversifying the generation facilities in Grande Terre and working on the stability of the electricity system. A proposition is to create a 44MW production facility by 2025. The objective is to cover part of this need with a biomass power plant project (12 MW) and a project combining photovoltaic installations and storage (13 MW), with the remainder covered by a power plant running on light fuel or liquefied petroleum gas
- To promote clean and sustainable mobility (e-mobility, public transit, maritime transport)

Official statistics suggest that one out of three households have insufficient access to running water, and many have no connection to the main energy grid. Ultimately, the local energy infrastructure suffers from a growing number of illegal connections and energy theft poses major challenges to the local grid operator. Conversations with communities and authorities revealed that some of the recently installed solar streetlamps were subject to theft. While this illustrates the reasons behind some people's scepticism towards shared community solar panels, it also reveals the massive demand for energy in marginalized communities.

The island finds itself in a phase of transition to renewable energy. The number of solar panels on buildings is constantly increasing. As part of the effort to move towards a greener and more sustainable energy system, the administrations of the four main districts CADEMA, CCSUD, CCPetit Terre and 3CO have recently launched the PCAET (plan climat air énergie territorial) which aims to foster an ecological transition within a time horizon between 2021 until 2026. According to the person in charge of this endeavour in the CADEMA region, which includes the capital Mamoudzou, the district tries to reach zero per cent carbon emissions. This shows that the point of time MAESHA is operating in Mayotte is very promising.

> *"At CADEMA, we are in an ecological/energy transition process. We are insulating the buildings, we want to create infrastructures that are totally self-sufficient. For the CARIBUS project, all the bus-stop roofs will be equipped with photovoltaic panels, for example. We are more in the transition, we are aiming for 0 carbon, to operate only with photovoltaic energy. We are currently at 5% of renewable energy in the territory, and I hope that by 2024, we will reach at least 24%. That would be a success."*
>
> *(Key informant, CADEMA)*

An important point concerning recently installed solar panels on rooftops is that most of them are owned by private independent power producers who sell the electricity to the local distribution system operator EDM. It is one goal of MAESHA to establish Local Energy Communities which can benefit from locally owned generation assets and practice self-consumption.

> *"…at the moment, concerning buildings, they are using rented roofs and then the service provider rents the roof and sells the electricity. {…} What would be good would be to start self-consumption projects."*
>
> *(Key informant, CADEMA)*

3. DATA AND METHOD

Existing studies indicate that demographic, socio-economic, socio-institutional, and environmental factors play a vital role forming the necessary preconditions for the emergence of community energy initiatives (Wirth, 2014; Koirala, 2016). Taking these insights as a basis for this assessment, we put a special emphasis on illuminating dynamics of normative (What's the right thing to do around here) and cultural-cognitive institutions ("How are things done around here") as well as socio-economic determinants including awareness about renewable energy technology (RET) and climate change. This theoretical fundament served a basis for the creation of the survey.

The following chapter describes the research method and presents the characteristics of the gathered data from the questionnaire survey in detail. Finally, it entails the results of an exploratory factor analysis which serves as a basis for the further examination of the data.

3.1. METHOD

We have gathered a variety of different data to assess the situation in Mayotte and have collected a substantial number of questionnaires yielding quantitative data. Further, we conducted several semi-structured interviews with both, lay people and key-informants from relevant stakeholders. Additionally, an ethnographic research approach has been applied by observing and exploring the situation in Mayotte from our own perspective and through the eyes of local staff.

3.1.1. Local Change Ambassadors

For the study we have worked together with two Local Change Ambassadors. This was important to ensure that the team gathering the data knows the local culture. The two young researchers are born and raised in Mayotte and speak the local languages Mahorais, Kibushi and French. Both are either graduates or currently enrolled in the local university's geography program. As part of their curriculum, they have already conducted a similar survey including a questionnaire and interviews.

3.1.2. Questionnaire survey

We compiled a questionnaire survey with 37 questions, which can be found in the appendix of this document. Most questions could be answered on a 5-point likert-scale on which participants could indicate different levels of agreement or disagreement. Other questions included multiple answers to choose from plus adding one's own points. The questionnaire was distributed by the two local Project Officers or "Local Change Ambassadors" who, sometimes with the help of local facilitators, visited communities in all five regions of the island. We applied a door-to-door sampling method in previously defined geographic areas and different types of neighbourhoods.

Using smartphones, the questionnaire was read out loud and filled by the two local Project Officers. We applied this method as many of the inhabitants of Mayotte are illiterate or don't speak French fluently. This way, our local staff was able to translate, explain and support the study participants if necessary. In more dangerous areas, where carrying a smartphone was not recommended such as

precarious settlements, we used printed paper versions of the questionnaire and digitalized the answers after the mission was completed. Ultimately, we managed to make the survey process as inclusive and accessible as possible. Nevertheless, the presence of our local staff may have contributed to skewed answers such as exaggerations given by the survey respondents.

For the creation and distribution, we used an online form which not only allowed us to bypass the logistic challenges of paper-based surveys but also made it possible to always monitor the sample to make necessary adjustments of target groups. This strategy provided us with a well stratified sample which can be considered representative of the demographic structure of Mayotte. In total, we collected 392 questionnaires which exceeds the number of questionnaires necessary to reach a representative sample size for the population size of Mayotte (Singh and Masuku, 2014).

The content of the questionnaire covered four main sections. The first section asked the participants about their perception of the surrounding ecosystem and enquired about people's access to energy and water. This also helped to establish a sense of trust between the research subjects and the researchers. The section also covered the level of awareness about Climate Change and renewable energy technology (RET) and to what extent the local population should be responsible for the natural environment.

The second section focused on the energy system and captured causes for potential dissatisfaction with the current system. It also investigated the support and acceptance of RET in Mayotte, people's willingness to participate in a community energy project, motives for participation and potential types of involvement.

The third section explored aspects of community life in Mayotte which are deemed crucial for the success of a community renewable energy project. Questions informed about a sense of Community Spirit or Social Capital such as trust, personal identification with a community or social network, and solidarity within ones' respective community. Note that community is a complex and culturally sensitive construct. It can be very subjective what a person defines as community. It may be the people in ones' close surrounding, the municipality (French: communauté) or even the wider society in Mayotte. To control for this complexity, we also exchanged the term community with "neighbours" which yielded very interesting results to be discussed in Chapter 5.

The last section documented the demographic characteristics of the respondents such as age, gender, or cultural background. It also asked whether the participants agreed to be contacted later for a potential post-evaluation.

3.1.3. Semi-Structured Interviews

Additional qualitative data were obtained from several lay people from different socio-economic backgrounds as well as key-informants representing the municipalities. The interviews covered the same overall topics as the questionnaires but allowed us to explore more in depth what community means to the people or what exactly they would think would happen if a community energy project would be launched. The qualitative data give a more nuanced view on certain topics and illustrate what is meant by some of the quantitative information we have retrieved. The interviews were held in French language and were translated for the purpose of this document. All participants agreed to

have their conversations recorded in advance. Note that all questionnaires and interview data has been anonymized and personal information of participants is only accessible to HUDARA gGmbH. All data have been stored in compliance with the ethics requirements as set out in this project.

3.1.4. Data Analysis

For the analysis of the questionnaire-data we used IBM SPSS software version 28.0.0. SPSS which allows for the statistical analysis of quantitative data such as survey data by performing regression analyses, descriptive statistics, factor analyses and a variety of tests.

For the analysis of the interview-transcripts we used the framework approach, described by Pope et al. (Pope et al., 2000), as a reference. It proposes to thoroughly scan and code interview transcripts in order to make claims and avoid overlooking any details while preserving the integrity of the researcher. By inductively analysing the interview content, it is then possible to generate categories and at the same time refine questions to explore certain aspects in more depth. It is suitable to link quantitative and qualitative data and builds on grounded theory.

3.1.5. Chi-Square statistics

The Chi-Square test of statistical independence is a statistical tool used to explore differences by subgroups. It is used for nominal data and is characterized by a high level of robustness, meaning that it can be applied for variables independent of their distribution (McHugh, 2013). When comparing different subgroups, e.g., age groups, a Chi-Square test can show whether the distribution of a variable is significantly different between the respective groups. This allows to make claims such as: “The distribution of Variable X is significantly different in subgroup Z, compared to subgroup Y.” In the following document the phrase “significantly different” refers to a Chi-Square-test with a p-value smaller than 0.05 or 0.01, signifying that the probability of the observed differences being a result of pure coincidence is smaller than 5% or 1%, respectively.

3.1.6. Exploratory Factor Analysis

Large datasets like the one obtained from this study can include a high number of variables. To reduce the number of variables and hence ease the interpretation of the data, it is possible to group some variables which share the same variance into hypothetical constructs, called factors (Catell, 1973). For example, variables which inform about the quality and satisfaction of basic needs and the energy system may all be grouped together as the factor “energy- and ecosystem”, while other variables which are concerned with renewable energy technology (RET) may result in one combining factor called “Support for RET”. Eventually, these factors can be used in regression analysis or can help to compare different subgroups without the necessity to look at all variables individually. However, the necessary precondition that the included variables behave similarly in terms of their variance needs to be fulfilled and therefore tested for in advance.

The statistical procedure which allows for such testing is called “Exploratory Factor Analysis”. As a result of this procedure 19 variables were grouped into three different factors, each representing a certain thematic field. The final and statistically approved factors with the respective variables, that load on and therefore constitute that factor, are presented in Table 2. In this document, each relevant chapter starts with a presentation of the overall distribution of a factor before looking at each variable individually for a more in-depth exploration.

Table 1: Factors with respective variables

"Energy- and Ecosystem"	"Community Spirit"	"Support for RET"
• *Access to electricity* • *Change of access to electricity* • *Access to water* • *Change of access to water* • *State of the natural environment* • *Change of state of the natural environment* • *Satisfaction energy system*	• *Trust in community* • *Trust in authorities* • *Sense of a social net* • *Pride in community* • *Ask neighbours for help* • *Adopt RET if neighbours do*	• *Support of RET in Mayotte* • *Solar panels in proximity* • *Willingness to play an active role* • *Support community energy project* • *Perceived advantage from RET in day-to-day life* • *Perceived advantage from RET in professional life*

3.1.7. Limitations of the study

Here we should note also one of the weaknesses of the study. Due to a lack of capacities we did not manage to stratify each region individually according to the general population statistics. This would have allowed to make more nuanced claims about regional differences. In the case of this study, each region entails different proportions of demographic groups, such as more students in the south, or more precarious groups in Petit-Terre. Therefore, we cannot easily compare regions, as differences may stem from demographic differences within the sample groups.

3.2. DEMOGRAPHIC AND SOCIO-ECONOMIC CHARACTERISTICS OF THE RESPONDENTS

The upcoming chapter shows how the sample obtained from the questionnaire is distributed among different demographic sub-groups. We argue that the obtained sample is well stratified and reflects the demographic situation of Mayotte sufficiently to deem it representative for the island.

3.2.1. Sample distribution by gender and age

The distribution within the sample by gender is relatively equal with a slight surplus of female respondents, see Figure 1. This is caused by the fact that we tried to reach more women from precarious contexts in the last stretch of the survey process.

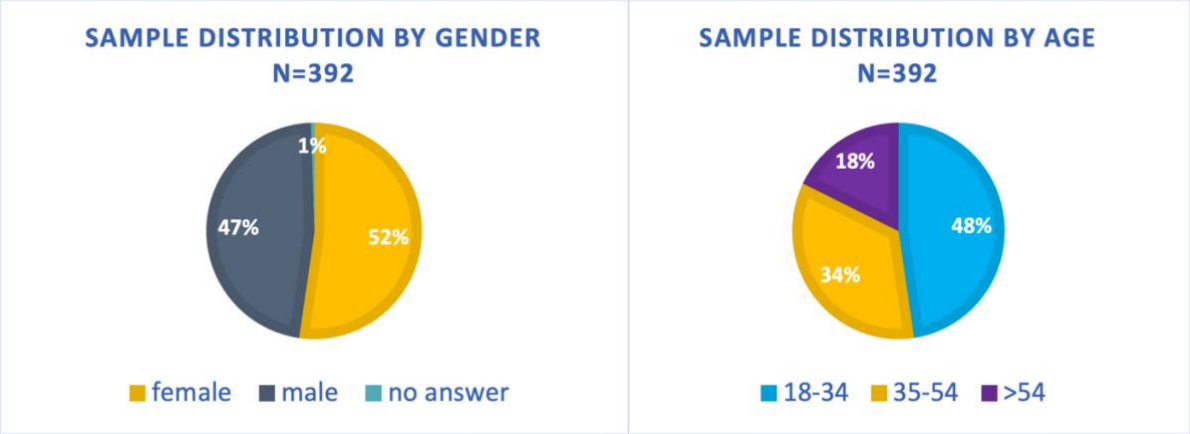

Figure 1: Sample distribution by gender and age

Mayotte's age structure is characterized by a strikingly young population with official estimates stating that approximately 50% of the population are younger than 18 years old. For the study we decided to only include people who are older than 18 due to legal considerations and ethics-agreements regarding this project. Ultimately, around half of the sample is younger than 35 years. One third are between 35 and 54 and 18% are older than 54.

3.2.2. Sample distribution by cultural background

Mayotte is home to different cultures, languages and backgrounds. To capture existent cultural differences, we asked the respondents for their mother tongue, leaving it open whether they wanted to give multiple responses. This allows the phenomenon of overlapping identities and mixed cultural backgrounds to be considered in the data. We were able to reach a quite representative sample structure in terms of cultural backgrounds. While Shimaoré is the predominant language spoken in Mayotte and basically forms a Comorian dialect, we wanted to also consider people who have a background from the neighbouring Comoros and speak one of the other two Comorian dialects, namely Shingazidja and Shindzwani. Therefore, we made the distinction between Mahorais and Comorian. "Only French" speaking respondents can usually be considered migrants from metropolitan France. Lastly, we have gathered questionnaires from people with a Malgache background, who predominantly inhabit the south and north-west of the island. The common name of the language spoken by people with a Malgache background is Kibushi.

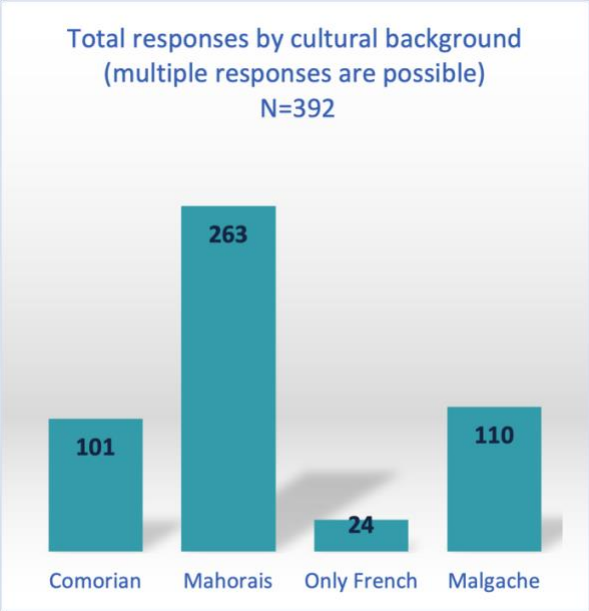

Figure 2: Bar chart mother tongue of participants

The data we have gathered follows a similar pattern as the data obtained in a study conducted in 2006 by the Ministry of National Education which found that the ranking of first languages was in the following order: 1. Shimaoré (55.1%), 2. Shindzwani (22.3%) 3. Kibushi/Malgache (13.6%) 4. Shingazidja (7.9%) 5. French (1.4%). When also asking for the second language the ranking was as follows: 1. Shimaore (88.3%) 2. French (56.9%) 3. Shindzwani (35.2%) 4. Kibushi (28.8%) 5. Shingazidja (13.9%) (Barreteau, 2017). Ultimately, a comparison between our sample, official statistics and the data obtained from the above-mentioned study leave us confident that the population structure in our sample is very similar to the actual distribution of cultural backgrounds in Mayotte.

3.2.3. Sample distribution by profession

In terms of profession, the sample is well stratified and represents a diverse set of backgrounds. 21 % of the respondents are students, 32% are employees, 13% consider themselves self-employed which are often informal workers e.g., street-vendors. 34% of the survey respondents are unemployed which corresponds to official statistics stating that roughly 35% of the population are unemployed. However, taking into account that around half of the population is not represented in official statistics because of their irregular situation, we assume that the real number of unemployed people is likely to be even higher.

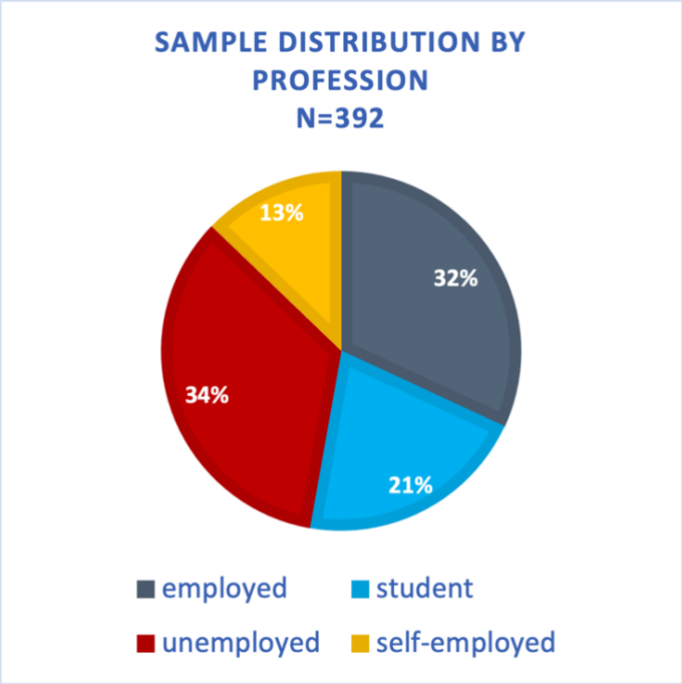

Figure 3: Sample distribution by profession

3.2.4. Sample distribution by region

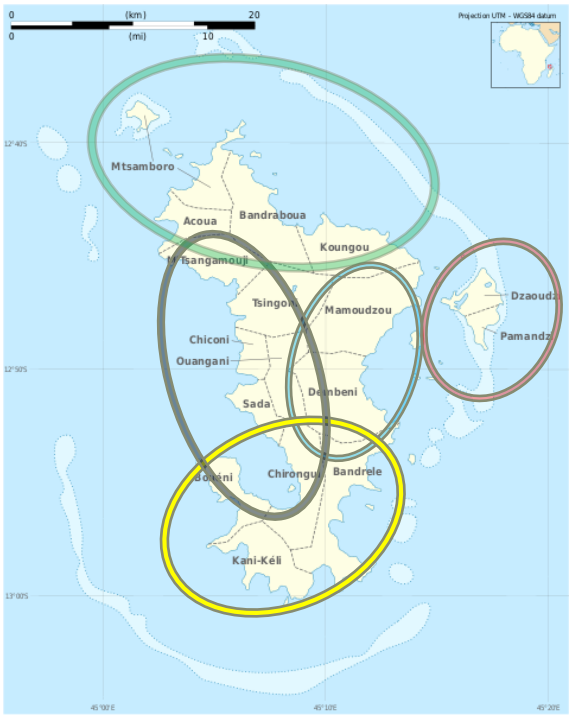

Figure 4: Map and regions of Mayotte

The island of Mayotte can be divided into five different main regions. The most densely populated is the area around the capital Mamoudzou and the neighboring commune of Dembeni on the east side of the island. The mid-west of the island around the cities Sada and Chiconi are also rather densely populated compared to the north and south of the island. Petit-Terre, the little neighboring island on the east is is connected to the bigger island by ferry. On this island is the airport located. Each region is administered by a “Communauté de Communes”, a Community of Communes. These are: CADEMA (the agglomeration of Dembeni and Mamoudzou), CCPetit-Terre (communes of Petit-Terre), CCSUD (communes of the south), 3CO (communes of the mid west) and Grand-Norde (communes of the North). The communes of the north are currently not actively administered by a community of communes.

For the questionnaire survey we tried to reach each of the five main regions in order to adequatly represent all citizens of Mayotte. This was important as there are substantial differences between communities. One already mentioned example is the Malgache background of many of the inhabitants of the south and north-west of the island. Further, some of the problems such as delinquencies and community conflicts are less visible in the north or south as they are less densely populated. Ultimately, the sample we have gathered is fairly stratified among the different regions of Mayotte. The most densely populated agglomeration of Dembeni-Mamoudzou (CADEMA) amounts to 26% of the sample. 21% of respondents are situated in the north (Grand-Norde), 21 % in the south (CCSUD), 20 % in the midwest (3CO) and finally 12% of the respondents live in the smaller of the two islands of Petit-Terre (CCPetit-Terre).

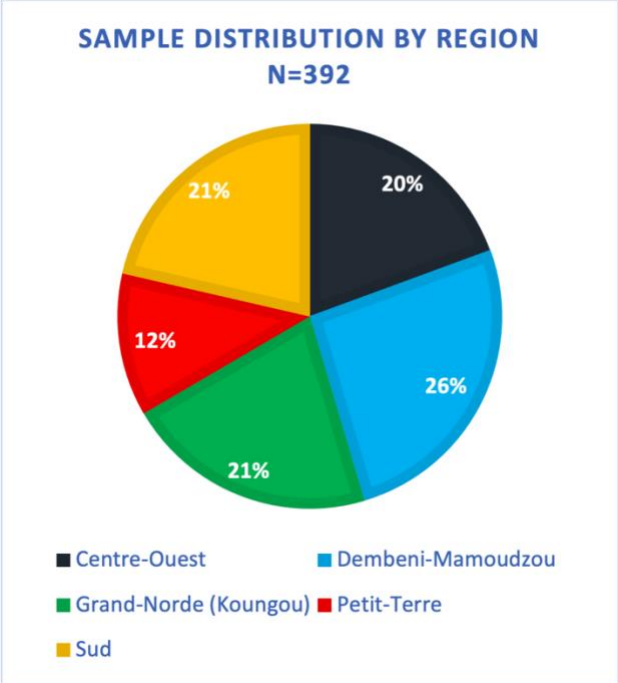

Figure 5: Sample distribution by region

3.3. HOUSING CONDITIONS AS PROXY FOR SOCIO-ECONOMIC BACKGROUND

The island near Madagascar and Mozambique is not a place like any other. On the one hand, it is home to a variety of different cultures, such as the Malgache, the Comorian, the Mahorais and the metropolitan French. On the other hand, socio-economic differences are exorbitant and shape the way people experience energy in their everyday lives. For us it was very important to portrait these differences by visiting those communities which are marginalized and are often not included by local politics.

Figure 6: Picture of a settlement in Majicavo-Koropa

To approximate these differences in our survey, we looked at different types of houses of the participants. Thus, we had the opportunity to capture the social surroundings and general living conditions of the participants. This appears to us as a more suitable proxy for socio-economic background than by asking for monthly income or other socio-economic determinants which often don't yield valid answers or involve feelings of shame and reluctance to answer. The outcome is that we could well capture different living conditions in the survey, often with statistically significant differences.

The semi-structured interviews included a question about the types of people who live in one's neighbourhood. The answers we have received confirm the applicability of distinguishing between complete houses (mostly concrete or earth houses), houses under construction which are often self-built houses by people who have managed to generate an income and settle more permanently. Many times, these houses can be identified by unfinished rooftops because inhabitants plan to add another floor in the future. The third group consists of people who still find themselves in a precarious setting. The latter are often characterized by living in sheet metal houses, tin huts or containers. Some of the interview participants were asked to describe their own housing situation and the types of houses they see in their community. In several statements the participants used a similar phrasing of housing conditions such as the following:

> *"The types of houses in my community are hard houses for some wealthy people and houses under construction like mine." (F6)*

Table 2: Socio-economic differences by housing condition

Characteristics from sample (N=392)	Complete house (N=198)	House under construction (N=117)	Precarious (e.g., metal sheet or tin houses) (N=76)
Unemployment rate	20.7%	39%	**63%**
Employed	42%	30%	**9%**
University Education	31%	19%	14.5%
Only Primary School	13%	31%	50%

Looking into the socio-economic data of each subgroup, namely "complete house", "house under construction" and "precarious" (e.g., metal sheet building) confirms the validity of this approach. People living in precarious living conditions e.g., metal sheet houses tend to be less educated, have lower income, and communities have poor access to basic needs, which will be further discussed in chapter 4. Energy and Ecosystem. The category "house under construction" lies somewhere in the middle and includes people from precarious settings who are in the process of stabilizing financially or are simply reluctant to admit that they are living in precarious conditions.

While approximately every 5th resident of completely built and finished houses is unemployed, a staggering amount of 63% inhabitants of precarious houses is. The same holds true vice versa when looking at the percentage of employed people with 42% and an extremely low 9%, respectively. Also, the statistics for education speak for themselves. Half of the respondents from precarious settings finalized their school education at aprimary school, in comparison to 31% with a university degree in complete houses.

Naturally, it is not clear sometimes whether a house can be considered under construction or complete. Hence, the categorization is subject to errors and biases. However, due to the great number of observations in our data, the socio-economic differences between different types of houses are visible and statistically significant. The same holds true for much of our further analysis of the data. We conclude that the descriptions of different types of houses is a powerful proxy to capture socio-economic conditions of study participants.

For the following analysis and presentation of the data we have decided to sometimes compare the two opposing housing conditions "complete house" and "precarious" to portrait differences concerning socio-economic background. In the following sections of the document, we occasionally exchanged the wording "complete house" for "stable", in order to make the comparison more comprehensive and intuitive.

4. Energy- and Ecosystem

This chapter deals with the first of three aspects of interest in the study, “Energy- and Ecosystem”. It looks at different variables such as people’s awareness about climate change, the environment and renewable energy sources as well as their access to basic needs and their perception of the energy system.

4.1. Awareness about Climate Change, environment and renewable energy sources

The extent of awareness about climate change and environmental degradation as well as knowledge about existing innovative technologies may be one critical aspect when it comes to drivers of support for the transition to renewable energy. A similar driver for the desire for change may be the extent to which people have sufficient access to basic needs such as water and electricity. This sub-chapter explores these aspects by analysing the results of the questionnaire survey while drawing insights from the semi-structured interviews.

4.1.1. Knowledge about Climate Change

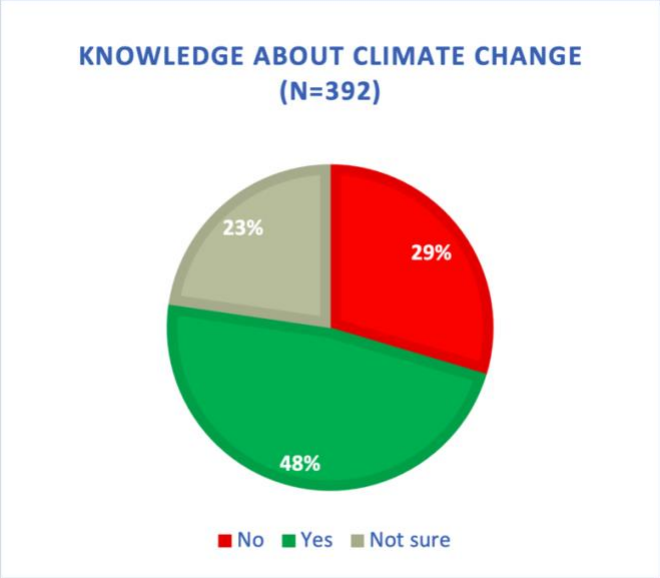

Figure 7: Pie-chart knowledge about climate change

Due to the geographical position of Mayotte, the island is vulnerable to be impacted by human caused climate change. Being aware of this can act as a catalysator for the adoption of mitigation strategies such as the transition to renewable energy. Therefore, we asked participants in the study whether they have heard of the term climate change. Other than in mainland Europe where approximately 93% of the population considers Climate Change a serious problem, only around half of the participants in our study on Mayotte certainly know what Climate Change is ("European Comission", 2021). 23% are not sure and almost a third does not know about Climate Change.

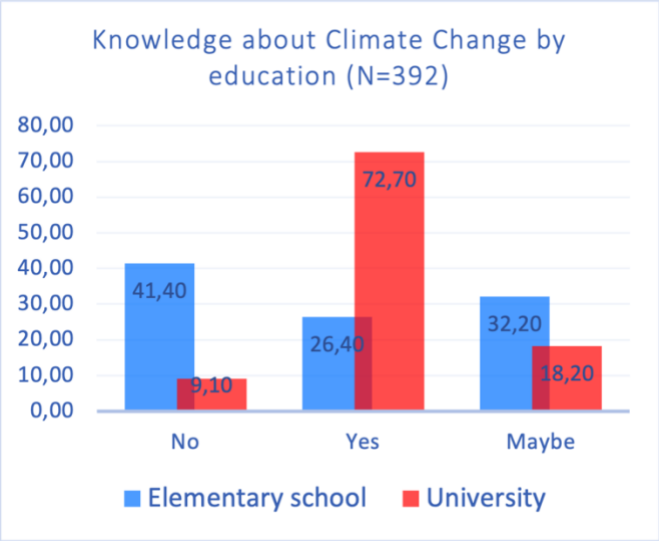

Figure 8: Bar chart knowledge about climate change by education

The knowledge about Climate Change directly corresponds to the education of the participants. Whereas most people (72%) who received a university education answered the question with "yes", study participants who only visited primary school most often don't know what Climate Change is or are not sure. The same observation can be made when looking at the more unstable living conditions and social backgrounds which usually correlate with lower levels of education. As described in the following section, the role of education was highlighted in several interviews with both lay people and key-informants.

4.1.2. People's voice: Awareness is a matter of age and education

In our questionnaire survey, a great percentage of the population finds that the local population should take responsibility for the environment/Climate Change. However, the qualitative data we have gathered from the interviews offer a more nuanced view on the topic and reveal a shared scepticism concerning the general environmental awareness of the island population and further highlight the intergenerational differences often related to education.

In Mayotte, some citizens like to engage in local community projects such as beach cleaning missions or awareness raising campaigns, organized by the municipalities. Especially among young people, taking responsibility by volunteering with a local association or the civil service is common.

> *"They (the people) don't care too much about the environment here. Let's say that it's more the municipality, the associations and some volunteers who take care of it." (M4)*

On the other hand, individual action often stems from economic incentives, such as saving energy costs:

> *"They throw a lot of rubbish in the street. They never talk about the environment, or at least they don't talk about it much among themselves. When they do, it's to avoid economic problems. Nevertheless, the municipality often organizes beach and street cleaning days (town hall)." (M2)*

This statement about economic incentives is illustrated even better when listening to the voice of another interviewee on the environmentally friendly actions undertaken by the local population:

"They are careful not to waste too much, for example with the air conditioning, they only turn it on in the evening to sleep. During the day, they open the windows to let the air in." (F6)

One of our key-informants from the north of the island stated that people do not care about the environment; one only would have to look at the beach or the rivers and see all the disposed waste everywhere.

Further, environmental awareness and concerns are described as an intergenerational issue and deeply related to education.

"The older people don't really know the role of the environment and they don't know anything about the environment or the role of the environment." (F4)

Asked for the underlying reasons, a representative of the municipality answered:

"Because they have not been educated about it. The new generation, thanks to the school, certainly. It is at school that we were best taught about environmental issues. Most of the older people here don't have these notions, and the same goes for most of the immigrants who never went to school or who were not made aware of all these environmental problems." (M4)

The matter of generational differences has also been raised in relation to a potential community renewable energy project:

"It will work, but it would mostly be with the new generation. The older generation doesn't calculate these issues too much. Maybe if they see that the new generation is involved. They will do the same. Then we will have something beautiful."

(Key-informant, CADEMA)

4.1.3. Knowledge about Renewable Energy Sources (RES)

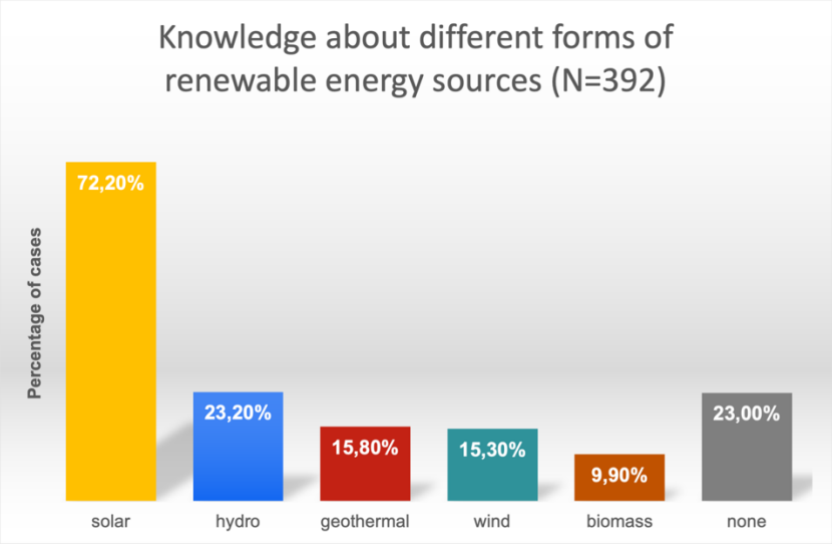

Figure 9: Bar chart knowledge about different RES

Enquiring the knowledge of citizens about different forms of Renewable Energy Technology (RET) revealed the following: the general awareness about a variety of different forms of RET is seemingly low. What can be said is that among the different forms, solar technology stands out by far as the most known technology. One reason is that Mayotte has experienced a visible increase in installed solar panels across the island. Many roofs, such as the big market building near the harbour of the capital Mamoudzou have recently been equipped with solar panels, and some municipalities have started to install solar street lighting systems.

A Chi-Square test of statistical independence provided evidence that the knowledge about different forms of renewable energy sources depends on the level of education. Figure 10 shows these differences. What is clearly visible is that participants with a university degree have much higher awareness, especially about forms of renewable energy other than solar. More than one third of the participants who visited school up to the age of 15 could not name a single source of renewable energy. While the percentage of cases who know about a particular form of RES increases with the number of years spent in school, we also see that the pattern looks different in the case of solar.

As mentioned before, there is the phenomenon of stolen solar panels from the municipalities or independent power producers (IPPs), which are allegedly used in informal and precarious settlements. Through our observations and conversations with key-informants we can confirm that solar technology is already used in some marginalized communities as a means of electricity supply. According to one informant, this response to the lack of reliable access to electricity has even made some slum-residents “experts in solar technology”.

> *“People are not stupid. Solar panels are existing everywhere, so they steal them and install them on their own house.”*
>
> (Key-informant, City of Koungou)

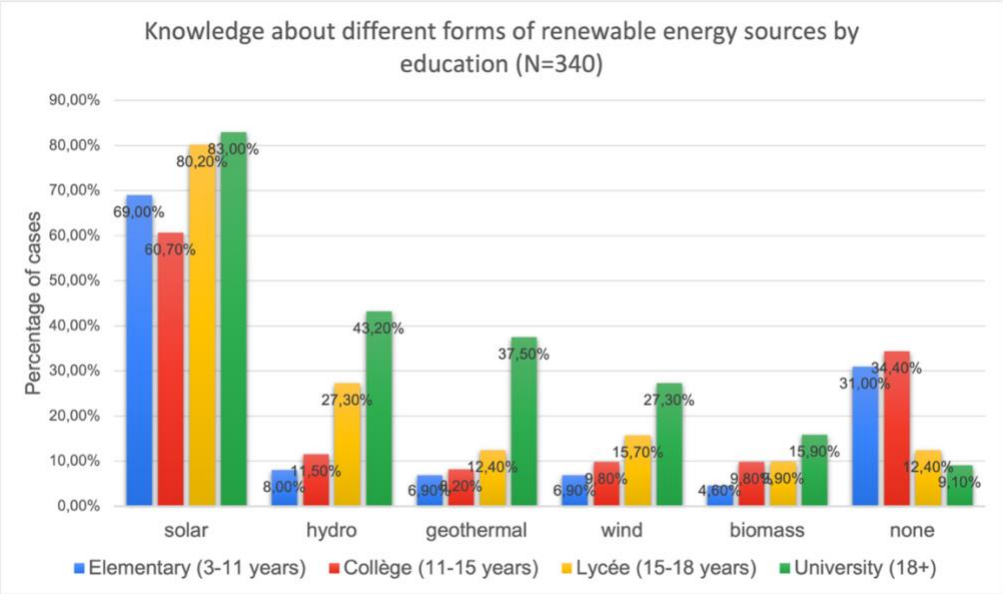

Figure 10: Bar chart knowledge about different RES by education

The data display that the knowledge about solar energy is about as high (73,7%) in precarious settlements, where levels of education are relatively low, as in the group with “complete houses” (78,3%). We also heard that some stolen solar panels are shipped to the neighboring Comoros-Islands to help family members which is another stark sign for the increasing demand for energy access and renewable energy technology in the region.

4.2. BASIC NEEDS AND THE STATE OF THE NATURAL ENVIRONMENT

The factor Energy- and Ecosystem covers a variety of variables which inform about the population’s access to basic services, the perceived condition of the natural environment and the general satisfaction with the energy system. The data yielded relatively high scores, however with major differences when comparing different housing- or living conditions.

The factor combines all likert-score-variables included in the factor, as listed in Table 1. The median score of the factor itself is situated at 4 which can be interpreted as “good” or “high”. The minimum and maximum values are 1 for “very bad” or “very low” and 5 for “very good” or “very high”. 75% of the observations are situated between 3 “neutral” and 5. In the following subchapters, we present each individual variable informing about the access to basic needs and the state of the natural environment.

4.2.1. Access to electricity

People were asked to rate their access to electricity and how it has changed over the last 5-10 years. Almost two third of the population rated their access to electricity as good or very good. Nevertheless, one should keep in mind that our sample may oversee people in informal settings who are not connected to the main grid. It should also be considered that a high number of people rated their access to electricity as "neutral". This could mean that they think that their access to electricity is neither good nor bad. It could also imply a reluctance to speak about the topic due to shame. When looking at how people rate their access to electricity in comparison to 5-10 years ago, 40% indicated that it is now "much better" and 25% "better". This indicates that, while the situation in Mayotte for many people is far from perfect, and a great part of the population still lacks sufficient and reliant access to electricity, for many the situation has seen an improvement over the last years.

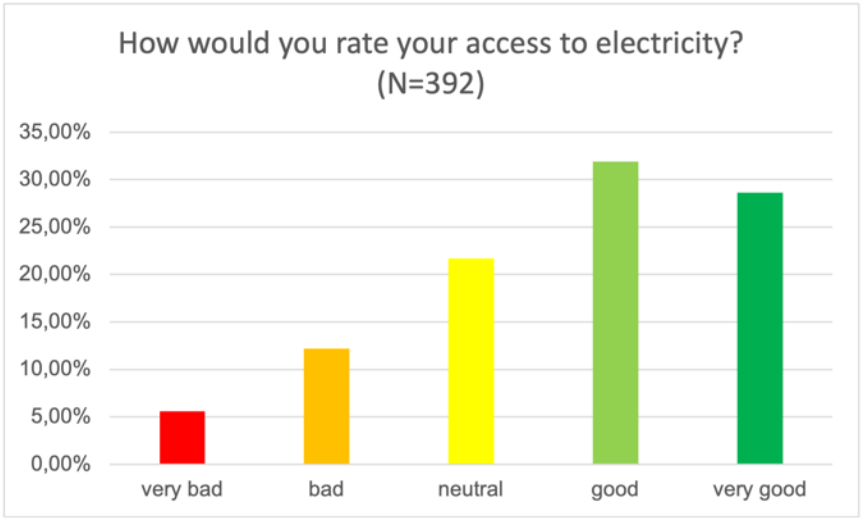

Figure 11: Bar chart access to electricity

4.2.2. Access to water

The access to water has been rated like that of electricity. It should be noted, however, that more than one out of six persons have stated that their access to water is "bad" or even "very bad". Further, more than 20% have rated their access to water with "neutral" which is again a sign for insufficient access. Again, a big proportion of 35% and 25% have stated that their access to water has improved to "much better" or to "better", respectively.

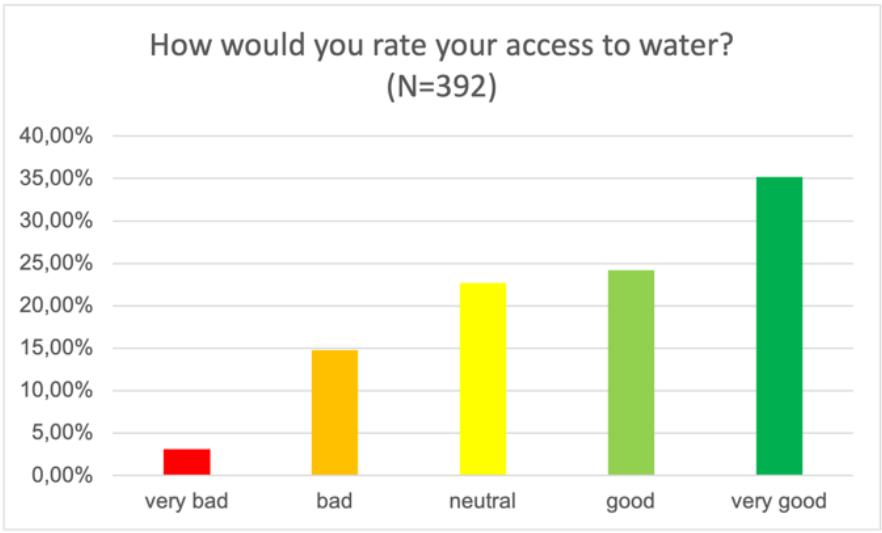

Figure 12: Bar chart access to water

4.2.3. State of the natural environment

More than half of the participants have rated the state of their close natural environment as “good” or “very good”. More than 20%, however, have stated that the state of the environment would be rather “bad” or “very bad”. Again, there is a large proportion of almost 25% who neither say “good” or “bad”. In this context it should be noted that many people perceive the growing amount of waste disposed into nature as a severe problem. One interviewee stated:

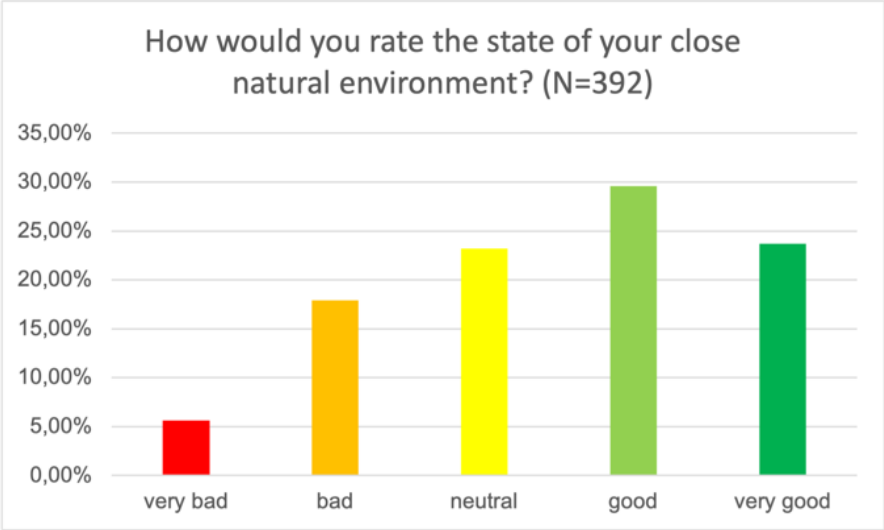

Figure 13: Bar chart state of the natural environment

“Mayotte is a small island, and at the rate we are going in terms of waste and pollution, we risk being buried by our own waste, and making us sick, and making our island despicable.” (F2)

4.2.4. Socio-economic background matters

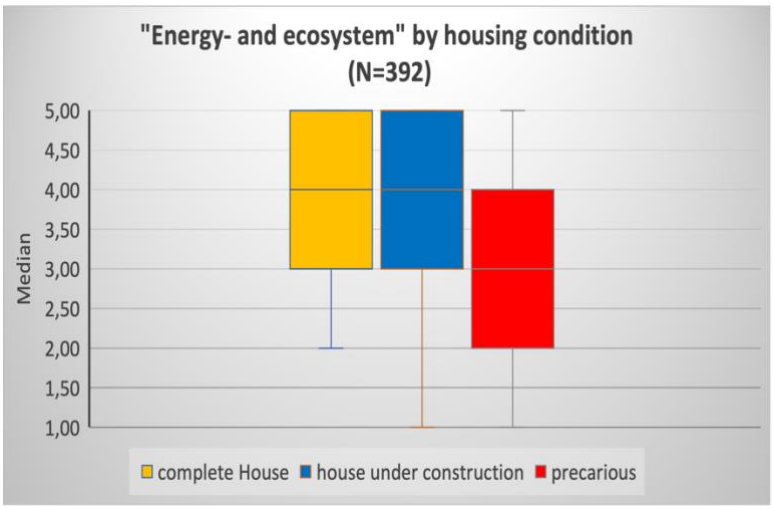

Figure 14: Box and whisker plot factor "Energy- and Ecosystem" by housing condition

As mentioned before, the data reveal significant differences between different housing conditions. The box and whisker plot in Figure 14 shows the distribution of the factor “Energy- and ecosystem” by housing condition. Participants who stated that they lived in a complete house, or house under construction, on average are well satisfied with the energy- and ecosystem.

The inter-quartile-ranges for both groups is situated between 3 “neutral” and 5, “very good” or “very high”. On the contrary, scores indicated by tenants of precarious settlements are significantly lower, as has been tested via Chi-

Square test of independence. The lower and upper quartile for the group “precarious” is situated at 2, “poor” or “low” and 4 “good” or “high”, respectively.

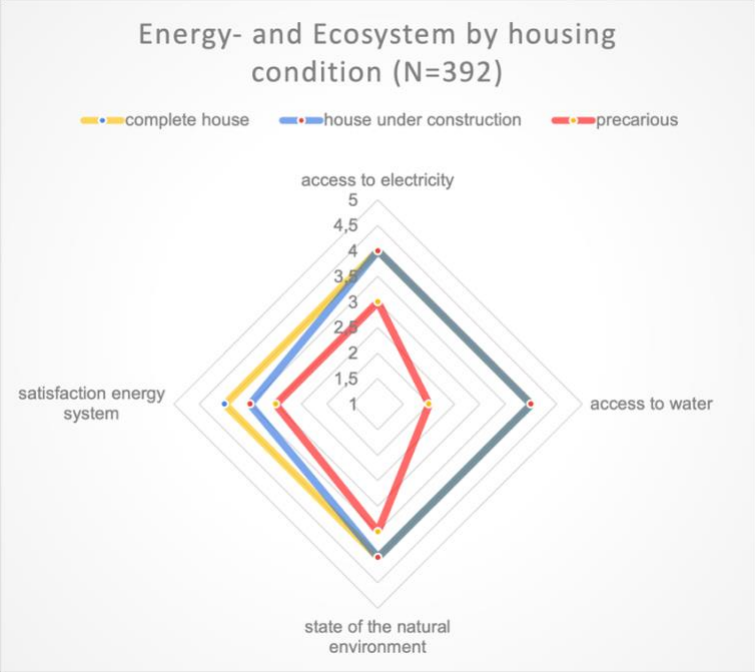

Figure 15: Radar chart of factor Energy- and Ecosystem

The differences in the described factor become even more visible when looking at some of the included variables individually, as in Figure 15. Especially *access to water* with a median value of 2 = “bad” for the group “precarious” shows how stark the discrepancies between different housing conditions in Mayotte are. Official statistics (NNIE) state that an approximate 30% of people in Mayotte do not have reliable access to water. This rough and rather conservative estimation is confirmed in the data of our study, which show that 75% of participants who admitted living in precarious settings rated their access as worse or equal to “neutral”.

4.3. PERSPECTIVES ON THE ENERGY SYSTEM

In this section, we take a closer look at the energy system and how people perceive it. Figure 16 presents the distribution of answers on a 5-point-likert-scale. While approximately half of the population is somewhat or very satisfied, a relevant proportion indicated that they are not really or not at all satisfied with the energy system in Mayotte. A high share of 30% expressed that they were neither satisfied nor unsatisfied with the energy system.

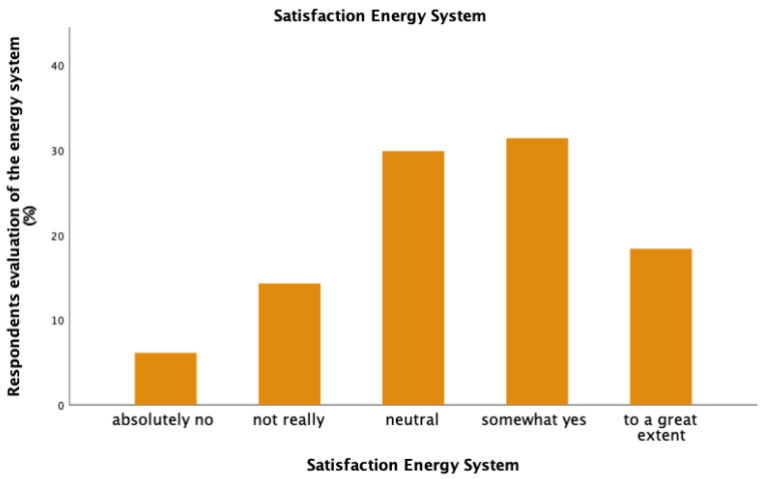

Figure 16: Bar chart satisfaction energy system

To look behind the different causes for the dissatisfaction, participants were asked to state reasons for complaint. Most people answered the question even if they indicated that they were overall satisfied.

4.3.1. The energy system: Too expensive and bad for the environment

In total, 313 participants have mentioned reasons for complaint. Among the main causes for dissatisfaction were the high costs of electricity, service issues, environmental damages caused by the energy system as well as safety issues. Figure 17 shows the distribution of answers of the entire sample.

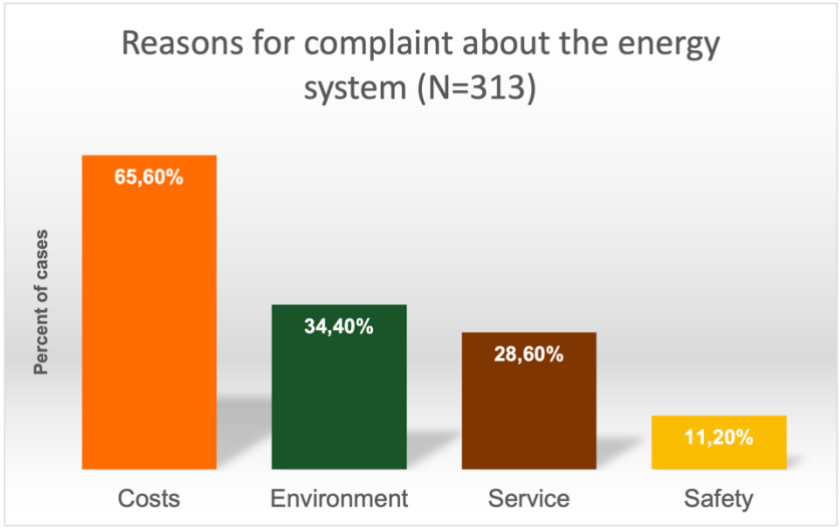

Figure 17: Bar chart reasons for complaint about the energy system

The data depict that electricity or the energy system is considered too expensive for most people, with the group of self-employed being the largest group filing this complaint. Despite the fact that the electricity prices in Mayotte are subject to subsidies and therefore lower than normal, for many people, especially with low income, the costs are still substantial. Interestingly, high costs have also been mentioned frequently by people with stable socio-economic backgrounds. This may be for two reasons: First, their complaint looks at the energy system from a wider perspective, instead of only the individual electricity bills. The import of fossil fuels to generate electricity in Mayotte is indeed very expensive and many individuals are aware of this problem, in particular those with higher education. Second, households already enjoying stable and reliable access to electricity and don't have much to complain about, may still hope hope for cheaper bills as a consequence of their complaint.

4.3.2. Educated individuals are more concerned about the environment

Education plays a role related to complaints about the energy system. A Chi-Square test of independence revealed significant differences in respect to education. Especially educated individuals regard the environmental aspect of a fossil fuel-based energy system as problematic. From all the study participants who have a university degree, more than half complained about the environmental impacts of the current energy system. In comparison, only around 25% of less educated individuals shared this view.

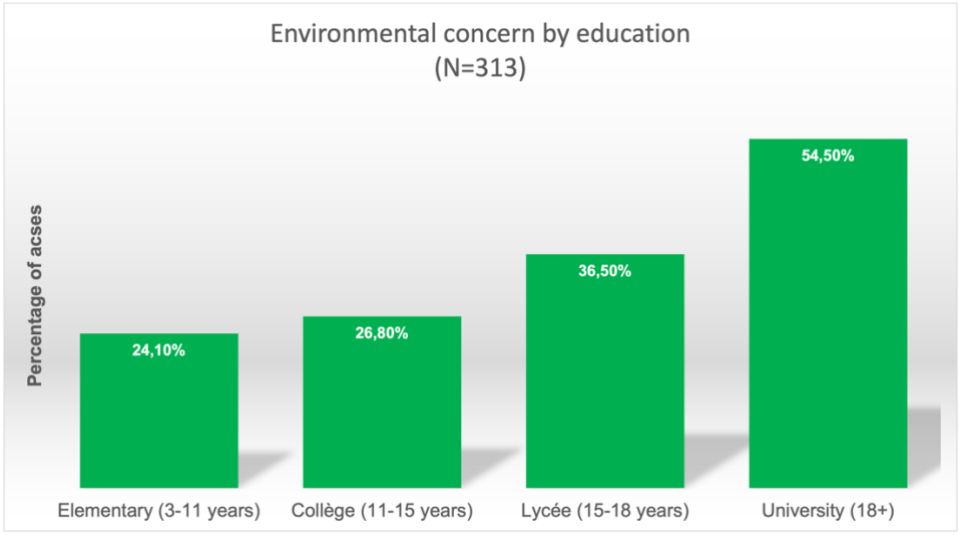

Figure 18: Bar chart environmental concern by education

4.3.3. Marginalized populations are exposed to service and safety issues

Strong contrasts between socio-economic backgrounds can also be observed when exploring safety- and service issues. These are named often by people with a precarious background. Service complaints are mentioned by almost 50% of the vulnerable part of the population. This group experiences frequent power cuts or, in the worst case, is not connected to the main grid. This is the case in many informal settlements. In some of these areas, electricity is obtained through illegal means via energy theft which can be very dangerous, especially when cables are hidden in water pipes, as described by one of our key-informants from the city of Koungou in the north of the island.

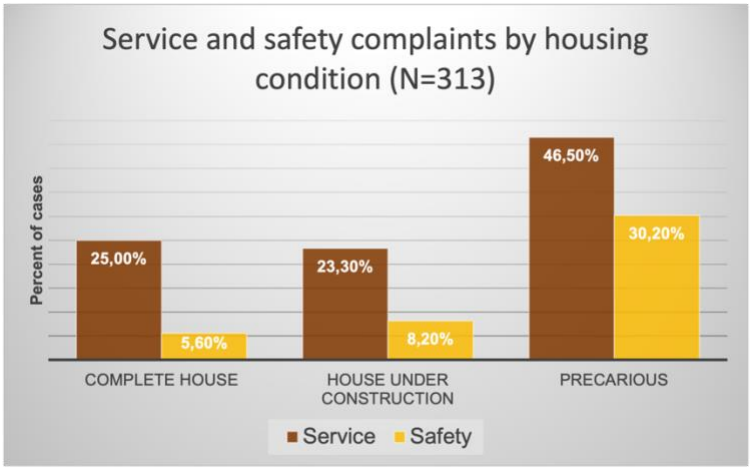

Figure 19: Bar chart service and safety issues by housing condition

5. Community and Society

Community may mean a lot of different things to different people. Therefore, it can be difficult to assess the perspectives on community in a quantitative survey. In most of the semi-structured interviews, participants defined community as a set of shared identities, language, and culture. For some, it is equivalent to one's neighbours, one's kin or religious group, the municipality or even the entire island of Mayotte. Other interpretations for community refer to a sense of having a common project or goal which is pursued as an organisation or association.

In this chapter we will first look at the survey results. Further, we will have a closer look into the qualitative data we have obtained and see that views on community life in Mayotte can be quite opposing to one another. Overall, we conclude that Mayotte is characterized by a very vibrant and complex community life which is, while hard to put in numbers, equipped with decent levels of solidarity and a high willingness for mutual aid and support. On the other hand, the Mahorais community life is characterized by intense and often historically rooted community rivalries, especially between neighbouring villages.

5.1. Factor Community Spirit

The factor "Community spirit" combines variables informing about aspects of community belonging such as trust and the willingness to ask one's neighbours for help. The median score of the factor itself is situated at 4 which can be interpreted as "high". The interquartile interval, where 50% of the data is found, is situated between 3.5 and 5.

5.1.1. Individual variables of factor Community Spirit

This section presents, describes and interprets each community variable in detail.

5.1.1.1. Trust in community

Figure 20 shows a bar chart with the distribution on the respective 5-point-likert scale about the levels of trust in one's community. 32% of the sample indicated that they somewhat trust the people in their community and 30 per cent do so with high certainty. Generally, the levels of trust are high which is an important precondition for the successful establishment of a community energy project or the involvement in local energy

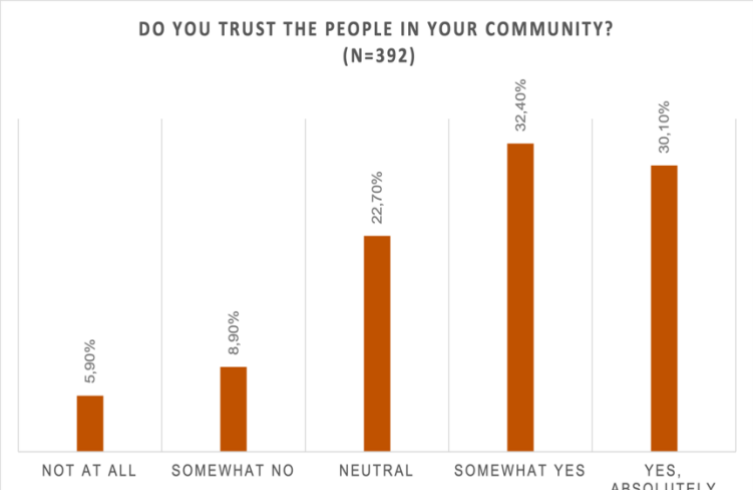

Figure 20: Bar chart trust in community

communities. For instance, the levels of trust may affect people's willingness to collectively invest money. In this case, it is left open to the participants on how they define community. The median value of the variable is 4, "somewhat yes".

5.1.1.2. Trust in authorities

Like trust in one's own community, it is important to have sufficient trust in local authorities, especially, if an energy project consists of public-private partnerships, in which case municipalities or other public bodies are involved. Figure 21 shows the distribution of the variable *trust in authorities* on a 5-point-likert scale. The median value is situated at 4 "somewhat yes". It becomes visible, however, that the distribution of answers slightly differs from the variable *trust in community*. On the one hand, on third of the people have indicated to absolutely trust the local authorities. On the other hand, one out of five have indicated to have somewhat no or no trust at all. Most likely, this can be attributed to the answers given by people from informal settlements who, due to their situation, are sceptical towards the local authorities. This aspect will get more attention in chapter 5.1.3. trust and solidarity.

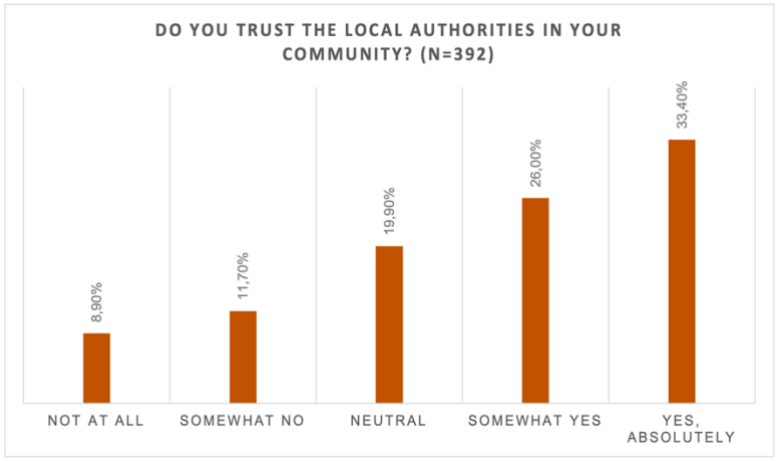

Figure 21: Bar chart trust in authorities

5.1.1.3. Social net

We also asked participants whether they have the feeling of being part of a social net. The question approximates the level of solidarity within a community as well as the existence of a shared social identity. It can also inform about the level to which people have the feeling that the authorities or other communities are willing to provide help when needed. The median value of this variable is 4 which represents the answer "somewhat yes".

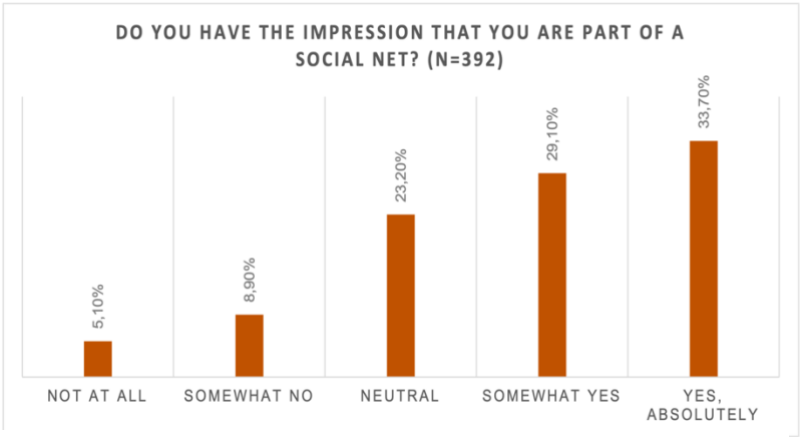

Figure 22: Bar chart social net

5.1.1.4. Pride in community

Identification with one's own community, a sense of belonging and a feeling of shared responsibility can be crucial when it comes to establishing a community project. The variable *pride in community* which is presented in Figure 23 informs about this sentiment. The median value is again situated at 4, "somewhat yes". Interestingly, more than 40% of the asked participants indicated that they are very much proud of their own community and 30% do somewhat feel good about being part of it. Only a small minority of less than 10% have indicated that they don't have any feelings of pride when thinking of their neighbourhood or commune. Further we should note that a community energy project can also add to a sense of pride for ones' own community. Therefore, it would be interesting to re-assess this variable in a post-evaluation after a community project has been successfully implemented. In respect to pride, one of our key-informants mentioned:

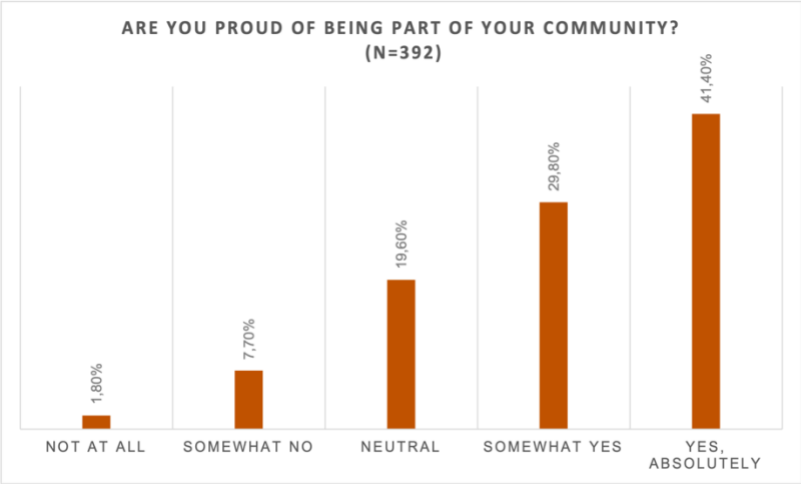

Figure 23: Bar chart pride in community

> "*Here people like to be proud, so if they can participate in the project, or even if the municipalities participate, that would be a good thing.*"

The potential of a community renewable energy project in relation to pride and a sense of empowerment through personal responsibility should not be underestimated as illustrated by a comment of the following interviewee:

> *"(…) in my neighbourhood nobody knows anything about energy. So it would be a source of pride for me to know all this about my neighbourhood." (F4)*

5.1.1.5. Ask neighbours for help

Finally, solidarity within a neighbourhood can be drawn from people's perception of the willingness to help and support each other. Therefore, we have introduced the variable *ask neighbours for help* to the questionnaire. Note that we have changed the wording by exchanging the term "community" for "neighbours". This controls for the different subjective definitions of community. While community can

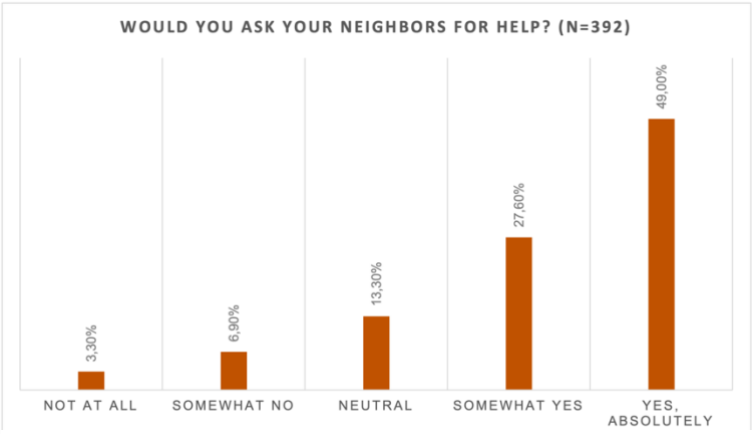

Figure 24: Bar chart ask neighbors for help

stand for the municipality, one's own kin or even the entire island of Mayotte, "neighbours" is more specific. Surprisingly, the results show that one out of two indicated that they would absolutely ask their neighbours for help. The median value of the variable is 4, "high", as for most community variables so far. The results of this data are very promising in respect to a community renewable energy project. It portrays an image of a society where mutual help and exchange within a neighbourhood are seen as natural and self-explanatory.

5.1.1.6. Adopt RET if neighbours do it

The variable *adopt RET if neighbours do it* intends to find out about the likelihood of people's tendency to copy their neighbours if they would install and use renewable energy technology on their property. Figure 25 shows the distribution of the respective 5-point-likert scale. The high median score of 5, "yes absolutely" is very promising, especially in respect to MAESHA which is intended as a demonstration project. More than 80% of the population would adopt innovative technologies if they would see that their neighbours did so as well. We can conclude that the effect of a successfully implemented demonstration site, and the establishment of some local energy communities can result in a wider acceptance and replication of such projects.

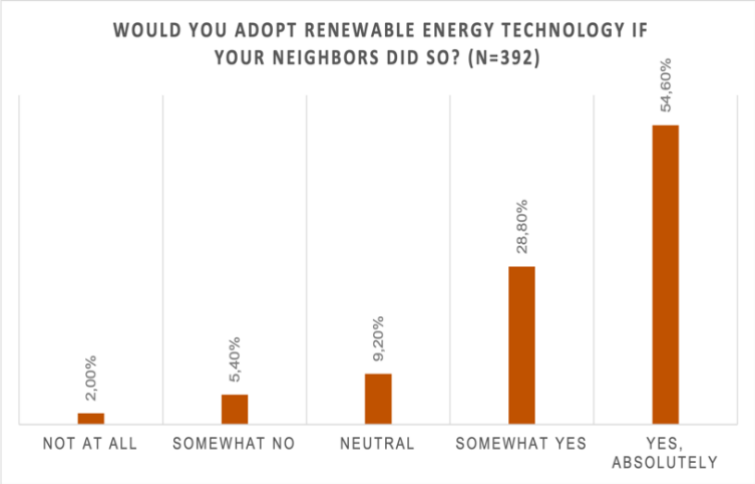

Figure 25: Bar chart adopt RET if neighbours do it

According to one community representative, the implementation and adoption of a technology will be easier in suburban neighbourhoods with individual houses compared to big housing complexes, for example those operated by Société Immobilière de Mayotte (SIM).

> *"The fact that it's more individual brings people together. I think that in this kind of neighbourhood, as soon as a neighbour doesn't participate, we'll know. Whereas in a bigger building like SIM's, I think it will be more complex"*

5.1.2. Radar chart of factor Community Spirit

Figure 26 shows the individual median scores of each included variable in the factor “Community Spirit”. The individual scores are ordinal values which represent answers on a 5-point-likert scale. The interpretation of the different values and a detailed description of each variable can be found in the prior section of this chapter.

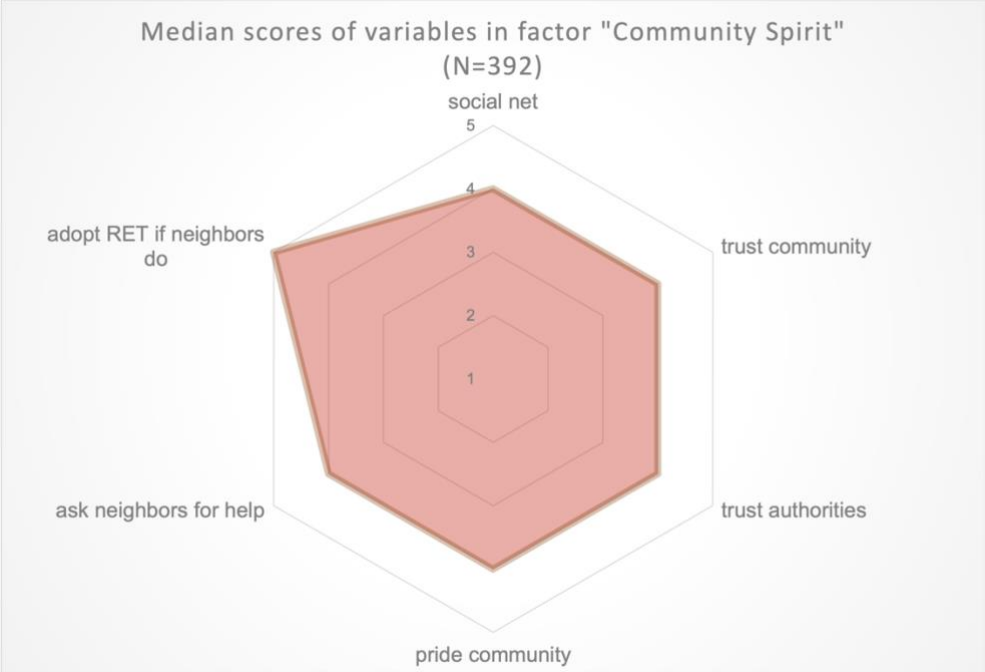

Figure 26: Radar chart with median values of different community variables

5.1.3. Trust and solidarity

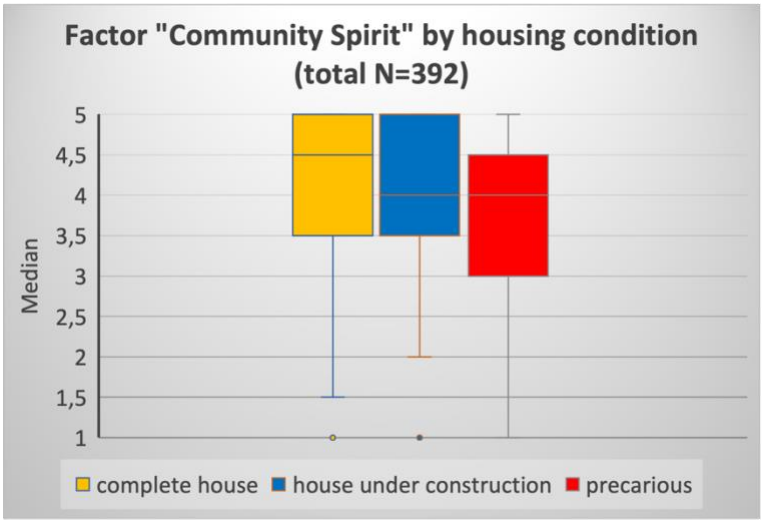

Figure 27: Box and whisker plot Factor "Community Spirit" by housing condition

Like the factor *energy- and ecosystem*, differences between housing conditions become visible in the data and are statistically significant. On average, community spirit is lower, the more unstable the living conditions of participants are.

The box and whisker plot in Figure 27 displays these differences. For the groups "complete house", "house under construction" and "precarious", the median values are calculated at 4.5, 4, and 4, respectively. Despite having a similar median value, the plot visualizes that the interquartile range of the group "precarious" is situated at a lower level. This interval in which 50% of the data is found, lies between the values 3 and 4.5 with a minimum value at 1. Note that outliers of the other two groups can also be found at the value 1.

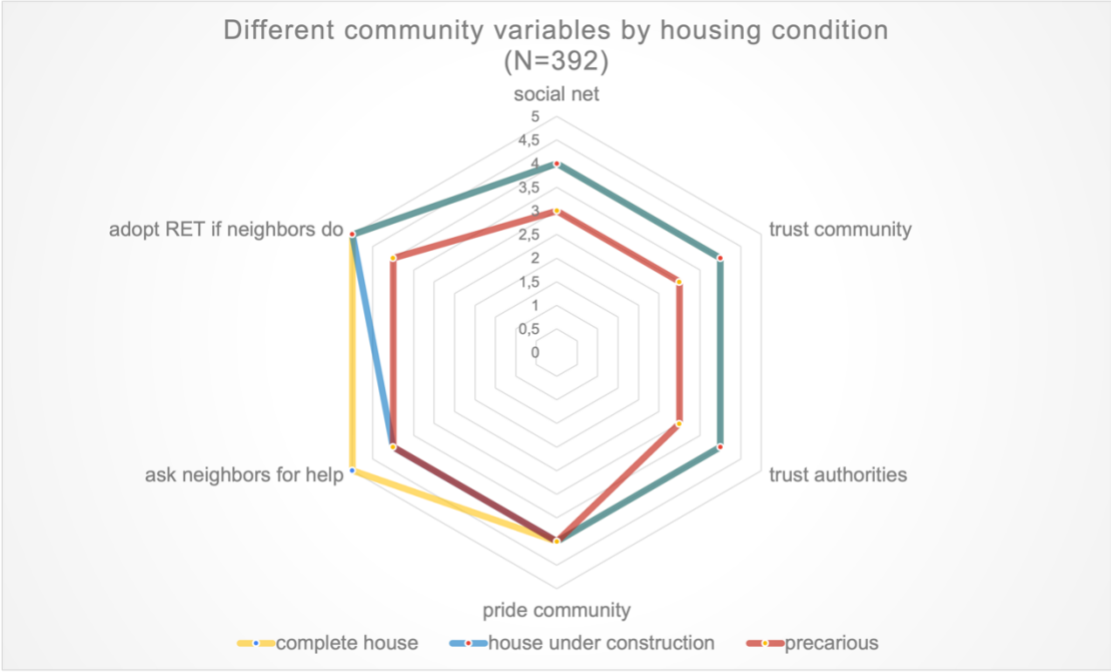

Figure 28: Radar chart of different community variables by housing condition

Exploring the individual variables in the factor *community spirit* we discovered that people from a precarious background are characterized by significantly lower levels of trust in authorities and the "community" and less often have the feeling of being part of a social network. For example, 38.2% of participants from precarious contexts indicated to have little or no trust at all in local authorities compared to only 12.6% who indicated the same in the group "complete house". Yet, there are no significant differences when asked whether individuals would ask their neighbours for help. We conclude that the term "community" may have been interpreted by some of the participants from precarious settings as the municipality ("communauté") or the wider Mahorais society. The Radar chart in Figure 28 displays these differences.

While trust and social cohesion may be lacking in relation to the wider Mahorais society, or even the government and municipalities, communities may stick together internally and support each other. The same seems to hold true in marginalized communities. When asked what she liked the most about her community, one 22-year-old Mahorais citizen said:

"I think of the solidarity, here people help each other a lot in case of problems."

The fact that the solidarity within communities is high can be observed when looking at the phenomenon of mutual financial support. Some families practice a type of mutual support system where every family gives a certain amount of money in a collective which will then be paid to one family of the community. After each period, another family takes turns and receives the money from the collective. This way, families do not only support each other and form an informal social net but create a form of interdependence and a strong social cohesion.

Similar conclusions can be drawn for *trust* within communities and towards outsiders. We heard many times that everybody in a village knows one another but that there are strong rivalries between villages. According to one anonymous key-informant the lack of trust towards authorities does not only stem from the precarious legal situations some settlers find themselves in, but also from the inaction of local politicians. Some districts have not experienced any changes or have seen any investments in their neighbourhoods. Despite promises by local authorities to change and improve the living conditions of the precarious population, not much has changed over decades. This inaction has caused levels of trust in public bodies to diminish over the last years. Some parts of the population are left with the feeling of simply being forgotten. It can be challenging for new projects to restore this lack of trust and project initiators should be careful to not make any empty promises. A helpful strategy to involve communities and to win back the necessary trust, is by working very closely with community representatives or local mediators. These can serve as a trustworthy bridge between the local population and the project initiators. These mediators have the knowledge and experience necessary to communicate projects goals and help monitoring public perception.

5.1.4. People's voice: It needs trust, solidarity and leadership

While solidarity within some communities proves to be very high and most people seem generally optimistic when speaking about their own community, other interviewees had quite opposing opinions and expressed their frustration about the community life in Mayotte. This following study participant who lives in a complete concrete house, surrounded by mostly metal sheet houses said:

> *"In my community it's everyone for himself and God for all, there's no community like there used to be, no solidarity (…) There is no longer the mutual aid that there used to be, we live in a sort of competition, so everyone wants to have more than the other. This creates jealousy and hatred between those who have a lot and those who have nothing." (F4)*

A similar statement comes from the following person:

> *"We are in a society where we are more and more individualistic. I'd like to see more about bringing people together." (M2)*

While her opinion is one voice of the many on the island of Mayotte, she underlines once more the social disparities and differences between the rich and the poor. It is vital to design future community projects as inclusive as possible and allow for an equal participation of all community members. There seems to be a shared hope that a community project can counteract the growing separation within communities and bring people together. When asked about the necessary conditions for her to participate in a community energy project, the same interviewee stated:

> *"First of all, this renewable energy community would have to be serious, there would have to be involvement from everyone, there would have to be leaders who run everything, and there would have to be solidarity between the participants, and most importantly, of course… to eat." (F4)*

Within the last statement the interviewee has raised the notion of leadership. It will be crucial for the success of a shared community project that it is equipped with community leaders who can speak to different groups and bring them all together. Being asked what it would need for her to participate, our key-informant from the CADEMA region confirmed the impression about leadership and a clear formulation of different roles:

> *"A lot of awareness raising at the beginning and training (having a community leader who will give meetings and training)…that I am not just a spectator in the community but that I can act. That I am told "ah it's you who is doing the maintenance this week, it's you who is going to do the surveys etc."*
>
> *(Key-informant CADEMA)*

5.1.5. Co-operative tradition

Wirth (2016) mentions the relevance of an existing co-operative tradition for the emergence of local energy communities. This can be measured by the number of memberships in clubs or organisations. Germany, for example, which is one of the leading countries when it comes to community initiatives and energy cooperatives, has a very vibrant culture of clubs and organizations. Almost half of German citizens are members of a club. Therefore, organizing and coming together in a formal setting comes natural to most citizens and helps establish new forms of organizations.

In Mayotte, only a minority of people mentioned being organised formally. Of 392 questionnaires, only 16% stated that they are members of a club, association, or organisation. However, it is important not to judge quickly. Despite not being as organized in formal settings compared to Germany, people still come together and solidarity within communities is high. It will be a new experience to be involved in the foundation of a co-operative or association and it is important that local citizens are going to be supported, for example through legal counselling and by members of the public administration and other experienced public actors such as CRESS (Chambre Régionale de l'Economie Sociale et Solidaire).

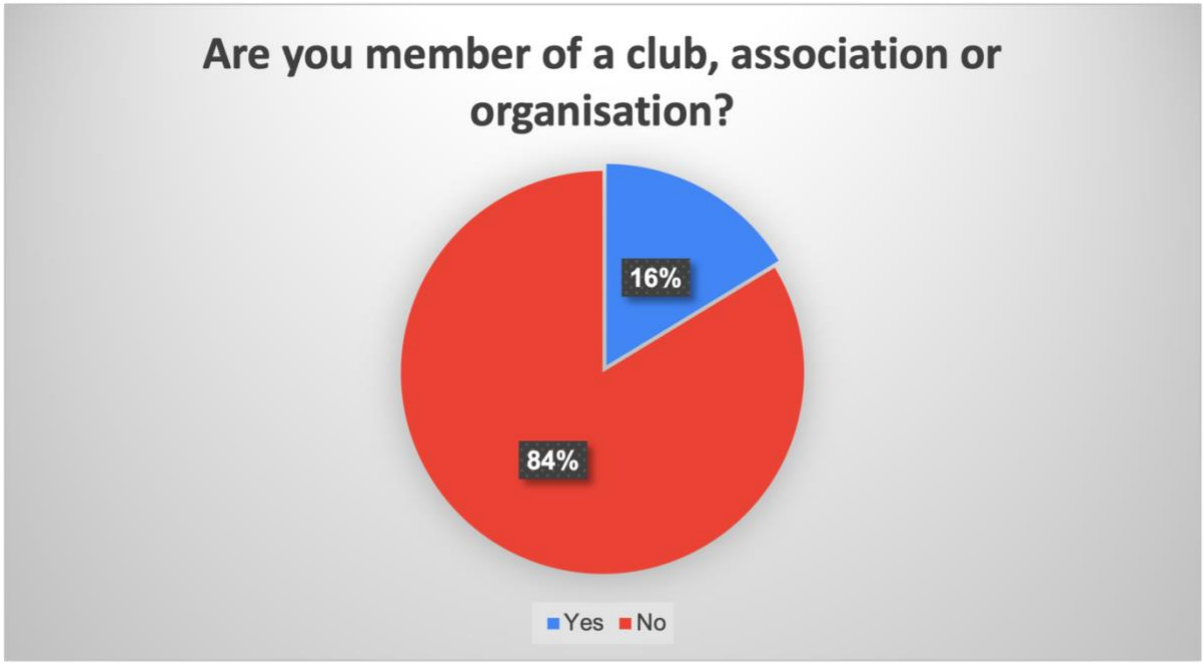

Figure 29: Pie chart membership in a club, association or organisation

6. Renewable Energy Technology and community energy

6.1. Support for Renewable Energy Technology (RET)

The factor renewable energy technology involves a variety of different variables which inform about the support and acceptance of innovative technology and the willingness and interest to participate in a community renewable energy project. The median score of the factor is situated at 5 which can be interpreted as “very high”. The minimum and maximum values are 2.5 meaning something between “low” and “neutral” and 5 for “very good”. 75% of the data are situated between 4 “high” and 5 “very high”. The data includes outliers at values 2 and 1.

The factor indicates that the support for renewable energy and a community energy project in Mayotte is very high. This leaves us with great optimism.

From the qualitative data we have gathered we get the same impression as from the quantitative data: Renewable energy is extremely popular especially among more educated individuals and the young generation.

Or to put it in the words of one of the interview participants: *“I would say it is the future”*

6.1.1. Individual variables of factor “Support for RET”

In this section, the individual variables of the factor “Support for Renewable Energy Technology” are explained and described alongside the graphs of their individual distribution on a 5-point-likert scale.

6.1.1.1. Support of RET in Mayotte

The variable *support of RET in Mayotte* asks whether study participants are in favour of more Renewable Energy Technology in Mayotte. As can be seen in Figure 30, the support is very high, indicating that most people generally wish to see more innovative technologies such as Solar Panels in Mayotte. The median value of the variable is 5. The same median value and a very similar pattern of positive responses can be observed for the variables “perceived advantage of RET in day-to-day life” and “perceived advantage of RET in professional life”.

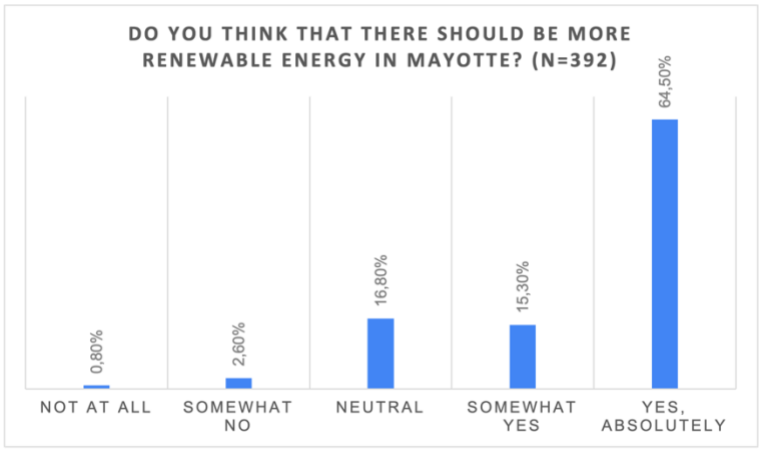

Figure 30: Bar chart support of RET in Mayotte

6.1.1.2. Solar panels either in proximity or on one's property

Aside from the wish to generally see more RET in Mayotte, we wanted to know from participants whether they would be in favour of having a solar panel installed in proximity to their property. This is an important question especially in respect to the phenomenon of "Not in my backyard (NIMBY)" which describes people's frequent reluctance to have Renewable Energy Technology such as wind turbines or solar panels installed close to their house.

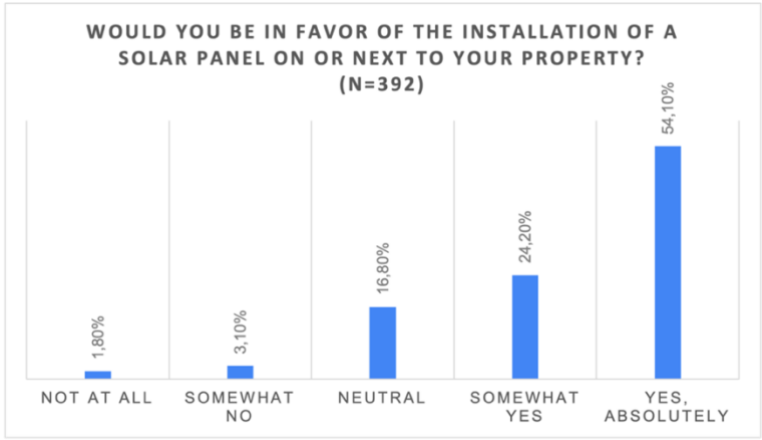

Figure 31: Bar chart solar panels in proximity

This form of reluctance mostly stems from aesthetic concerns, worries about noise pollution or a devaluation of one's own property. Fortunately, answers we have received tend to be quite positive. Note however, that when looking at scepticism regarding RET in Chapter 7, environmental concerns are expressed frequently and should be taken into consideration. The person in charge of the ecological transition in one of the municipalities underlined that many of the neighbourhoods are indeed reluctant to have photovoltaic farms installed close by to their homes.

Another concern foresees the potential theft of generation assets. In some neighbourhoods, people expressed their fear of theft and criminal actions in their surroundings in case of the installation of solar panels. This is because solar technology is widely associated with wealth and therefore may attract criminal activities.

6.1.1.3. Support community renewable energy project

People seem to be very supportive and curious about a community energy project. Figure 32 shows the distribution of the variable *support community renewable energy project.* Even though the term local energy community is unfamiliar to the majority, we experienced a keen interest in innovation and change. Around half of the study participants answered with "yes, absolutely". Less than 10 per cent formulated their reluctance to participate and only 15 % remained neutral on the topic.

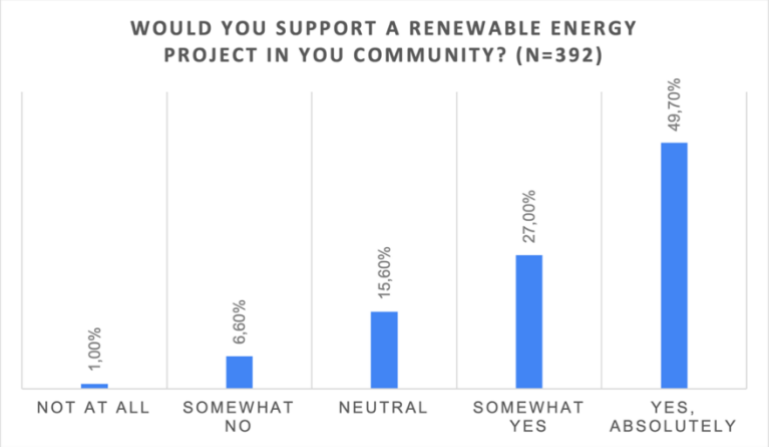

Figure 32: Bar chart support community energy project

6.1.1.4. Willingness to play an active role

We also asked participants about the likelihood of actively participating in a community energy project. The results are equally promising. Figure 33 presents the bar chart with the distribution of the responses over a 5-point-likert scale. Some people expressed their reluctance due to time constraints or lack of general interest. However, most people seem interested in becoming part of a community energy project and to take on different roles which are further explored later in this document.

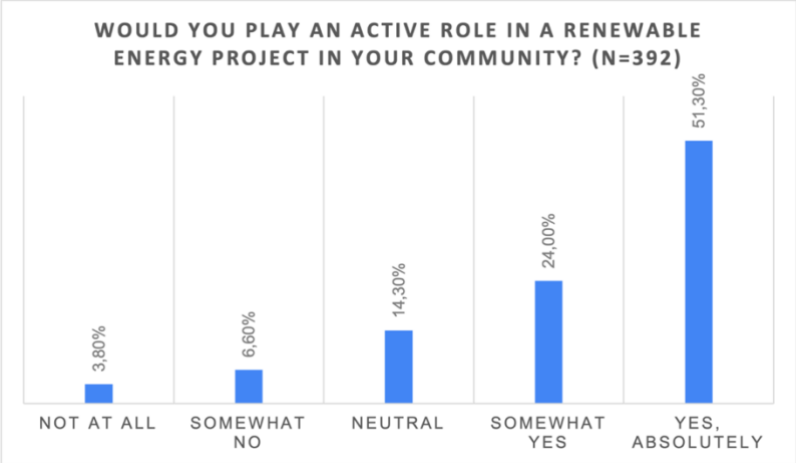

Figure 33: Bar chart willingness to participate

6.2. MOTIVES TO GET INVOLVED IN A COMMUNITY RENEWABLE ENERGY PROJECT

We also looked at the people's motives to participate in a Community Renewable Energy Project (CREP). Motives include financial benefits, a general sense of future sustainability and more concrete positive expectations such as environmental- and community advantages and a sense of personal responsibility.

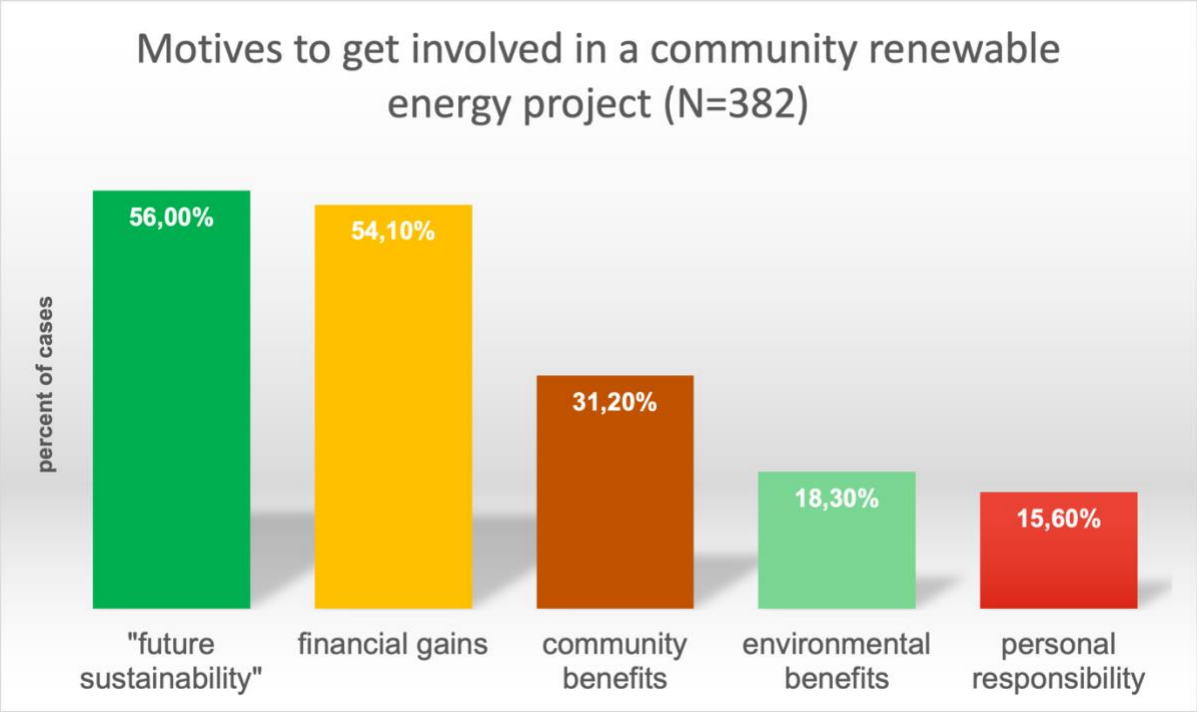

Figure 34: Bar chart motives for involvement in community renewable energy project

Generally, the biggest motive behind peoples' willingness to participate in a CREP is the perspective to gain some money and to contribute to a more sustainable future. Asked about his opinion on community energy and how it would affect his life, a 21-year-old high-school teacher told us:

> *"It would be a good thing {…} It will allow me to save money {and} it will allow me to be in a good moral situation, as everyone is responsible for the environment."*

6.2.1. "Sustainability" as a matter of privilege and education

The motives vary by looking at different groups by their profession. Students and employees most often chose future sustainability, followed by money and community benefits as their main drivers of motivation. Unemployed and self-employed participants valued financial benefits the highest, followed by future sustainability. Figure 35 makes visible how the priorities in terms of motivation shift when we distinguish between socio-economic background, approximated by housing condition. We see that almost 70% of the group "stable", indicated that sustainability was a driver for the participation in a community renewable energy project, compared to only 30% in the group "precarious". On the other hand, looking at money as a motivator, we see that the group "precarious" takes the lead with approximately 60% seeing it as their main priority. Nevertheless, money is also a driving factor for the rest of the participants.

We should also note that the high priority which is given to sustainability by people from stable and often educated circles, may certainly be attributed to the fact that these individuals are more accustomed to the term of sustainability (*durabilité future*) e.g., through the media.

Less educated people may associate less with the term but nevertheless value environmental and social aspects. This becomes visible when looking at environment as a motivator. Such an insight can be helpful when choosing appropriate narratives addressing different groups of people. On the one hand, educated individuals may be easy to attract by talking about climate change and future sustainability. On the other hand, those who have not enjoyed a higher formal education need more concrete propositions and ideas which are relevant to their lived realities. Likewise, one community authority representative expressed to us that most people would not be interested in "academic projects". They would be interested in small-scale, short-term projects which directly impact their lives.

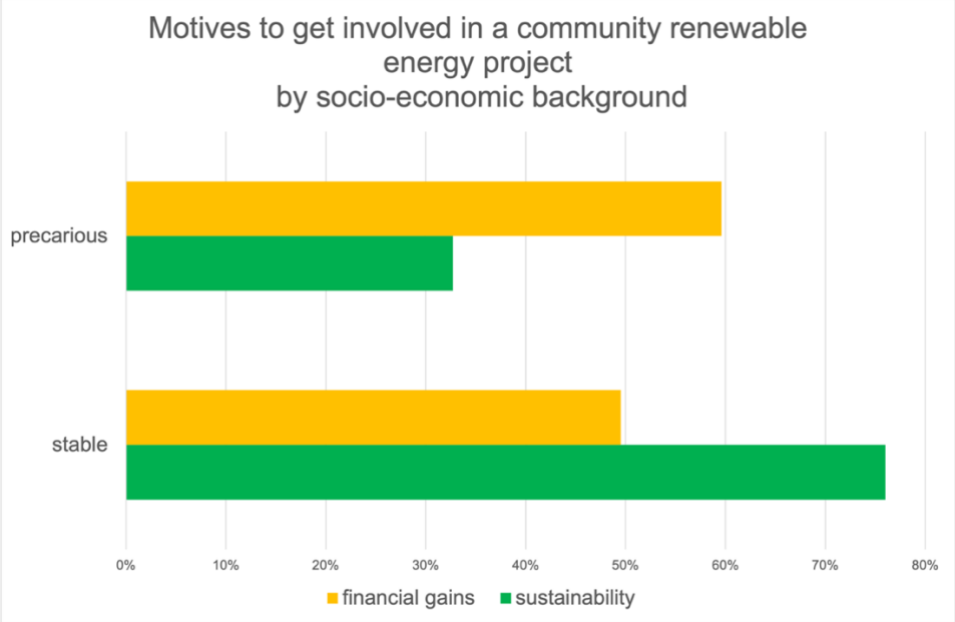

Figure 35: Bar chart motives by socio-economic background

6.2.2. Independence from local DSO

Some participants expressed their frustration about the dependence on the single system operator on the island. When asked about his complaints, one person said that it would not make a difference to express them because eventually one does not have a choice but to comply with the status quo. Here we can see a desire to have more options to choose from and to gain some sort of independence from the current system operator EDM. Ultimately, this may be a strong motivation in respect to local energy communities and to practice self-consumption.

One study participant stated:

"I would go and install solar panels to be less dependent on EDM and pay less bills." (F4)

6.3. Types of involvement: Community reunions and volunteering

The idea of Community Energy involves different forms of involvement of citizens in the energy system, for example in the management of Local Energy Communities. The type and intensity of involvement can range from low level participation in community reunions over financial contributions, to consulting roles and investing work and time in a project as well as taking on a leading position.

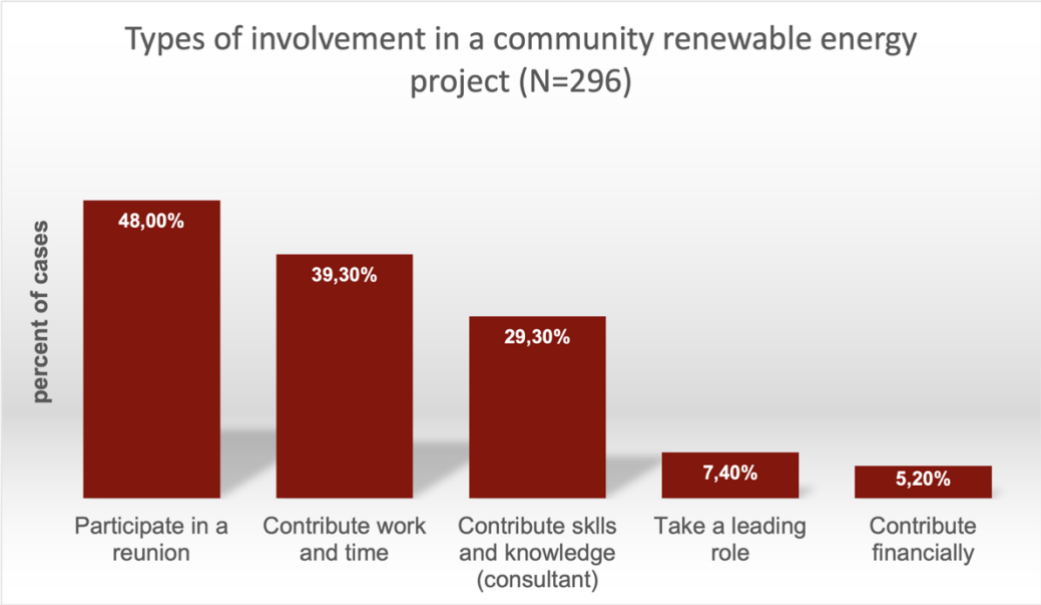

Figure 36: Bar chart types of involvement

Looking at the entire set of answers given by people who can imagine participating in a community renewable energy project, most people are open to participating in a reunion (48%) followed by

contributing work and time (39.3%) as well as skills and knowledge (29.3%). This has also been shown during our interviews where some interviewees have said that for now, they can imagine participating as a simple volunteer.

Only a minority of 7.4% and 5.2%, respectively, can imagine taking a leading role or by contributing money. From our interviews and prior research done on community energy we derive that those who already take on leading roles in their communities, for example teachers, are well suited and willing to also take responsibility in a community energy project. Apart from leaders, a community project calls for qualified mediators who do not only emit a sense of authority but are trusted by many community members. These mediators should come from the same village or neighbourhood as the rest of the project participants and take on a leading role.

6.3.1. Volunteering vs. working

We also split the sample by different subgroups and omitted the categories *leader* and *money* because of a lack of observations. A Chi-Square statistical analysis of independence indicated significant differences between different socio-economic subgroups and how they want to get involved. Students and employees as well as those who live in a stable socio-economic setting are keen to participate in a community reunion over contributing work or time. Moving towards more precarious living situations and the group of people who are unemployed or self-employed, the more likely it is that participants choose to invest work and time over joining a community reunion. The reason for this may be twofold. On one hand, people who already have a job or are students usually have less time available for extra work. On the other hand, considering the desire to gain financially, contributing work and time may be understood as finding actual work. Also, it must be considered that people from precarious settings are much more unlikely to visit community reunions due to their questionable legal status. Due to the suspicion towards local authorities, approaching

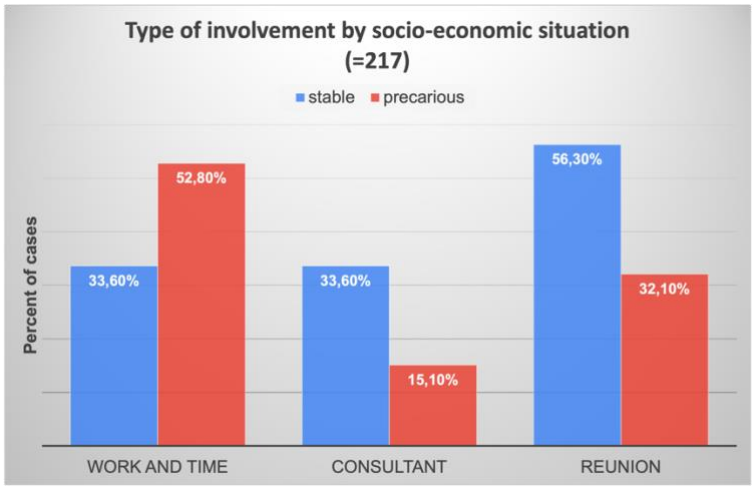

Figure 38: Bar chart type of involvement by socio-economic situation

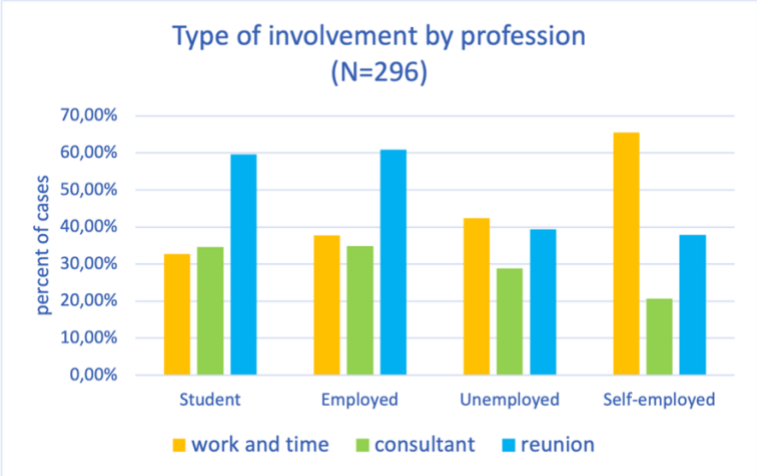

Figure 37: Bar chart type of involvement by profession

these groups can be very difficult as has been experienced by our local staff. The same observation can be made in respect to acting as a consultant, meaning contributing skills and special knowledge. The more unstable the socio-economic situation, the less people can imagine contributing with their skills and knowledge. This hints at a potential lack of confidence to be able to contribute in a meaningful way when less educated. It will be important in future workshops to help people from different socio-economic backgrounds to empower themselves and be able to speak for themselves and their communities as well as acknowledging the value of their own experiences.

6.4. Electric Vehicles (EVs)

Regarding the transport system, which is the primary source of GHG emissions on the territory, it is almost exclusively based on thermal vehicles. In recent years, the first slow EV charging stations have been installed with little usage so far due to the little number of electric vehicles on the island. Until today, there is only one car-dealership which sells EVs. However, given the size of the island, electric vehicles, if they are recharged with non-carbonized electricity, could provide significant reductions in CO2 emissions and air pollutants.

As part of the Plan Climat, initiated by the different municipalities in Mayotte, more charging stations are being installed across the island. Especially the little neighbouring island Petit-Terre belongs to the front runners in installing the necessary infrastructure to allow for more Electric Vehicles on Mayotte. CCSUD and CADEMA have recently added electric vehicles to their fleet and serve as examples for the ongoing transition of the energy and transport system in Mayotte. On top, the small start-up company SAZILE is running a little business with solar powered electric scooters in the greater area of Dembeni-Mamoudzou.

Despite the recent advancements, EVs are still extremely underrepresented due to the high costs and lack affordability for the average citizens. This poses a big barrier to the expansion of EVs and the necessary infrastructure on the island. However, the data resulting from our assessment show that the willingness to adopt EVs is very high across different groups, independent from the ability to pay for them (see Fig. 39). This is a promising insight and calls for intelligent strategies to increase the visibility and usage of EVs other than through private purchases. Note that it may be necessary to evaluate the life-span deterioration of batteries in areas of extreme heat like Mayotte.

From our assessment we conclude that the biggest potential lies in shared Electric Vehicle fleets for businesses or the public sectors e.g., hospitals. Another promising way to introduce EVs to the life of the average citizen is through innovative designs of Local Energy Communities where community revenues can be reinvested in shared EVs.

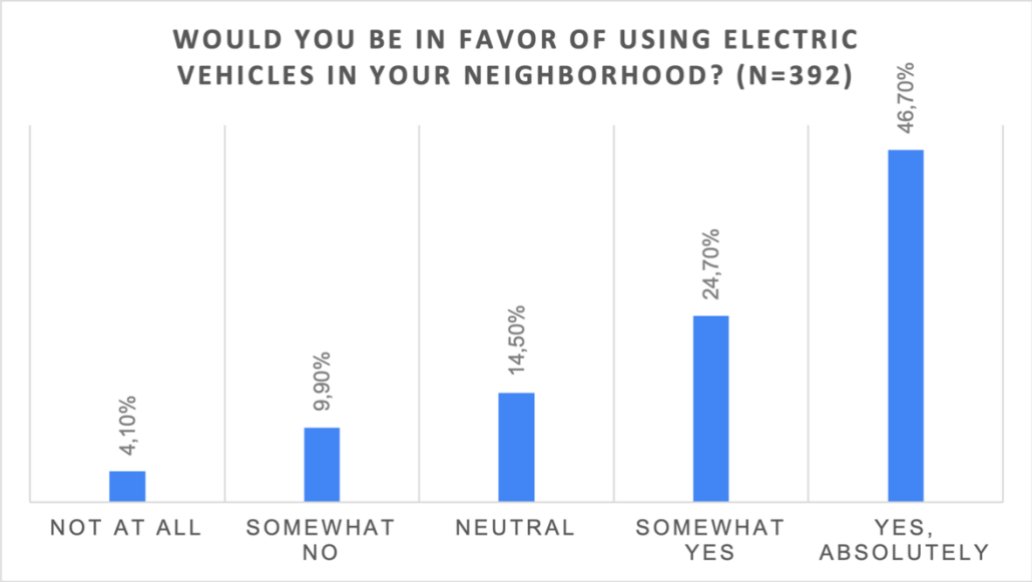

Figure 39: Bar chart support for electric vehicles (EV)

7. Scepticism towards Renewable Energy Technology

The survey entailed a question on why participants would be reluctant to participate in a community renewable energy project. The predefined answers were Environmental/Ambience concerns which can count into the category of the phenomenon “Not in my backyard”, Security concerns which imply the risk of violence, or any other harm caused by other humans, service concerns and safety concerns which in contrast to security concerns talk about the risks of accidents and other technology related dangers. Further, participants had the possibility to add their own points of scepticism – an option which has been used quite rarely.

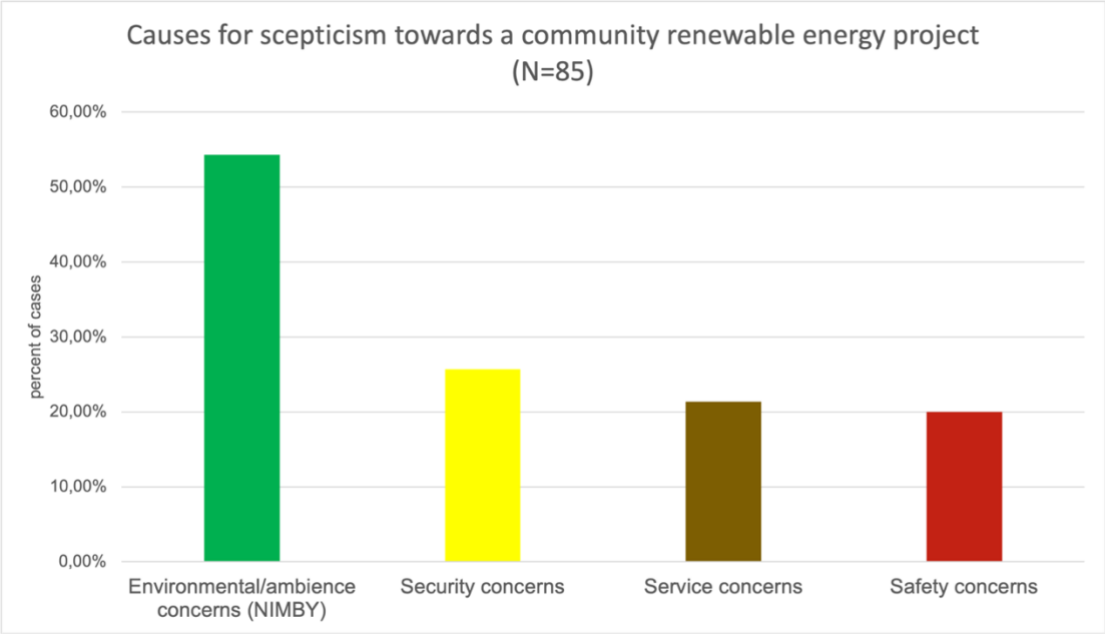

Figure 40: Bar chart causes for scepticism towards community renewable energy project

85 participants have replied to the question with the following results: The leading points of scepticism were environmental/ambience concerns (NIMBY) with more than 50 % of cases. This was followed by security concerns with 25,7%, service concerns with 21,4% and safety concerns with 20%. Note that the majority of the participants who answered the questions are situated in the mid-west region of Mayotte (3CO) and therefore the results may not be representative for the entire island.

7.1. NOT IN MY BACKYARD (NIMBY)

As highlighted in the survey data, the environmental impact of solar technology is very relevant to the local population. The person in charge of the ecological transition in one of the municipalities underlined that they experience reluctance to changes in the local environment. Asked whether the local population in her community are concerned about the environment she said:

> *"I can say yes and no. Yes, as long as it doesn't have a negative impact on their daily lives. {…} people are very happy and enthusiastic about the idea of cleaning up the river, the neighbourhood. But as soon as they perceive it as negative, they'll say no. For example, if we tell them that we want to build a photovoltaic farm somewhere in the village, they'll say "oh yes, but...". In fact, as soon as it touches their space, they will be more reluctant. They will be really motivated by small initiatives. They want to do well, but they have difficulty with big changes."*

Asked for the underlying reasons she stated:

> *"Because we touch their environments, their direct sensitivities/realities."*

7.2. SECURITY- AND LEGAL CONCERNS TO CONSIDER IN MAESHA

Security is by far the most mentioned concern that people have regarding community life in Mayotte. Violence, delinquencies, and other perceived threats are subject of constant discourse. Often these issues are linked to illegal migration.

Official statistics suggest that one out of three households have insufficient access to running water, usually without connection to the main energy grid. Ultimately, the local energy infrastructure suffers from a growing number of illegal connections and energy theft poses major challenges to the local grid operator. We heard an anecdote of recently installed and shortly after stolen solar street lamps in almost every conversation. While this illustrates the reasons behind some people's scepticism towards shared community solar panels, it also reveals the massive demand for energy in marginalized communities. According to our local staff, in conversations with the local population, security concerns were raised more frequently in densely populated regions which struggle more with delinquencies and community conflicts.

Another aspect which should receive attention is that many residents in so-called informal settlements occupy land illegally. This can pose a major barrier to the implementation of new technologies and will create resistance from different stakeholders.

> *"I just don't know if it will work in the informal areas, in the sense that these are*

materials that are going to require space, maybe permits. The people themselves won't be against it, but will it be technically feasible to put the panels on land that they don't own?" *(Key-informant, CADEMA)*

8. ENERGY ACCESS AND PERSPECTIVES FOR POTENTIAL DEMONSTRATION SITES

It is estimated that around half of Mayotte's 500 000 residents do not hold a valid legal status. Official statistics suggest that 30 per cent of the population have insufficient access to running water and 40 per cent live in sheet metal houses, often without clearly defined property rights of the inhabited land and without connection to the main grid. Ultimately, the local energy infrastructure suffers from a growing number of illegal connections and energy theft is posing a major challenge to the local Distribution System Operator (DSO)/Transmission System Operator (TSO). The reduction of these illegal connections as one goal of MAESHA (see KPI 3.6) and the necessity to consider the local context and requirements of the local population have led to the formation of the Energy Access Use-Case which is described in this chapter.

The community-based approach lies at the heart of the MAESHA project and it is crucial for the projects' success, impact and sustainability. This also means that relevant community needs, such as the demand for better energy-access, must be considered from an early stage on. Disregarding the local context and de-emphasizing community needs bares the risk of MAESHA being seen as intellectual or elitist project which is dedicated only to wealthy and educated individuals. Hence, a fair and just distribution of the benefits reaped from the project serve as benchmark for accomplishments of MAESHA in the region.

Further, according to community representatives, the level of awareness for Renewable Energy Technology (RET) is low. For many, RET is expensive and only for wealthy people. While the issue of climate change has gained much relevance in central Europe and in educated circles, the topic is given much less importance to by communities who struggle to meet their basic needs. Demonstration sites which focus on the better provision of energy to residents, especially those who find themselves in precarious living conditions, can have a major impact. They serve as good examples for the accessibility and potential benefits of renewable energy and to help establish trust into local authorities and even into the European Union. Visible examples of RET in vulnerable and marginalized communities are key for their further adoption and ultimately for combating climate change and energy poverty. The Use Case Energy Access also builds on the Sustainable Development Goal set by the United Nations, namely SDG7, to "ensure access to affordable, reliable, sustainable and modern energy for all."

Due to legal constraints, some of the area's most affected by energy poverty are difficult to include in the project, as residents often do not own the property rights of the land they live on. Considering this barrier, we identified three possible target groups who may benefit from the Energy Access use case:

1. Legal communities with no connection to the main grid. Note, however, that most legal settlers are already connected to the main grid.
2. Legal communities who are connected to the main grid, but an upgrade of the connection is needed e.g., if existing lines are congested.
3. Farms or agricultural areas with no energy access/connection to the main grid.

8.1. PERSPECTIVES FOR SOLAR COMMUNITY/COLLECTIVE SELF-CONSUMPTION

A first assessment related to Energy Access has revealed that there is high potential for residential solar technology, possibly in combination with social housing and resettlement programs, set up by municipalities.

8.1.1. Example of a potential Local Energy Community (LEC) in Majicavo Koropa

The city of Koungou is currently carrying out a resettlement program, to relocate marginalized communities from sheet-metal settlements to low-cost houses (see Figure 41 below). These houses can be equipped with solar panels which can be maintained and managed by the inhabitants of the houses. By forming a Local Energy Community, inhabitants can exert agency under the umbrella of some legal entity, such as an association. Thus, they can collectively decide over investments and other relevant issues.

Local Energy Communities can be involved in a variety of different tasks and come in different legal forms and constellations. Most common are Energy Co-operatives who are involved in collective self-consumption. Public-Private-Partnerships are also frequently found, where a public institution such as the municipality can support the LEC either financially or by other means such as legal counselling. Further, LECs can set up awareness campaigns on energy savings, provide energy services such as demand side mechanisms and energy auditing or reinvest generated income in a neighbourhood electric vehicle fleet. Thus, they play an important part in the transition to a green energy infrastructure and enable citizens to become an active part of the energy system.

In the case of marginalized communities such as in Majicavo Koropa, the collaboration with local public actors is crucial to overcome different entry-barriers to Local Energy Communities. The nature of these barriers stem from financial restraints or the lack of education, trust and/or other capacities. It also helps overcome some of the substantial legal issues around informal settlements. This scenario is a step towards introducing marginalized communities to Renewable Energy Technologies and helps building capacities for active energy citizenship. At the same time, it empowers vulnerable communities to harvest the potential economic and social benefits of innovative technologies introduced by MAESHA, bringing them at the forefront of the broader social and energy transition aimed for in MAESHA. Ultimately, these communities can become role models in the region and inspire others to follow their example.

Within MAESHA and to assist the development of a demonstration site in Majicavo Koropa in the city of Koungou, it is proposed to call upon a French metropolitan association called Sol Solidaire which develops solar projects in self-consumption in social housing. This association helps to fight against energy poverty by financially supporting the installation and operation of photovoltaic power plants of social landlords, on the site of low-rent buildings, with the aim of supplying the occupants with free solar electricity produced on site.

Membership to this association is in the form of candidatures to a call for tenders launched every year between September and December. Candidates (usually landlords and/or public authorities) commit

to supply the energy of the installation to their tenants. The city of Koungou could apply for this call for tenders. A PV power capacity between 10 and 250kWp must however be respected.

Figure 41: Majicavo Koropa resettlement program

Installation and operation of PV power plants are financially supported by the association, which funds are supplied by sponsors. Funds are collected in metropolitan France but can be used for projects located in Mayotte. For our project, the sponsor could indirectly be the local authorities of Mayotte through various companies. Local authorities of Mayotte (Department and Region) can subsidize companies if the objective of the subsidy concerns the development of renewable energies (like installation of PV panels). This subsidy would then be conditioned to the payment of a part of the profits of these companies to the association Sol Solidaire. It should be noted that the association Sol Solidaire does not carry out any economic activities, so this aid does not fall within the scope of the regulations on state aid.

8.2. Perspectives for Power to Hydrogen to Power (P2H2P)

Another perspective is the use of Power to Hydrogen to Power (P2H2P) Technology where communities with insufficient access to electricity are provided with a fuel-cell and hydrogen supply which ideally is produced from RES (Renewable Energy Sources) in an electrolyser connected to the main grid. Note that the energy mix in Mayotte is still heavily based on fossil fuels which means that the hydrogen cannot be considered green yet. However, as the transition to Renewable Energy in Mayotte progresses, the produced hydrogen becomes greener as a result. In the best case, the installation of the P2H2P technology will be accompanied by the installation of a solar plant, which compensates for the additional use of electricity.

As it is the case for residential solar energy, the provision of P2H2P can be accompanied with the formation of different legal entities forming Local Energy Communities. Both residential solar panels and P2H2P can bring benefits to localities which are not connected to the grid, e.g., agricultural areas. Besides, P2H can provide flexibility services to the main grid (e.g., frequency control), by taking advantage of the quick ramp-ups and ramp-downs and the power range of operation of the electrolyser.

This works as follows: a fuel cell is installed in an area where there is no connection to the main-grid, or it needs to be upgraded. The fuel cell would then be fuelled with hydrogen which is transported from the production site where the electrolyser is connected to the main grid. Local people can be trained in the maintenance of the fuel cells, or even the transport of the hydrogen from the electrolyser to the fuel cell. This opens many opportunities to combine the provision of electricity through innovative technology and the community-based approach and formation Energy Communities in MAESHA.

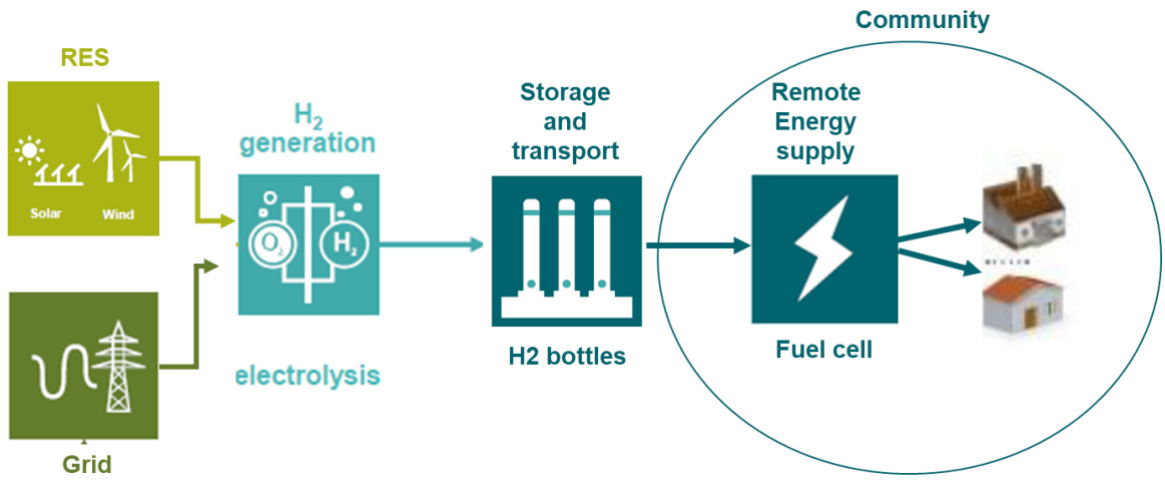

Figure 42: P2H2P diagram

9. Final Conclusion

In this document we have presented extensive data on the perspectives of the transition to renewable energy and community energy on the island in Mayotte, obtained by a mixed set of methods and tools. The study provides valuable insights to help the further implementation of renewable energy projects within the MAESHA project and beyond. It lays bare the complex social, cultural, and economic context of the island and helps to understand the attitudes and requirements of the local population. It outlines the heterogeneous socio-economic backgrounds of the island's inhabitants and the contrasting lived realities experienced by local communities.

We have approximated the socio-economic background of participants through an enquiry of the relevant housing conditions, namely precarious settlements such as tin and metal sheet houses and complete houses, usually concrete houses. This distinction proved to be useful as it accounts for several socio-economic differences such as levels of education, employment, access to basic needs and services as well as experiences in relation to the energy system and/or with local authorities.

A comparison between the two relevant groups is found in Table 3 below. It summarizes the most relevant findings of the quantitative survey:

Table 3: Summary by socio-economic background

	Precarious (e.g., metal sheet)	Stable (complete house)
Current complaints	• Service and safety issues	• High costs of energy-system • Environmental concern
Priorities/motives to get involved	• Income • Energy access	• "Sustainability" • Income/financial returns • Community building
Types of involvement	• Work and time (employment)	• Community reunions • Volunteering
Challenges	• Legal constraints • Security concerns • Inclusion and willingness • Lack of trust in authorities	• "Not in my backyard"

9.1. Energy- and Ecosystem: awareness, concerns and priorities

Exploring the factor “energy- and ecosystem” has revealed how different the lived realities of island inhabitants are. While communities who live in stable settings are generally satisfied with the ecosystem in which they live, for a large part of the population, environmental degradation, and lack of access to basic needs are everyday companions. The same differences can be observed when comparing groups by profession and groups by their highest education. Ultimately, the view on the energy- and ecosystem heavily depends on class and social background.

According to community representatives and local informants, the general concern for the environment is low. Despite organised beach clean-up missions and awareness-raising campaigns organised by local NGOs and municipalities, environmental degradation plays a minor role throughout society. However, with the increased presence of a more educated and young generation, environmental topics have gained relevance in recent years and continue to do so at a moderate pace.

The level of awareness for Renewable Energy Technology is generally quite low. For many, it is expensive and only for wealthy people. While the issue of climate change has gained much relevance in privileged circles, the topic is given much less importance by communities who struggle to meet their basic needs. Talking to some committed citizens and staff of local organisations, it becomes clear how important it is for them to pay the utmost attention to social problems and people's perspectives and priorities while combating energy poverty. The MAESHA project is once again confronted with the reality that any initiative for technological innovation should have this at its core, because renewable energy alone will not lead to a more equitable or inclusive society. Ultimately, existing power structures determine who reaps the benefits of technological and social change.

9.2. Motives and types of involvement

There is a high willingness to participate in a community renewable energy project. Many of the citizens in Mayotte, especially those from rather stable socio-economic backgrounds would like to join a community reunion or help as a volunteer to make their community more sustainable and potentially generate some income. The more unstable the socio-economic situation becomes, the more unlikely it becomes that people join community reunions and official events. This has also been mentioned by one key-informant of a local environmental NGO who states that it is necessary to go directly to the neighbourhoods, for example with a special vehicle or a bus, and approach the residents directly. A similar advice comes from Roel Massink, Project Coordinator of the IRIS Smart Cities project in Utrecht who, when reporting about their learnings trying to include marginalized or migrant communities, said:

“Go to the comfort zones of the people, don’t invite them into yours”

Aside from that, people from more unstable socio-economic backgrounds, especially those who work in informal jobs or are unemployed seem more willing to contribute work and time to generate an income and benefit their community and the natural environment.

This hints at the great potential for community-based initiatives in Mayotte. One part of the population, especially the young, educated and employed, are motivated to contribute their skills and knowledge for the future sustainability of the island. Another part, the one who is more concerned with the daily struggle of making an income, is looking for ways to take on personal responsibility and earn money. Community Renewable Energy has a great potential to tackle both – a green island and prospering communities as well as green jobs.

9.1. Strategy implications

Concern for the environment can be a driving factor for the implementation of renewable energy technology in communities, as seen for example in Europe. In Mayotte, more urgent issues such as the generation of income, access to basic needs and services, basic education, community conflicts and illegal migration overshadow the desire for a clean and environmentally friendly society and energy system. Despite projects like MAESHA and renewable energy adaptation in general is of utmost importance for sustained well-being, not only in Mayotte but globally, actual and current needs and priorities of the local population must be at the centre of interest throughout the coming implementation process. This has important implications for the recommended communication strategy. Economic incentives for users and citizens should be emphasized. Any other narratives that focus on common themes such as sustainability, climate change or green energy may result in refusal from the local population, as being disregarded as academic or elitist and should therefore not be too present. There is dire need for small-scale, short-term projects with positive economic impacts for the local population. Large-scale projects and projects without specific local context sensitive demonstration sites within communities bear the risk of increasing resentments towards both, local authorities and innovative technology deemed as inaccessible. Further, renewable energy projects should increase the focus on self-consumption projects, co-designed with the local population to benefit them effectively.

9.2. Lessons learned from other community energy projects in Sub-Saharan Africa

Important and valuable insights can also be gained when looking at projects related to community renewable energy in Sub Saharan Africa (SSA). A fast growing and extremely young population, cultural similarities as well as the urgent need for energy access are only some commonalities to be found when comparing Mayotte with the African continent. Ambole et al. (2021) reviewed 16 projects in SSA which involved the establishment of Local Energy Communities. They found that there were substantial barriers that hindered a successful implementation of community energy projects such as a lack of adequate citizen participation. Table 4 summarizes the main challenges they have identified which are also relevant to Mayotte, with some additional points added from our own side.

The first challenge relates to engagement and participation and describes the lack of engagement of local communities. This may not always be attributed to a lack of willingness or motivation but often stems from the top-down nature of the project implementation phase. These projects are often characterized by elitist organisations or governments who concentrate most power on themselves

during planning and implementation. Most citizen participation which is practiced can be described as “nominal participation” where citizens or communities are invited to have a seat in the project but are not given any real agency (White, 1996). This is being avoided in the MAESHA project, which in terms of funding source and project consortium structure shows similar patterns of technocratic knowledge and Eurocentrism. In order to not repeat the less effective patterns from past projects, it is therefore important to always put communities and their needs at the centre of interest. Place-based and context specific planning is as important as the co-design of project activities from the beginning to the end. The establishment of ground-level panels and transition boards as well as the facilitation of community-dialogues are essential components of a community-based project.

Many communities in SSA, even those who are willing to invest time and energy in a community energy project do not receive adequate institutional support to establish business models, receive legal advice or technical training. This needs to be tackled for MAESHA as well for any other project related to community energy. It will be important during the implementation process and beyond to provide communities with assistance for example by establishing a central institutional body, or intermediary which can mediate between different relevant stakeholders. Such an institutional bodies can be think tanks or NGOs e.g., REScoop Europe.

Finally, as is the case for Mayotte, many African communities lack the upfront capital to establish and maintain a community-based energy system (CBES). It will be crucial for the MAESHA project to, alongside developing innovative, contextualized business models, research and develop adequate financing schemes for local communities.

Table 4: Challenges for community energy projects

Challenges	Description of challenge
Engagement and participation	• Lack of engagement of local communities • Top-down project implementation • Power remains with governments or elites • “Nominal participation”
Institutional	• Communities lack institutional support, e.g., business, legal or technical advice
Financial	• Communities lack upfront capital to establish and maintain a CBES

Table 5: Pathways of success for community energy projects

Challenges	Description of possible solution
Engagement and participation	• Community engagement from the beginning • Place based (context specific) • "Co-Design", community-dialogues, ground level panels, transition boards…
Institutional	• Community Energy Intermediaries
Financial	• Innovative and contextualized financing schemes

9.3. PROMISING OUTLOOK FOR ENERGY COMMUNITIES

Our first impression is that there is a high potential for solar technology in residential areas, possibly in combination with social housing and resettlement programs set up by the municipalities. Our collaboration with local public actors is crucial to overcome various barriers to access such as financial constraints, lack of education, trust or other capacities. Public-private partnerships in the context of resettlement projects can tackle both legal problems associated with informal settlements and enable disadvantaged people to reap the potential economic and social benefits of innovative technologies. It will allow marginalized and vulnerable communities to be at the forefront of the social and energy transition that the MAESHA project aims to bring about. Apart from the major challenges the project is facing, there is a great opportunity to positively impact the lives of the island inhabitants when working together. Our conversations with key-informants and the local population leave us very optimistic that when following appropriate strategies of communication, stakeholder-interaction and citizen participation, the project will be a great success. We have only just started, but we are full of hope and determination to make a difference together with and for the people.

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11. APPENDIX

11.1. QUESTIONNAIRE OUTLINE AND ORIGINAL QUESTIONS

Cher participant,

Dans le cadre du projet EU MAESHA, nous avons développé le questionnaire suivant pour évaluer l'opinion des habitants de Mayotte vis-à-vis des énergies renouvelables et leur inclusion dans le développement de modèles pour les appliquer dans leurs communautés

Le sondage est anonyme et prend environ 15 minutes à remplir.

À propos de MAESHA
MAESHA est un projet d'innovation financé par le programme Horizon 2020 de l'Union européenne qui vise à démontrer à Mayotte un modèle de système énergétique intelligent pour décarboner les îles et le reproduire le plus largement possible.

MAESHA est l'acronyme de « deMonstration of smArt and flExible solutions for a DecarboniSed energy future in Mayotte and other European islands », mais signifie également « future » en Shimaore, le dialecte local de l'île française de Mayotte.

À propos de votre participation
Votre participation à ce questionnaire est entièrement volontaire et toutes les données collectées seront traitées de manière confidentielle. Les informations et les résultats résultant de ce travail n'incluront que des données rassemblées, sans possibilité pour quiconque d'identifier vos réponses individuelles. Il n'est pas obligatoire que vous fournir toute information qui pourrait vous identifiez personnellement (par exemple, votre nom).

En participant à l'enquête :

- vous confirmez avoir au moins 18 ans, avoir lu et compris ce formulaire de consentement.
- vous acceptez de participer à cette étude de recherche et êtes heureux que vos réponses anonymisées soient incluses dans notre analyse et résultant de ses publications de recherche.
- vous acceptez que nous traitions vos données conformément à nos lignes directrices éthiques sur l'implication humaine.

Si vous avez des questions, n'hésitez pas à nous contacter par e-mail :

Chargée de mission Mayotte :
Chef de projet : tbaerens@hudara.org

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Plus d'informations sur le projet sont disponibles sur https://www.maesha.eu

Souhaitez-vous participer à cette étude et acceptez que vos réponses soient traitées ? *

( ) oui ( ) no

Section 1 : Sensibilisation à l'énergie et à l'environnement

1. Comment évaluez-vous votre accès à l'électricité ? *

2. Comment évaluez-vous votre accès à l'électricité aujourd'hui par rapport à il y a 5-10 ans ? *

3. Comment évaluez-vous votre accès à l'eau ? *

5. Comment évaluez-vous votre accès à l'eau aujourd'hui par rapport à il y a 5-10 ans ? *

6. Comment évaluez-vous l'état de votre environnement naturel proche ? *

7. Comment évaluez-vous l'état de votre environnement naturel proche aujourd'hui par rapport à il y a 5-10 ans ? *

8. Savez-vous ce qu'est le changement climatique ? *

9. Pensez-vous que le changement climatique/la dégradation de l'environnement vous affectera à l'avenir ? *

10. Pensez-vous que les citoyens locaux devraient assumer la responsabilité de l'environnement/du changement climatique ? *

11. Connaissez-vous des formes d'énergie renouvelable et si oui, lesquelles ? *

12. Pensez-vous qu'il devrait y avoir plus d'énergies renouvelables à Mayotte ? *

Section 2: Soutien et acceptation des technologies et services innovants

13. Etes-vous satisfait du système énergétique actuel ? *

13a. Si non, pourquoi?

14. Soutiendriez-vous un projet d'augmentation des énergies renouvelables dans votre communauté ? *

15. Seriez-vous favorable à l'installation d'une centrale solaire a proximité o sur votre propriété ? *

16. Pensez-vous qu'il serait avantageux pour vous d'utiliser une technologie d'énergie renouvelable dans votre vie quotidienne ? (par exemple un four solaire, lampe solaire etc.) *

17. Pensez-vous qu'il serait avantageux pour vous d'utiliser une technologie d'énergie renouvelable dans votre vie professionelle / pour générer des revenus ? (par exemple un four solaire, Lampe solaire etc.) *

18. Pensez-vous qu'il serait avantageux pour vous d'utiliser une technologie d'énergie renouvelable dans votre vie professionelle / pour générer des revenus ? (par exemple un four solaire, frigo etc.)

19. Seriez-vous favorable à l'utilisation partagée de véhicules électriques dans votre quartier (e.g. Scooter électrique)? *

19a. Si non, pourquoi?

20. Joueriez-vous un rôle actif dans un projet sur les énergies renouvelables dans votre communauté ? *

20a. Si non, pourquoi?

21. Seriez-vous prêt à payer un certain coût supplémentaire pour obtenir de l'énergie renouvelable ? *

22. Seriez-vous prêt à payer un coût supplémentaire pour obtenir de l'énergie renouvelable, si vous obteniez d'autres avantages comme des réductions au cinéma, les restaurants ou des festivités locales ? *

<u>Section 3 : La vie communautaire à Mayotte</u>

23. Avez-vous l'impression de faire partie d'une communauté ou d'un réseau social ? *

24. Faites-vous confiance aux personnes de votre communauté ? *

25. Faites-vous confiance aux autorités locales de votre communauté ? *

26. Êtes-vous fier de faire partie de votre communauté ? *

27. Demanderiez-vous de l'aide à vos voisins ? *

28. Adopteriez-vous les énergies renouvelables si vous réalisiez que la majorité de vos voisins le font? *

29. Êtes-vous membre d'un club, d'une association ou d'une organisation ? *

Section 4 : Informations générales

30. Quel est votre sexe ? *

31. Quel est votre âge ? *

32. Quel est votre plus haut niveau d'éducation ? *

33. Dans quelle région de Mayotte vivez-vous ? *

34. Comment décririez-vous le contexte dans lequel vous vivez ? *

35. Combien d'argent gagnez-vous par mois ? *

36. Combien de personnes vivent dans votre foyer ? *

37. Quelle est votre profession ? *

38. Quelle est votre langue maternelle *

39. Serait-il possible que nous vous contactions à nouveau à un stade ultérieur de ce travail pour vous informer des développements et vous considérer dans une post-évaluation ? *

39a. (Si la question précédente a été répondue par oui) CODE (première lettre du nom de la mère, première lettre du nom du père, année de naissance, première lettre du mois de naissance)

_____

11.2. INTERVIEW TOOL (ENGLISH)

11.2.1. Structure and Research Questions

1. Introduction
2. Institutions
   a. Cultural-cognitive
      i. What does community mean to the people?
      ii. To what extent do people trust their communities?
      iii. To what extent do people identify with a community/group?
      iv. Is there a sense of belonging?
      v. To what extent do people exchange ideas, help each other, have a sense of solidarity?
      vi. Is there a cooperative tradition, tradition of clubs, associations etc.?

   b. Normative
      i. How much do people value autonomy and ownership?
      ii. How much do people value locality in terms of responsibility for the environment and the community?
      iii. How motivated are people to invest time and energy in community projects and take responsibility?

   c. Regulative
      i What are peoples' experiences with local authorities and laws?

3. Awareness about Energy and Environment
   a. Environment
      i. What are peoples' perspectives on the environment and climate change?
   b. Energy
      i. What are peoples' perspectives on the current energy system?
      ii. What do people think about Renewable Energy?
      iii. How engaged are people/women with the energy system?
4. Perspectives on Community Energy
   a. Are people open to participating in innovative technology projects?

11.2.2. Interview Guide (English)

Note that the interviews did not always strictly follow this guideline. We wanted to have open and informal conversations with each participant and explore a variety of different foci, depending on the context and situation. The interview tool has been adapted multiple times to according to the interviewee. This interview tool serves a vague guideline for the interviewer and to give an overview of the questions asked most frequently. Interviews were held in French and recorded via phone and transcribed after. All participants agreed to be recorded and all data is stored according to the ethics guidelines agreed upon in this project.

Introduction

Can you tell me something about you? What did you do last weekend?

Community

How does the research subject view community life? (What is community?)

1. What does community mean to you?
2. Tell me something about your community, maybe start with what kind of people live in your neighborhood?
3. What do you like the most about your community?
4. If you could solve one problem in your community, what would it be?

a. and how would you solve it? (Split questions if possible)

5. How do you engage with the people in your community?
6. What are common topics/problems that you discuss in your community?
7. Think about the last time you did something together with people from your community… Tell me about that experience?

8. What motivated you to participate in that community action?

9. Tell me about your last experience with local authorities.

Environment and Energy

How aware is the research subject about the environment and energy?

10. When you think about earth and the environment, what comes first in your mind?

11. Are the people in you community concerned about the environment?

12. When you think about your everyday life, how do you experience energy in your daily routines? (Who pays the bills?)

How supportive is the research subject about RET?

13. Maybe you have heard of renewable energies like solar energy…? What do you think about it?

How are the RS perspectives on local energy communities?

14. What do you think would happen if the local communities in Mayotte would start to create their own energy?

15. What would it need for you to become actively involved in an energy community?

16. What would make you personally participate?

17. What kind of role could you imagine?