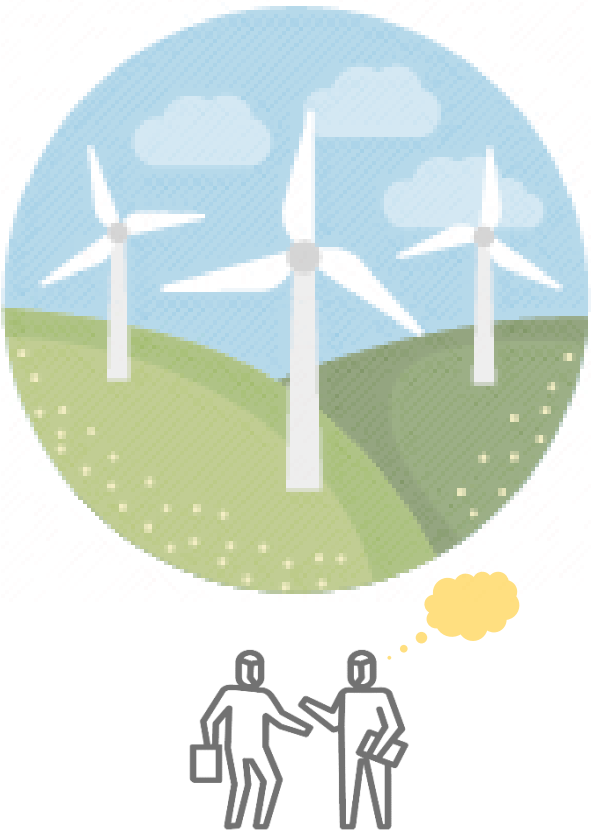
UNIVERSITY OF COPENHAGEN

Faculty of Science

Department of Food and Resource Economics

MSc in Climate Change

Exploring energy justice and sovereignty in a local-scale hybrid project of a Greek island



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Copenhagen, 2021

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ACKNOWLEDGEMENTS

The topic of the thesis was an imaginary of a possible fairer and better world existing in Ikaria. Therefore, different abstract thoughts changed time after time to arrive at the final theme with the great guidance of my supervisors, Rebecca Leigh Rutt and Mattias Borg Rasmussen. They always encouraged me throughout this process, and I am very thankful to them. They were patient, giving insightful and thorough feedback, helping me to improve my study.

I would also like to thank all the citizens in Ikaria who helped me conduct research and either participated by themselves, recommended potential interviewees, or drove me around the island to look for respondents. The hospitality of some participants was moving, and I would like to thank them for their time and enthusiasm to enrich the study with their knowledge and experiences.

Furthermore, I would like to thank Giorgos Koutsos, who hosted me at his eco-community in Ikaria, the energy cooperative ELECTRA and especially Chris Vrettos for his support and willingness to help me whenever needed, and the Climate-KIC organization for the financial assistance.

Finally, I would like to express my gratitude to my precious friends who helped me with their feedback and encouragement. Moreover, my family for their support during insecure phases of fieldwork and writing, and Ioanna Mastora for creating the original design of the cover illustration.

ABSTRACT

Energy transition is a fundamental approach in order to mitigate anthropogenic climate change. However, this can multiple times foster energy injustices through the large-scale deployment of renewable energy technologies. The present study investigates energy justice and sovereignty elements, using the Greek island Ikaria as a case study. In Ikaria, there is an innovative small-scale hybrid energy project called NAERAS, promising to bring social and environmental benefits. Based upon the conceptual tools of energy justice, sovereignty and democracy, this study explores the drivers of NAERAS uptake, the decision-making processes, and the impacts on Ikarian society. The findings formulated by this thesis demonstrate that the NAERAS system can moderate unjust energy transition; however, there are still existing gaps in citizen participation strategies and approaches for a positive social outcome.

Keywords:

Energy transition
Energy democracy
Small-scale energy
Islands

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LIST OF ACRONYMS

ADMIE	Independent Power Transmission Operator
HEDNO	Hellenic Electricity Distribution Network Operator
PPC	Public Power Corporation
RAE	Regulatory Authority for Energy
RES	Renewable Energy Sources

1. INTRODUCTION

1.1. Problem Statement

One of the main challenges for dealing with climate change is shifting to renewable energy sources and, at the same time, addressing energy poverty and improving energy security (Newell, 2021). Global energy security and access closely intertwine with welfare, happiness, equity, freedom and fair treatment and constitute one of the main justice challenges (Sovacool & Dworkin, 2014).

Society must have sufficient energy to cope with extreme weather events like heatwaves, especially in the least developed nations, which are more vulnerable to climate change (UNDP, 2011). However, unfortunately, there are many cases where citizens are not favoured by large-scale renewable energy projects, with big corporations contributing to land grabbing and dispossession of people. These problematic energy transition initiatives emerge from elite groups, the main driver of which is not to mitigate climate change, but instead, an approach that constitutes a favourable juncture to make profit from and test or evaluate low-carbon technologies (Siamanta and Dunlap, 2019; Sovacool et al., 2019).

In Greece, there are multiple examples where energy transition by establishing large-scale projects has resulted in land grabbing and dispossession of people (Siamanta and Dunlap, 2019). However, in recent years, some innovative renewable energy projects have been implemented, and one of those is the small-scale NAERAS system in Ikaria island (PPC, 2020). It constitutes one of the two hybrid energy projects in Europe that uses wind and hydropower for electricity production and is considered to have contributed to a variety of social and environmental benefits (Tsipouridis, 2019). Small-scale energy technology is a potential fundamental element of a sustainable degrowth society (Kunze and Becker, 2015). Degrowth calls for downscaling production and consumption in ways organized to eliminate harm to other humans and non-humans, leading to more equal societies that do not transgress planetary boundaries. Degrowth can be achievable through commoning, where community citizens manage and share resources through mutual use (Kallis et al., 2020).

The deployment of a local and small-scale hybrid project can also be a driver of energy democracy (Kunze and Becker, 2015), in which citizen participation is encouraged in decision-making processes and energy resources are governed to favour social equality. In addition, energy sovereignty and

procedural justice are also concepts where decision-making is a crucial element linked with energy democracy (Feldpausch-Parker et al., 2021).

The main objective of this study will be to investigate if the NAERAS project is a prototype of energy justice and sovereignty. Ikaria is a compelling case for empirical research, as it is a known island about the simplistic way of living and the practices of commons, which align with the concept of degrowth. Furthermore, different bottom-up initiatives had emerged, either by sharing the natural resources of the forest called Randi or by improving various institutions after they collected profits from festivals (Bareli, n.d.; Coumparou, 2002; Bareli, 2014; Kallis et al., 2020). Therefore, one of the focal points of the thesis will be to explore if the NAERAS project was another bottom-up approach. Also, decision-making processes will be evaluated, and finally, the impact that the innovative hybrid renewable energy project has had on the livelihoods of Ikarians. For instance, whether land transformation affected the locals and if NAERAS improved their well-being by alleviating energy poverty.

1.2. Research Questions

I will examine the general research question about energy sovereignty and justice by collecting data through document review, observations, semi-structured interviews with Ikarian citizens and based upon the conceptual frameworks of energy democracy, energy sovereignty, and procedural justice. In particular, the study aims to explore the following research questions:

- Which were the drivers of NAERAS project uptake - are those related to energy sovereignty?
- How is NAERAS unfolding in terms of management and decision-making?
- How has the NAERAS affected the livelihoods of Ikarian society?

The thesis is structured beginning with background information regarding energy transition issues, energy provision and policies in Greece and the energy context of Ikaria. Then, in Chapter 3, the conceptual frameworks used for the analysis are presented. The following section is about the methodology, explaining the process of data collection and analysis. Then, in Chapter 5, the findings and discussion are described, analyzing the study results, based upon the conceptual frameworks used, and finally answering the research questions. In the conclusion section, recommendations about energy transition are presented.

2. BACKGROUND

2.1. Energy transition and possible challenges

The environmental, economic and social impacts caused by climate change are already happening around the globe and the different initiatives of energy transition are crucial. However, renewable energy has already caused injustices and conflicts in the past and it is an issue that should be largely addressed. For instance, countries of Latin America are not yet ready for just energy transition, as there is high level of coercion and cases referring to pollutants like mercury released from dams to downstream areas, affecting agriculture and fishing (Finley-Brook and Holloman, 2016; Pestana et al., 2019). Also, climate change can make hydro projects more vulnerable either by causing issues of less water flow or through flooding by a hurricane (Carvajal et al., 2017).

In Papua New Guinea, limited access to electricity fostered administrative reforms in order to address environmental and health issues linked to energy poverty. For twenty years, small-scale solar systems have been promoted to schools, homes and small businesses. Nevertheless, market principles and constraints by donors in used technology have created obstacles which are difficult to be surpassed by local authorities and finally created community rejection over solar energy transition (Sovacool et al., 2021). Therefore, energy poverty can be challenging to address when there is no coordination of local and transnational authorities.

2.1.1. Energy poverty and rising inequalities in Europe

Energy poverty is mainly related to two main elements - income and energy. It refers to various issues, from insufficient household access to power to the quality of energy services, like cooking, space heating and cooling (Bouzarovski, 2018; Spiliotis et al., 2020). Those problems can become more frequent with higher energy costs, a decline in household income due to unemployment or low-income jobs, extreme environmental conditions, and energy inefficiency resulting from inefficient insulation (Moore, 2012). In Europe, energy prices are higher per unit of consumption for gas and electricity for those who use less energy - a phenomenon noticed in almost every Member State (OpenExp, 2019).

The Southern and Eastern nations experience more energy poverty among European countries due to the aforementioned factors (Bouzarovski & Petrova, 2015). For instance, Greece and Bulgaria had the highest rates of outstanding payments on energy bills in 2018, of the order of 35.6% and 30.1%, respectively. On the other hand, Northern and Western countries, like the Netherlands, Czech Republic, and Sweden, featured the lowest arrears rates of 1.5-2.2% (EPOV, 2019). Few arrears cases may occur due to higher GDP per capita in the latter EU Member States, more rigorous regulations about the buildings, and the lower social classes receiving financial support to afford the high electricity bills (Kolokotsa & Santamouris, 2015; OpenExp, 2019).

The main reasons for energy poverty in the developing EU countries are the insufficient energy infrastructure and the high energy prices (Bouzarovski and Petrova, 2015). Furthermore, as Spiliotis et al. (2020) point out, energy poverty is also difficult to cope with due to a lack of standard definitions. Consequently, politicians do not fully comprehend the multidimensional concept of energy poverty to distinguish energy-poor households, eliminate this issue, and save energy.

2.2. The energy sector in Greece

For many years (2000-2015), Greece's primary source of electricity production came from lignite, or otherwise called brown coal. In 2020, the figures were quite different, and electricity production was as follows by source: gas (37%), wind (18%), coal (15%), oil (12%), solar (9%), hydropower (8%), and other renewables (0,7%). The same year, total electricity consumption reached 48,33 TWh. (Ritchie and Roser, 2020). This energy transition occurred due to the energy and climate goals that aim to achieve permanent closure of the lignite factories till 2028 and drastically increase the deployment of renewable energy sources (RES) to cover 60% of electricity production in 2030 by almost doubling their supply in a decade (Ministry of Energy and Environment [MoEE], 2019). However, the primary source of electricity production for the non-interconnected Greek islands, which are not interconnected with the distribution system of the mainland, is by far from fossil fuels. An average of 80% came from oil and only 15% from wind energy in 2020 (Regulatory Authority for Energy [RAE], n.d.; Hellenic Electricity Distribution Network Operator [HEDNO], 2020; HEDNO, 2021).

2.2.1. Energy provision

The public-private company PPC (Public Power Corporation) provides energy supply in Greece and has monopolized energy production and distribution for many decades since 1950. It started as a public company, and since 2002 part of the corporation is being privatized (Burnes et al., 2004). However, PPC is still the company with the most significant share of energy production, supply and sale in Greece. A subsidiary of PPC, called HEDNO, and ADMIE were founded in 2012 and 2011 and distribute electricity production. ADMIE distributes the energy of high and ultra-high voltage and is in charge of the interconnection of the energy transmission system among islands, the mainland and neighbouring countries. HEDNO distributes electricity to the citizens of Greece and regulates the function of the market, the operation of production and the energy systems of the non—interconnected islands. Recently, there has been a significant policy transformation, and PPC announced the privatization of 49% of HEDNO to the transnational Australian company Macquarie (PPC, n.d.; Kibouropoulos, 2021; Lidorikis, 2021).

At the top of the hierarchy of the energy sector in Greece is the independent regulatory authority, RAE, which is in charge of the energy market. It also has the jurisdiction of evaluating the applications for the deployment of RES stations and the licensing process. In the past, the Ministry of Energy had a minor role in controlling RAE's decisions about RES, but nowadays, it is under the exclusive authority of RAE (RAE, n.d.). Furthermore, a new environmental law 4685/2020 has reinforced the policy framework for RES and has contributed to acceleration and simplification of licensing, RES deployment on public land at low cost and reform of the land uses in the Natura 2000 protected areas (Kati et al., 2021). Consequently, these policies have already brought different environmental and social issues.

2.2.2. Nature conservation vs Wind energy transition

The Mediterranean basin constitutes a global biodiversity hotspot, with 27.3% of Greece's land area being part of the Natura 2000 network of protected areas (Myers et al., 2000; EEA, 2020). It is therefore essential that thorough scientific research has been conducted for spatial planning of potential wind farms. However, as Kati et al. (2021) documented, there are plenty of cases in Greece where climate policies create risk for biodiversity. Therefore, the Greek government has largely

favoured RES deployment; already, 23% of wind utilization took place in Natura 2000 protected areas (MoEE, 2019; Kati et al., 2021).

Since the onset of the economic recession in 2008, the wind energy transition is affirmed to be a way for international investments, with an annual increase of 12% from 2006-2017 (Argenti and Knight, 2015; MoEE, 2019). Specifically, since March 2020, the total investment interest was six times more than the national target of 7.05 GW (Kati et al., 2021).

Large-scale wind farms have been installed in mountainous areas of Greece, owned and primarily funded by international corporations. In most cases, those land-use changes neither favour local communities nor produce wind power owned by the public sector (Sovacool, 2021). Typical examples are the future onshore wind farms planned to be set up in the Greek islands Crete, Chios and Skyros. Those large-scale projects that will produce energy also exported to Northern European countries have raised concerns in local communities (Argenti and Knight, 2015).

Another concerning decision that could provoke unrest is that some of the wind energy on Chios was planned to be exported to Turkey, which is in constant conflict with Greece. Moreover, governmental suppression and unjust planning affect the livelihoods of those dependent on tourism and agriculture (Argenti and Knight, 2015). Expansive submarine cables have been set up till the mainland of Greece to transfer energy from seven wind farms in Chios. As a result, the marine environment has deteriorated, and those energy transition projects have not favoured Chios Island (Avila, 2018). Regarding Crete, when society resists unfair wind energy transition, it is suppressed by police and upcoming court decisions (Siamanta and Dunap, 2019).

Overall, the spatial design of onshore wind farms is characterized by "green grabbing" and "land grabbing". The decisions for energy transitions are non-participatory, and in private discussions, RES companies guarantee landowners that they will receive financial support and jobs if they sell or rent out their private land. Some of the environmental issues created after installing wind farms were constructing access roads, industrialization of mountains, land degradation and deforestation (Argenti and Knight, 2015; Siamanta and Dunlap, 2019). These environmental injustices have been renamed legal by the international corporations that provided funding and the Greek government that gave permission (Sovacool, 2021).

2.3. Case selection and description

Ikaria is a mountainous island of the Aegean Sea with a total population of 8,423 and 255 km^2 (Fig. 1). Due to the climatic conditions, there is no air or sea transportation for about one-third of the year, and historically, residents of the island had to find ways to sustain their lives independently, from energy to food. For instance, a few traditional jobs were charcoal burning, shoemaking, sewing, shipping, and beekeeping. The island's economy has been traditionally diversified, and the families were self-sufficient, satisfying their basic needs through farming. However, since 1950, it has been primarily a practice of families dependent on small pensions, daily wages or small occupations. Nowadays, some primary professions are related to public services and tourism (ELSTAT, 2011; Bareli, 2014; VisitIkaria, n.d.).

Figure 1. Political map of Greece (Source: Adapted from Wikipedia, n.d.).

Ikaria is characterized as the "Aegean Cuba" or the "red island", as most Ikaria residents approved of the communist ideology. During the 20th century, Ikarians had accomplished to resist centralized institutions of governance and private ownership. Being involved in civic associations, they improved their livelihoods by collecting profits from their annual festivals and using them for building schools, irrigation and water systems and communal buildings. Those festivals were a way to cope with injustice and validate their independence, as the Greek state had marginalized Ikaria due to poverty and the leftist ideology (Bareli n.d.; Bareli, 2014; Bareli, 2020). Also, they are known about sharing

the natural resources of a forest, examples that are linked to degrowth and commoning, as it has already mentioned above (Coumparou, 2002; Kallis et al., 2020).

2.3.1. Electricity production

Ikaria is one of the thirty islands of Greece that is non-interconnected to the mainland, and electricity production is primarily based on petroleum. In Agios Kirykos of Ikaria, an oil power station (16 MW) has operated since 1967. Seven wind turbines provided up to 12% of the island's electricity needs back in the day, but their operation ceased in 2006, after about 20 years. In 2020, total electricity demand was 27,3 GWh, and the contribution of renewable energy was only 23%, and mainly supplied by the hybrid project NAERAS (9,9 MW), a privately-owned wind turbine (600 kW), and another one by PPC Renewables (900 kW) (Gianniris, 2011; Vlachos, 2016; PPC, 2019; HEDNO, 2020; HEDNO, 2021). Therefore, except for the environmental burden of the dependence on fossil, Ikarians have to deal with higher energy costs and energy poverty (Gakis, 2018). In June 2021, HEDNO ceased electricity supply for Ikarian households and businesses with debts to the company. That also happened in cases where the debtor had arranged a debt settlement with HEDNO and paid the cost as it was agreed (Axioti, 2021).

2.3.2. Hybrid energy project NAERAS

In 2019, in the Southern part of Ikaria, a new step towards energy transition started with the inauguration of an innovative pumped storage plant using hydroelectric and wind power (Fig. 2). It

Figure 2. The hybrid energy project NAERAS. (Source: Adapted from Schiza, 2012).

consists of a local-scale wind park with three wind turbines of 900 kW each, two small hydroelectric power stations (SHPP) with three hydro turbines using the excess water from the Pezi dam and pumped water and two water reservoirs for wind energy storage. As the water flows during the non-irrigation period (October-April), electricity for the island's network is produced. Wind power is used to pump water from the lower to the upper water reservoir, and in this way, it is stored (Tsipouridis, 2019).

According to Greece's Public Power Corporation (PPC), the NAERAS project can contribute various socio-economic and environmental benefits. For instance, it is estimated to reduce CO_2 emissions by 13.800 t per year and improve the island's energy security. Furthermore, 3% of the project gross revenues will be used from residents and the local authority (Tsipouridis, 2019). Also, the NAERAS project is now connected to the Hellenic Electricity Distribution Network Operator's (HEDNO's) electricity network, the subsidiary of PPC (PPC, 2020; HEDNO, 2021).

2.3.3. Tension about wind farm licensing

Since 2011, it has been planned to set up 110 wind turbines with a total power of 330 MW on the ridge of mount Atheras in Ikaria. This large-scale project was decided to be implemented without the involvement of the local government and the local community. Therefore, a local association organized three informative meetings to raise awareness about this issue. Finally, residents resisted vividly against this plan, ceasing the installation of wind turbines. One of the main arguments was that the total energy demand during summer reaches the maximum value of 9 MW, and there is no need to deploy a large wind power station. Furthermore, there are already five wind turbines on the island, and in combination with the hybrid energy station, it was declared that most of energy demand was satisfied (Green Agenda, 2016; Natsis & Bratsos, 2020; Botsi, 2021). The citizens were a bit ambitious regarding the total contribution of RES in electricity production, but regardless of this, they prevented the deployment of this large-scale onshore wind farm. Nevertheless, in November 2021, RAE announced the confirmation of licensing of this large-scale project, with the addition of a new plan to interconnect Ikaria with the mainland. Consequently, reactions have already raised by Greek citizens and the Mayor of Ikaria stating that the island has municipal and not public land (Kalampogias, 2021; RAE, 2021).

3. CONCEPTUAL FRAMEWORK

3.1. Energy democracy

According to Bessette et al. (2021), energy democracy started as a social movement, aspiring equitable, just and inclusive energy policies. This movement was triggered by popular campaigns claiming decarbonization, renewable energy transition, and climate and economic justice (Burke and Stephens, 2017). Furthermore, energy democracy is an essential critique of the current economic and political power towards energy systems and creates a vision for the redistribution of authority (Stephens, 2019). Also, it refers to citizen participation in decision-making processes about energy issues and it is closely related to energy justice and sovereignty (Feldpausch-Parker et al., 2021).

3.2. Energy sovereignty

The concept of energy sovereignty is a pivotal part of energy democracy, as it is about communities and individuals being able to participate in decision-making for their energy policy. Those policies are related to energy sources, forms and scales, and the organization and design of production and consumption. Depending on the type of community, the meaning of sovereignty changes. For instance, for Tribal Nations, it refers to the nation-to-nation relationship of the sovereign nation with the United States, and it is about the right to self-determination, which contributes to community development and autonomy. Another aspect is the ability to live in an environmentally sustainable way, aligning with the community values related to the co-existence of humans, plants, and animals. On the other hand, for nontribal communities, sovereignty could be the right to make community-scale decisions related to issues like the development of renewable energy. (Bessette et al., 2021).

3.3. Energy justice

A core element of energy justice is access to energy and has been used in planning and policy-making, and at an academic as well. It portrays energy issues of procedural justice, distributive justice, and recognition that are related to availability, good governance, sustainability, energy affordability and equity (Sovacool & Dworkin, 2015).

3.3.1. Procedural justice

Procedural justice refers to the right to decision-making processes so that people from different groups are engaged in a non-discriminatory way. As a result, people exchange ideas, and there is an open network of interaction. Furthermore, the citizens who are most affected by those decisions should have the freedom to speak up and special rights in involvement. Procedural justice has also been used in civil rights movements in North America to demand political inclusion. Therefore, it concerns issues related to gender, religion and class and is, however, hampered by pressure from multi-level legal systems (Hampton, 1999; Buckingham and Kulcur, 2009; Walker, 2009; Jenkins et al., 2015).

It is more and more important to have trust in the negotiation process, citizen participation in decision-making, and transparency at a community level. Legitimate public discourses should be characterized by reliable, honest and comprehensive information sharing. Affected and interested stakeholders have to be informed about investment costs and profits, the expected location of an energy project, the impact on the environment and humans, and learn about opportunities for decision making and participation. They should also be informed about the significance of renewable energy systems and how these can have an environmental, social and economic impact (Scherhaufer, 2021).

3.3.2. Distributional justice

Distributional justice is related to the location of energy infrastructure and whether it affects the citizens living nearby. It is also about access to energy and the distribution of the increased energy cost, and it is therefore correlated with the issue of energy poverty. For instance, a fair distribution of benefits and losses could be achieved through tax rebates or lower electricity bills for those affected by the energy transition. In addition, the benefits and burdens should be shared equally with a community regardless of race and income (Jenkins, 2015; Scherhaufer, 2021).

4. METHODOLOGY

I have chosen Ikaria island to conduct empirical research, as it is one of the non-interconnected islands of Greece that faces different challenges, including dependence on imported fossil fuels, increased energy costs and energy poverty (Gakis, 2018). Another important factor was the hybrid project NAERAS that has been operating on the island since 2019 (PPC, 2020). Also, Ikaria is a known place about the practices of commons, like sharing profits gained from summer festivals to improve the health system of the island; a fundamental principle of degrowth societies that can trigger more sustainable and equitable communities (Bareli, n.d.; Kallis et al., 2020).

4.1 Data collection

In order to answer the research questions about whether: a) the idea conception for NAERAS is related to energy sovereignty, b) the NAERAS energy system contributed to energy democracy, and

Figure 3. Location of study area showing the geographical points where the interviews were conducted (green) and the areas that NAERAS project expands on the island (purple). Source: Google Maps, 2014.

c) how the hybrid energy project has affected the livelihoods of inhabitants of Ikaria island; I conducted field study by using qualitative research methods. In particular, I carried out 14 individual semi-structured interviews between July and September 2021, with five key informants, including technical staff and the mayor, and with nine more local citizens (Appendix A) who either lived nearby the energy project NAERAS (Fig. 3) or had heard about it. Semi-structured interviews create some degree of freedom for the interviewees, as they can respond to open-ended questions as they prefer (Barthlomew et al., 2000). Moreover, this qualitative method is used to evaluate complex phenomena by providing insightful information and is used in cases where several research questions need to be evaluated (Piercy, 2004; Whitehead, 2005).

The length of the interviews was of great variance, mainly depending on the participants' depth of knowledge, something that affected the empirical data mentioned in the following chapter by each interviewee. For example, interviews by key actors ranged between 20 minutes and 1 hour and 40 minutes (average of about 50 minutes), whereas the ones with "local citizens" lasted between 10 minutes and 1 hour (average of about 30 minutes). The difference in interview length is also related to the participants' available time and whether they went off-topic. I sometimes allowed participants to share non-relevant information in the latter case to achieve a more natural discussion flow.

The empirical study started the last days of July 2021, and from the first day, snowball sampling was used to reach out to potential interviewees. Also, it occurred twice that residents introduced me to key informants instead of participating in the study. The last interviewee was the mayor of Ikaria, and due to his busy schedule, the interview was conducted online one of the first days of September. However, it did not affect study results because no reforms occurred in NAERAS progress during those months.

Another method used for participant recruitment was conducting random door to door interviews or looking for potential interviewees when meeting people on the street. Furthermore, I kept field notes to write down non-verbal observations or notes when a participant continued sharing information after the interview was completed. Also, a few data were documented in one case that a key actor was not willing to be audio recorded. In that way, I could sometimes understand the participants' positions and enrich the empirical data from the interviews. Lastly, on November 19th, I made a phone call to one of the participants to know if there were any news regarding the development of NAERAS.

I experienced different reactions from the participants, varying from enthusiasm to share information to a few being impolite. For example, some interviewees treated me to food or snacks, also talked

about their life in Ikaria, and one participant made a tour of the family garden. On the other hand, key informants were busier, and two of them were very talkative and tended to interrupt me, but they offered me to show the project facilities or take me back to Agios Polikarpos, the village I lived. Last, some of the inhabitants perceived me as a mediator to share their frustration or concerns. However, overall, they were willing to share information, and I felt that I was respected by most of them.

4.2. Data analysis

From the first days of interviewing, I started doing verbatim transcription of the interviews, and when they were clustered, I processed the collected empirical data by doing thematic analysis and creating 28 different codes (Appendix D). Coding was initially deductive, beginning with a set of codes based on the research questions (RQs) and the open-ended questions, and later, in cases that new topics became apparent, an inductive approach was applied. In this way, open-ended responses were categorized, and the gathered data were analyzed. Many of the codes were merged during the analysis, and the main themes emerged.

Document analysis was also a fundamental approach for obtaining more data and crosschecking the information derived from the interviews and observations. To answer the first RQ about energy sovereignty and the idea conception for NAERAS, I collected data about the background of NAERAS from public reports, available scholarly literature and internet sources, as a minimal basis before I conducted semi-structured interviews with the locals, and for comparing the gathered data. Some sovereignty examples in Ikaria, like natural resources management of the forest Randi (Coumparou, 2002), were used to test whether NAERAS is a current sovereignty case. Regarding the 2nd and 3rd RQs, the concepts of energy democracy and procedural justice were mainly used to evaluate the collected empirical data of the semi-structured interviews with the citizens living in surrounding villages and the key informants. I also conducted document reviews using local and national media websites and energy reports regarding electricity production and consumption in Ikaria. Furthermore, I collected recent scientific literature regarding energy justice in Greece to overview the current situation and compare it with the case of Ikaria.

4.3. Limitations

Most of the limitations are related to challenges regarding participant recruitment and therefore the total number of participants, who might not represent some views of the locals. The period of four

weeks I spent on Ikaria were a bit hectic for Ikarians, as it was during the most touristic season, and they were usually very busy. Even if they knew some information about the energy project, some people were not available or willing to participate. Furthermore, it was suggested to me to take interviews during the evening that the citizens of Ikaria would be more relaxed and would have finished their daily job. The first period, I followed their advice, but finally, I realized that it was difficult to conduct more than one interview in the evening, as it took time to find potential participants, especially at the beginning that I attempted to approach people only if they were outside, spending time at their yard. Furthermore, the weather conditions, with the daily temperature ranging from 30-40°C, also constrained the time of the day that I started looking for interviewees.

Another important limitation was the lack of regular buses with the public transportation being almost absent. Therefore, many locals and tourists move by their own or rented car. A more environmentally friendly option was the use of hitchhiking, which is common on the island. As a result, I preferred this way as the main choice for transportation around the island, where the distance can be long (i.e., 1.5 hours by car). Also, two key informants did not reach back after contacting them several times, trying to agree on a date to conduct the interview.

A last limitation was the unequal number of women versus men being interviewed. While looking for different participants, asking both female and male inhabitants if they were knowledgeable about the energy project NAERAS, I got a bit frustrated with the answers they gave to me. When I attempted to recruit women of different age groups, most of those had not heard about the energy project, and only a small fraction of 29% (6 out of 21) knew at least some information about the energy project. From the total number of 6 women who could be potential interviewees and were usually younger, 3 had no time that specific summer period and showed unwillingness to participate any other day and time. One was not available at that particular moment, and as I was at Agios Kirykos (1.5h away from Agios Polikarpos) that day, it would be difficult for me to visit the town another time. The rest two participated in the study, and they were the only female participants out of the 14 respondents. Furthermore, there were 4 cases that women recommended a man (husband, brother or co-worker) to be interviewed by me, and twice I realized that it was somehow automatically decided that a male is going to be interviewed, even in the case of a key informant and after sharing with her that I would like to take interview from a woman. These observations are cases that reflect the lowest ranking of Greece in Gender equality in the EU and the still existing gender stereotyping, referring to women as being primarily responsible for the care of the family and the domestic work (Kambouri, 2013; EC, 2018; OHCHR, 2019).

5. RESULTS & DISCUSSION

In this chapter, the results of the research questions: (a) *"What drove the uptake of the NAERAS project and is it related to energy sovereignty?*", (b) "*How is it unfolding in terms of energy democracy and justice?*" and (c) "*How has NAERAS energy project affected the livelihoods of inhabitants of Ikaria Island?*" are presented. The findings are mainly based on the empirical data collected through the abovementioned methods, including 14 semi-structured interviews, combined with information derived from observations, and are outlined with the document review and the conceptual framework used.

5.1. The drivers of the NAERAS energy project setup

As mentioned in a previous section, the NAERAS project is one of Greece's most innovative hybrid renewable energy projects, and it was proposed as an idea in 1999 (Tsipouridis, 2019). At that time, renewable energy consumption in Greece constituted only 3,7% of the total share (Ritchie and Roser, 2020) and this thesis aimed to investigate the incentives to implement a project like NAERAS. Whether its implementation was in line with the citizens' views about energy production and if it was finally a top-down or a bottom-up approach.

According to Bareli (n.d.), Ikarians had overcome centralized institutions of governance and private ownership during the 20th century. Moreover, being involved in civic associations, they improved their livelihoods by collecting profits from their annual festivals and using them for building schools, irrigation, water systems, and communal buildings. Based on those paradigms of bottom-up initiatives, one hypothesis was that the uptake of NAERAS could have been another example of sovereignty, where Ikarians aspire to low-carbon transition to improve their well-being.

5.1.1. Perspectives about energy production

To possibly find participants who took part in this initiative of energy transformation, the interviewees were asked about their willingness for energy transition before the time that the NAERAS project was first suggested. In that way, it would be investigated if there was any request by the local citizens to achieve decarbonization and if there were signals of a bottom-up approach that triggered the creation of the hybrid project, aligning with historical initiatives.

Also, it was necessary to understand citizens' perceptions about fossil fuel consumption for energy production. For instance, an electrical engineer working for NAERAS (Thomas) mentioned:

"It creates problems. Social, political, and ecological."

The Mayor, who lives in Agios Kirykos, the town that the oil power station is located, stated:

> *"I think it is very unfair and bad practice to use petroleum for the island, when we can have, for the needs of this place, for the needs of the island, energy from renewable sources, and so to […] have very low energy footprint. The PPC factory, which is a little further […], operates day and night, and we all see the results. Both with the smell and with the smoke that it emits."*

Therefore, both key informants are against petroleum consumption for electricity, and it is vital that especially the Mayor, who represents Ikarians, considers RES as an alternative to reduce energy footprint and air quality issues. Contrary, Mr Dimitris, a local journalist who works in Agios Kirykos, looked sceptical about it and said:

> *"Eh, probably it is needed […] My opinion was different when I was away […] That the best solution would be exclusively from RES, but we see, or at least at this stage, that they are not stable."*

Even if Mr Dimitris was against fossil fuel consumption for electricity production, he still considered oil necessary to cover the island's needs, arguing for lack of energy stability from NAERAS. However, one of the project's main benefits is the storage of wind power, resolving the issue of asynchrony between energy production and demand. Another reason why Mr Dimitris was sceptical might be related to his thoughts regarding the contribution of the NAERAS project to reducing fossil fuel consumption, considering that he works close to the port where the import of fossil fuel occurs.

Overall, the opinion of the interviewees was negative regarding the use of petroleum or mazut, and they were in favour of energy transition, supporting the deployment of renewable energy sources. Nevertheless, their willingness for decarbonization did not correlate with the conception of the idea about NAERAS and any citizens' request for transition to renewable energy. Consequently, the hypothesis of a linkage between Ikarian history regarding civic actions and a potential bottom-up approach that brought the idea of the NAERAS project had not been verified through Ikarians' view about electricity production at the island. More empirical data regarding the possible drivers of NAERAS uptake is analyzed in the next section, including the background information.

5.1.2. Background of the NAERAS hybrid project

The NAERAS system is located on the Western part of Ikaria that belonged to the former municipality of Raches. Raches is also a region including all of the villages shown on the zoomed part of Figure 3. PPC Renewables had announced that the project was an idea suggested by the company PPC Renewables and the Development Company of the former municipality of Raches of Ikaria (Tsipouridis, 2019). Based on this information, one of the study's main objectives was to explore the seed of the idea to carry out this hybrid energy project and how it all started.

While interviewing the different stakeholders, there were similar answers related to the substantial water resources of the island that could potentially be used for energy and about a few citizens advocating for this initiative of energy transition. For instance, the Mayor of the island, Nikolaos Kalampogias, who has been a permanent resident in Ikaria since 1999, mentioned:

> *"I think it was some Ikarians who first conceived the idea and proposed it to the PPC. There was some discussion, I think, and it took a long time until PPC decided to study it and then start the project."*

Mr Nick, who is a retired chemical engineer and former worker of PPC, explained:

> *"This started in the '90s, 2000, by the hydroelectric department of PPC. They came here after a request of the then community of Raches, to see the overflows of the [Pezi] dam [Figure 4], which in winter are great […] So, the engineers came, saw the water and were impressed as they did not expect that Ikaria has so much water in winter […] Ikarians saw that the overflow in the winter was large, and thought to call the PPC, the then hydroelectric if this can become energy. I also interfered to that."*

According to Mr Nick, who was the second interviewee, NAERAS was an initiative of the local community, and thus, the first days of the fieldwork, this was considered the reality. However, there was no further explanation, even if Mr Nick had made a thorough description of the history and establishment of the NAERAS project. Mr Nick used to live in Athens, and some years ago, while the project was ongoing, he moved to Proespera village, the region where the water reservoirs are located. He is very knowledgeable about the NAERAS project, and he claimed that the project had been implemented thanks to his contribution through political lobbying and by giving the engineers instructions to resolve technical or bureaucratic issues. Out of the 14 interviewees, only Mr Nick was involved in NAERAS progress. Therefore, it is very likely that the Mayor referred to Mr Nick through his statement.

Figure 4. The Pezi dam and the three wind turbines in the background.

Regarding the water resources of the Raches region, they started to be utilized in 1995, when the Pezi dam was constructed (Minagric, n.d.) – 4 years before the proposal about NAERAS. Therefore, the Pezi dam was the cornerstone to start considering ideas about hydropower potentials for the island. Even if the participant Mr Kostas, a restaurant owner in Nas, did not know how the idea started, he speculated:

> "*I think it was because the dam was built over for irrigation. […] Basically, it started from there. I do not know now exactly the idea, whose it was [inaudible] There was, let's say…the raw material, water. Now from where the idea started, I do not know."*

Different speculation came from another resident of Nas was that of Mrs Nataly, an unemployed, older woman and amateur painter:

> *"I think that the initiative to start was taken by some who get money. Clearly."*

Nataly's view shows an evident indication of distrust, which is widely perceived by Greek citizens towards political and impartial institutions (Ervasti et al., 2019). However, another interviewee, Mr Adam, a retired former technician of PPC who resides in Proespera, had a different view, underlining the incentive of getting subsidies from the EEC (European Economic Community). More specifically, he mentioned:

> "*It had started from the top, and they were discussing it. And in the prefecture, when the ones who knew, saw that the EEC subsidizes the projects that will be of the new form of energy, they rejoiced*

and understood what new energy is […] Much water run unnecessarily off to the sea, and we lost energy […] Below our house there was a large water source that went to the sea."

Overall, some of the interviewees did not know how the initiative regarding NAERAS started (Mr George, Jannis, Maria, Mrs Nataly, and Mr Kostas), sometimes speculating that the available water resources from Pezi dam must have been the reason for considering the construction of a hybrid project (Mr Dimitris & Mr Kostas). On the other hand, Mr Adam, who lives nearby the water reservoirs, talked about a top-down approach, which rationalizes the lack of knowledge of the interviewees. The rest of the participants believed or were certain that some citizens who were initiators of this idea decided the setting up of the project (Thomas, Mayor, Mr Marios, and Stelios).

The gap of knowledge regarding NAERAS drivers was bridged through the answer of Mr Adam about a top-down approach and an article about the hybrid energy project. It is characteristically mentioned that there was an essential contribution of Ikarian engineers for the idea conception about NAERAS and the initial spatial design. The promotion of the project was reinforced by the local government and prefectural executives and by Ikarian politicians (Karoutsos, 2019). Mr Adam had mentioned the prefecture staff being aware of the EEC subsidies and being glad they could use a new form of energy. Therefore, it was first conceived by Ikarian experts and communicated with local authorities in the public sector to promote it. The involvement of other shareholders and especially people who lived in Proespera; is absent. These findings of the 1st RQ contradict the concept of energy democracy, where democratic decision-making is enabled (Feldpausch-Parker et al., 2021). It is also intertwined with lack of energy sovereignty, and it lies in opposition with initiatives that are mainly bottom-up civic proposals (Laldjebaev & Sovacool, 2015; Szulecki, 2018), as citizens of Ikaria did not participate in decisions about the full scale of the project and the forms of renewable energy that would be deployed.

5.2. Decision-making and management of the NAERAS project

In this section, some of the significant decisions and management approaches of the NAERAS project are presented. These are related to the spatial design and the location of the hybrid energy project, the process of land acquisition, the source of financing, the management of energy production, and the compensatory measures provided to the local community, that will be analyzed in Chapter 5.3. It is also explored under which circumstances those decisions were made, considering the principles of energy sovereignty and procedural justice.

5.2.1. Spatial design and location of NAERAS

The spatial planning of the project was completed in the first years of the 2000s and was done twice, as the first design was inaccurate, according to what Mr Nick narrated. Then PPC decided to be in charge of it, and the second time, Mr Nick cooperated with engineers of the PPC and NTUA[1], who were in charge of the spatial design and gave guidance to them, either for resolving technical or bureaucratic issues (Gymnopoulos, 2012). As he mentioned, the first spatial design was completed by the Italian company Ansaldo. More specifically, he said:

> *"... studying the initial design, the engineers in Athens found that there were problems, and then a party was made by a civil engineer, a surveyor, a geologist, and we came here to review the issue. That is when I entered the game actively because, as Ikarian, I could not whistle indifferently. […] When we went to Proespera, I met an engineer who was the project manager. […] He told me a phrase that encouraged me, that: If we make a [power] station down there and use the whole altitude of the mountain, we will get three times more energy, so the project can be considered suitable and get approved by the board […] If I was not there and I was in Athens, and they came here unknown among strangers, they would have made a negative report and sent it to the board and PPC would have said: "Ok, we do not do it" and you lose it […] So the engineers' party and I went to the dam and started to redesign on paper*."

From the story that Mr Nick shared, one of the main observable patterns about decision-making; was that decisions were only negotiated by the inclusive involvement of male scientists and engineers[2]. It is only nowadays that a female engineer is working at the PPC Renewables office, and there were four engineers I met in total in Agios Dimitrios. According to a European study, this gender gap is observed at all levels in the European Union and its Member States, with low numbers of women being involved in decision-making in the energy sector (Clancy & Feenstra, 2019). Furthermore, Greece is one of the EU nations with the lowest rates of women's employment, and their role in management positions is also non-existent (OHCHR, 2019).

The spatial design of the project was completed only by experts both of the times, working either in the private company Ansaldo or at the then public company PPC/PPC Renewables. It was, therefore, a top-down approach, lacking energy sovereignty, as islanders did not get involved in decisions about the energy systems and the energy sources that would be used (Laldjebaev & Sovacool, 2015). Also, it is evident through the current study that the first decisions made for NAERAS lacked procedural justice. One of the core elements of procedural justice is the right to participate in decision-making to ensure that the basic energy needs and interests are satisfied (Guoyu et al., 2020).

[1] NTUA: National Technical University of Athens.

[2] In Greek language, gender is distinguished by using different definite and indefinite articles and endings of the words. This is how women's exclusion became clear to me, even when there was no reference to names.

5.2.2. Land acquisition

After the spatial design, the second stage was the land acquisition of the geographic areas that would finally be used. Many participants declared that public and private-owned land was leased or sold to the PPC. In the first years, a few Ikarian citizens were against selling the land area where the wind farm is located to PPC. As Mr Nick narrated:

> *"They [engineers from PPC] went there to put the wind turbines on the mountain. It is a bare mountain, and the goats have destroyed the area. They did wind measurements and found that this was the right place and that it belonged to the community, to the Municipality. We had issues with the wind farm […] The political party [KKE][3] formed a group here in Christos, which was not more than 15 people, who were against [selling the land]. They shouted: "And PPC and the multinationals will come and take our water, and the river will dry up and the wind turbines will affect the goats and what will happen to the goats" and something like that nonsense. […] No one counted them in. […] I knew them, and I told them: "You can shout as much as you want, but the project will be done. You do not have the knowledge or experience to overturn it"."*

Here we observe an example of technical elites who use the power of their knowledge to accomplish a goal by excluding at the same time citizens who are against the acquisition of public land. Moreover, Mr Nick continued:

> *"The [former Mayor] sent a letter to the PPC and said that "We do not sell it; we want to lease it". PPC threatened not to rent land to install wind turbines. There was a problem there because PPC […] sent a letter afterwards and said: "If you do not allow us to buy the property, we will stop the project". I had formed a group in Athens, like a kind of lobby [laughter] […] We invited the former Mayor in Athens, we explained him the issue, and he said that he is forced. I told him: "I know them" […] I said that we are going to ask the opinion of […] the party/team, which is the central authority of KKE in Greece […] Hopefully, the one who received it […] was an engineer […] He understood the seriousness of the project and […] he said, "We agree the project to be done." […] And the project was continued, and they sold [the land]."*

Therefore, when 15 local citizens were against public land acquisition for the wind farm establishment, technical elites and local authorities did not encourage communication. Instead, the lobby group of Mr Nick used techno-arguments to convince KKE politicians to allow the public land acquisition after the opposition of the citizens and the coercion of PPC to buy land. As a result, the wind farm is now expanded on an area of 1.3 ha, and the land used for other project purposes is at least 9.5 ha (Google Maps, 2014) and did not cause any meaningful conflicts so far. However, a

[3] KKE: Communist Party of Greece.

different approach, like civil society engagement and participation could have brought greater overall acceptance by the citizens (Carvalho and Horta, 2021) and therefore less scepticism.

5.2.3. Funding of the project

In 2007, two years before the project's construction started, it was initially funded by the EU and planned to last for six years (EC, 2021). However, due to delay of a predefined deadline, the EU ceased funding, and what followed is explained by Mr Nick:

> *"PPC held an international tender to submit bids, with specifications, international specifications, both for the electronic, electrical part, as well as for the civil engineering projects. ENET, the one that won the project, gave an offer […] And the other company that gave [an offer] and was forcing things […] was the Spanish PPC [Iberdrola] and was three times bigger and stronger than the Greek PPC. Both in know-how and budget. They did a similar project in the Canary Islands, outside Gibraltar. […] With the frictions and the conflicts, they delayed completing it. They went out of schedule, and from Brussels, they told them that they were dismissed. No, to understand the Greek bureaucracy as well. If it were another country, it would not have happened. In other words, they lost millions from the EU, because there were these […] frictions between them [ENET & Iberdrola], so they brought the delay […] And a […] PPC engineer, who was a smart man, but he was in the game of the conflicts too, he says "Eh, it does not matter that they cut us out. As they discarded us, we will do it with our own money". PPC had the money to do it, but if the other [EU] paid you 50% of the project…."*

It is essential to highlight that PPC used to be a public corporation, meaning that this funding was provided by taxes paid from Greek residents. According to PPC Renewables (2019), the final total cost of the project reached 50,000,000 €. Also, the project started to be constructed in 2009, the same year of the financial crisis onset. In 2010, a new programme called Kallikratis (Law 3852/2010) constituted a major administrative reform that reduced local government employees by 50% (Wikipedia, 2021). According to the sociologist Nicos Souliotis (2013), the Kallikratis programme triggered difficulties in the local administration system by transferring the austerity policies to a local level without adequate financial support.

Regarding Ikaria, the Kallikratis plan was that the municipalities would be centralized to only one administrative unit from the previous three (Raches, Agios Kirykos, Evdilos). However, the then Mayor of Ikaria, Christodoulos Stayrinadis, pointed out that this reform did not satisfy the economic resources needed, fostering existing inequalities (Bareli, 2014).

Consequently, it was a PPC engineer who exclusively decided the funding of the NAERAS project without considering local citizen participation, and it coincided with the beginning of the financial crisis and more severe inequalities. Therefore, a top-down approach was also applied to decide the source of project financing without citizen involvement in this vital decision-making process. Not surprisingly, though, this is in line with renewable energy planning in Greece, where citizens are not involved in decision-making (Polatidis and Haralambopoulos, 2004).

5.2.4. Energy Production

The total energy produced by the hybrid project is dependent on the available water resources of the Pezi dam and the wind potentials. Some of the key informants (Thomas, John, and Mr Nick) informed me about water resources management and the decision process about the overall energy produced. Thomas, who is one of the few engineers working for the NAERAS project at PPC Renewables, mentioned:

> *"By monitoring the water of the dam, the rainfall that brings water, but also a little monitoring of the consumption that the Municipality does, we intervene to say if we can get water or get less […] We help in managing this source of energy."*

Mr Nick talked about the provision of water supply to the PPC and how the Municipality controls it:

> *"Energy is produced from November, when the rain starts and the dam overflows, until the end of April that [overflows] start to stop. That is when the water level drops below the overflow of the dam by about 30 cm. There is a contract between PPC Renewables and the Municipality of Ikaria that [at this point, water supply for NAERAS] must stop. It is under surveillance, and PPC does not arbitrarily because at this point the Municipality can cease the water [supply]."*

The other engineer (John) working at the construction company ENET, said:

> *"Every day, there is a specific program that PPC Renewables from the head offices in Athens informs us about, in parallel with consultation with the local offices here…regarding the wind potential and the production need of the island…and they send us an operation schedule daily, depending on what load is required for [electricity] production."*

Accordingly, regarding the weather conditions, the availability of water, and the electricity needed, engineers decide how much energy will be produced. This amount of energy is only used by local citizens. Also, an important management strategy is about the water resources, as the municipality of Ikaria decides for water supply for the NAERAS project. Therefore, even if it is not a multi-

participatory approach, it can be considered that the municipality members represent and secure the needs of the locals. On the other hand, as engineer John reported, the total energy produced by the hybrid energy project is controlled by the PPC Renewables offices in Athens and Agios Dimitrios, contradicting with the concept of energy sovereignty and inclusion of citizens in the design of energy production (Bessette et al., 2021).

5.2.5. Strategies used for information disclosure

According to Jenkins et al. (2016), there are three main mechanisms that promote the inclusion of the citizens; greater information disclosure, improved institutional representation, and local knowledge mobilization to fulfil fair outcomes. These mechanisms can be used to potentially build procedural justice. While interviewing the participants about information disclosure, there were different responses about access and encouragement to information sharing. When two citizens of Proespera were asked how well informed they were about the upcoming project, they stated:

> "*In essence, it was just announced [to the villagers], they were not asked [...] No, we were not informed."* (Maria)

> "*People were ignorant of things and knew that the factory of Agios Kirykos was burning oil. They knew nothing else."* (Mr Adam)

According to Maria and Mr Adam, there was lack of inclusion and low education level. They were not encouraged to participate in planning decisions and lacked valuable information about the landscape. For instance, neither Maria nor Stelios, another citizen of Proespera, knew that the village is inside a Natura 2000 protected area, specifically a Bird Directive Site (SPA) important for passage migrants and breeding raptors (EEA, 2021). Also, Maria's words contradict the values of energy sovereignty that refer to people being part of decision-making processes about the energy sources and the energy systems necessary to satisfy local people's preferences and needs (Laldjebaev & Sovacool, 2015).

On the other hand, technical knowledge was easily accessible, and as Stelios said:

> *"Yes, whoever entered the project, they welcomed them, they showed the machines, the turbines. They gave a tour to everyone."*

Moreover, the engineer Thomas who is working the last years in PPC, talked about different forms of access to information:

"I had the chance to be informed by the electronic media […] I think the print media [was used], when the construction started, to inform the inhabitants of the island […] PPC Renewables had made some speeches open to the public, to inform the interested ones, the residents of the island. […] Company representatives recently held another such public briefing. Well, it is done. There has been a school tour, a visit from people who come from scientific interest, whether professional or academic..."

Hence, news regarding the project was mainly available through internet access, something that the journalist had also confirmed. The other engineer (John) mentioned about information sharing that:

"There was generally direct communication and contact and access to any resident or other interested party. Whatever had to do with the implementation phase of the construction, operation, which they were most interested in. […] We were always available. Both of us [ENET] and PPC."

However, when Maria was interviewed, she said:

"We went to the constructor, asked for the [environmental] assessment, and they did not give it to us. […] They told us, "We do not know, we do not have it. Who are you?" […] We went to the constructor, as that period, that summer, they put the rubble in the adjacent fields."

After Maria's narration, it seemed suspicious that the engineer(s) of the construction company did not know about the environmental assessment, even if they were in charge of putting the rubble in adjacent fields. Nevertheless, even if that was the reality, the engineer(s) of ENET should have referred Maria to a member of the supervision echelon for NAERAS, like Thomas. That would have been an example of transparency and access to information. However, this was instead an important case of information concealment. According to (Hitzeroth and Megerle, 2013), concealment strategy can bring increased risks of losing trust.

Finally, information sharing about the NAERAS project was achieved through public briefings, internet or print media and educational trips of local schools. In that way, technical information could be shared, and maybe it was also a way to inspire students about their future path. Though, there were citizens and mainly women, who did not know about the energy project, and finally, they could not participate in this study. Those women mostly belonged to an older age group, which might be correlated with gender stereotyping that is in decline, but still exists in Greece, and women are considered primarily responsible for the care, domestic work, and parenthood (Kambouri, 2013; EC, 2018). On the other hand, this does not excuse the lack of information disclosure strategies being

followed by PPC Renewables. For instance, "*ignorant people*", as Mr Adam called them, should have been encouraged in information sharing and especially the citizens of Proespera.

5.2.6. Citizen participation

Through the empirical data from the interviewees, it was evident that participants were not familiar with decision-making processes, which aligns with the study of Polatidis and Haralambopoulos (2004). For instance, Dimitris said:

> *"Now, a citizen to intervene autonomously; I would consider it absurd if each of us could do it. If we are 7,000, we will probably have 7,000 different interventions. I would like the Municipality to claim […] the citizens to demand from their representatives. To negotiate hard on such projects, so that the compensatory benefits are not vague, at a rate of 3%."*

The citizens of Proespera mentioned:

> "*I do not think that we can decide anything for the project. It is over [if there is anything I do not like]. [laughter] […] What can I say? I do not think that anybody will complain*." (Stelios)

> "*It is not that the residents living here will be asked. They were not even asked about the basics. Will they be asked how it will work, how much the revenue will be, and how it will be distributed? Etc.? There is no such thing. Well, we consider that PPC is a state body, so in essence, the state acts."* (Maria)

Another exciting opinion was that of a ceramist living in Nas (Mr Marios):

> *"I do not think anyone will ask me as a local. They will ask the municipality, and the municipality will, of course, listen to the residents. If it is done this way, it is democratic. You first listen to them, and then you make a decision. However, usually, decisions are not made democratically."*

Therefore, even if the respondents wanted to be involved, they did not consider participating in decision-making processes possible. Though, simplification could be achieved by organizing open dialogues with different stakeholders, especially the villagers of Proespera. That could also encourage more citizens to participate and get to know about their rights. However, there was a clear pattern of lack of encouragement for public participation and information disclosure. Those phenomena oppose the principles of procedural justice, which is related to democratic involvement in energy decision-making by all people potentially affected (Lee & Byrne, 2019).

The results of the study about the decision-making for NAERAS and its management indicate a manifest pattern of procedural injustices, and the only time that people were encouraged to participate

was in 2016 when the construction work ceased for 21 months, and 850 signatures were collected from the local citizens to send an out-of-court settlement to the PPC Renewables (Vitsaras, 2016).

5.3. Impact of the NAERAS project on the Ikarian residents

As the NAERAS project is a small-scale energy technology, a second hypothesis was that it could be considered a driver of a sustainable degrowth society, based on a previous study by Kunze & Becker (2015), and taking into consideration the simplistic way of living of Ikarians, and their practices of commons (Bareli, n.d.; Bareli, 2014). More specifically, the hypothesis was if NAERAS could trigger more equal societies - one of the elements of degrowth - eliminating harm to the environment and humans (Kallis et al., 2020). For instance, one assumption was the reduction of electricity costs, alleviating energy poverty, and achieving the decarbonization goal.

The construction of the NAERAS hybrid energy project lasted for ten years in total, from 2009-2019. During that decade, land transformation in Proespera village has occurred, and some problems that arose are described in the following lines. Also, the different compensatory measures that would improve the wellbeing of the citizens are analyzed, and further information about electricity distribution and cost that might have affected their livelihoods.

5.3.1. Land use in Proespera and conflictual events

Proespera is a small seaside village, as shown in Figure 5, with only 19 residents living there in 2011 (ELSTAT, 2011). The land area, either sold or leased, was initially privately owned and was used to construct the upper and lower water reservoirs, make concrete, and deposit rubble.

Figure 5. View of Proespera village.

The first years, during the second spatial design, one of the plans was the following that Mr Nick described:

> *"[We thought], we will go from the edges of the forest so as not to do much damage to the forest. This [design] was an ecological approach. We reached where there is now the upper [water] reservoir. There, there was a hill. He [an engineer] told me: "We will cut it, and we will construct a tank" […] We lowered the hill by 14-15 m. It became a plateau, like a court. They brought boreholes and drilled […] This job lasted for at least two years […] We avoided orchards and houses, crossed the coastal road and went to the sea, where the area of the lower tank had been chosen (Fig. 6), and so the project was located as it is today. No one could dispute it because it was the best solution."*

Figure 6. The lower water reservoir of the NAERAS system.

Also, he highlighted that:

> *"[Water] pipes are under the ground to avoid visual pollution, one is this, and the second is not to be vulnerable to hunters who strike with weapons, or to saboteurs […] It was created a prismatic trench, the bottom may have been 2 meters and the top 4 meters, and the depth from 2 to 2.5 m. We are talking about a trench, not jokes. This trench needs needles to be opened; it needs dynamites with minimal digging of the ground so that the shovel can pick up the materials, load them, take them*

where they should be and next to them pass cars in the rest of the section and put the pipes which are 12 meters."

Mr Nick mentioned the main construction work in Proespera village, and according to him, it became with consideration of the natural environment. However, it lasted for some years, and it caused issues like noise pollution, as Maria assured, and workers used to have night shifts even after midnight, until 4 or 5 a.m. Another issue that amplified afterwards was the soil removed from the construction sites. For instance, Mr Dimitris, the journalist, informed me:

"There was bedload, there was soil, gravel, which then…some floods occurred that swept away from them and made disasters at lower levels."

ENET started throwing soil in the sea, and the NGO Archipelagos, an Institute of Marine Conservation, started complaining about it (Archipelagos, 2011), and then ENET decided to buy some land, as Maria said. Maria, who now lives in Athens, and visits her parents at Proespera, explained that soil deposition to adjacent fields was the reason why she and her husband decided to make a public accusation:

"In the environmental study, it is supposed that the soil would have been transferred somewhere in Pezi, on the mountains; in fact, this is what we were told. So, instead of doing that […] My mother called me to tell me, "You can not imagine what is happening here. They throw all the rubble next to us." And what did they do? They bought some [plots]. Some even rented them. I do not even know if some people still receive [money] from that […] And imagine how much it would cost. To carry all this with trucks and transfer it up [to Pezi]. This road here was a dirt road. […] Initially, considering the cost would be tragically high, they decided to throw the soil into the sea. […] Then, [Archipelagos] made a denunciation that they should not…Moreover, because obviously that [NGO] is stronger and they have some connections etc., they were listened to anyway."

Therefore, what happened in Proespera is that after some complaints about the deposition of rubble occurred, more land was sold or leased. The NGO Archipelagos complained about ENET not complying with the environmental assessment guidelines, and after this issue gained popularity, ENET bought and rented land to put the soil residues. Stelios, who is an engineer and now a winemaker living at the upper level of Proespera, also verified it:

"They bought [land] right next to us to place the rubble. This is what ENET did. And then ENET forced PPC to buy the land from them so that it would not be left to ENET."

Later on, he described the reason why there were some reactions:

"Okay, there were disagreements at one point and then…because it went too far. The soil drowned us, and the project was not over. "X", who owns the company ENET, was defalcating money, and he was asking for more and the project was not progressing. And every winter, the soil drowned us. The roads were full of dirt; the water swept away the mud destroying everything. The vines have been destroyed. However, we were patient for it to end […] Now it is fine. However, from the moment the project works."

According to Stelios, ENET delayed the development of the project intentionally and through his words, there is lack of trust towards ENET. His statement is agreement with the ceasing of construction work for 21 months, the overall delay of 4 years, comparing to the initial plan (Vitsaras, 2016; EC, 2021) and the observations in summer 2021. These delays conduced to issues like mud running off during rainy days and destroying Stelios' vineyards.

Interestingly, Mr Nick said about the Archipelagos denunciation:

"When the contractor settled here in 2009, other complaints started. This group in PPC, which supported the Spaniards [another construction company], was trying to hamper the process, but it could not because there was a contract secured [with ENET] […] and they put some outsiders to complain about environmental […] disasters… Finally, however, we, Ikarians, took over. I was also involved, and we made a scientific and technical answer because he was saying many inaccuracies. And from the way he expressed his views, it was found that some others were hiding behind him and guiding him."

Therefore, Mr Nick's views contradicted those of the Archipelagos, Maria and Stelios, and it was prominent that Mr Nick was trying to highlight the benefits of the project. According to Maria and the report from the NGO (Archipelagos, 2011), it is manifest that ENET did not consider the environmental assessment and attempted to save money by throwing the soil residues into the sea and finally changing strategy by buying or leasing land, after the complaints of the NGO. As Stelios mentioned, ENET forced PPC to buy those plots of land and delayed the project on purpose for receiving more profits. It is also important to reiterate that the project was planned to be constructed in 6 years (EC, 2021), and there was an overall delay of 4 years.

When the participants were asked about their opinion regarding land dispossession, almost none considered this occurred. As Maria explained:

"There was space, and there were people who were shepherds until that time and had never had enough money. So, therefore, the acquisition of plots was nothing […] It was an area

with…completely ignorant people, poor people. Moreover, it was also convenient that there was already this road. So, they would not need to construct an extra one."

Mr Marios speculated that people who sold their land were content with this decision:

"Those who gave their land gave it because they did not need it. They wanted it, and they gave it. No one pressured them. No expropriation was made to anyone."

Therefore, people in the lower-income class who were receiving negligible wages as shepherds, could have bene the main reason land acquisition was an effortless process. Mr Adam was one of the people who leased or sold his land, even if he did not need extra income, as he considered it a good project for the island. ENET bought land next to the households of Proespera villagers to put the soil residues, being responsible for the restoration of the land, as will be explained in the following section.

An important observation about this small-scale project, is the fact that it has not caused land-grabbing and dispossession of the citizens. The interviewees informed me that no villager from Proespera was forced to leave due to the construction works or the acquisition of land. Also, in order to evaluate if there was land-grabbing, I collected data about the total land used by NAERAS and the land holdings in Greece, as land grabbing is related to the total size of land used and the land holdings of a country (Baker-Smith & Attila, 2016). In Greece, more than 50% of the country's agricultural holdings are less than 2 hectares (EC, 2021), and the total land used for NAERAS project is about 11 ha, representing the 6% of holdings of the country in 2010 (Eurostat, 2018). Therefore, NAERAS does not resemble multiple energy transition initiatives in Greece with large-scale renewable energy projects that contribute to dispossession of people and land grabbing, including (Siamanta & Dunlap, 2019; Sovacool et al., 2019).

5.3.2. Accountability about land restoration

Much information that the interviewees referred to had to do with unfinished plans like tree planting and the overall restoration of the Proespera region. For example, Stelios told me about the plot next to his vines:

"They now say that they will recreate that space and use it for […] picnic…they will make it a park."

In Figure 7, it is shown how the lower region of Proespera village has been left. This situation is what mainly worries both Maria and Mr Adam living nearby.

Figure 7. Former construction work area of NAERAS, including concrete production.

Maria mentioned:

> *"I know how my village was like before, and how it changed after […] If we go to the church, you will see. Further down, there are containers and barrels, various machines, etc., just like the machine that makes gravel. They have said that at some point, they will remodel the space, etc. Though, I do not think they will leave them there as they want to make the project visitable. We want to hope."*

Mr Adam repeated this issue a couple of times, saying once:

> *"I am afraid of leaving the junk, things […] Useless things that will not benefit them to pay for steamers and ferry boats to carry them back…It is now like an abandoned quarry."*

One of the primary measures promised to be taken to restore the land was tree planting. However, even two years after the inauguration of the project, this goal was not completed. Some of the interviewees said that it would happen throughout 2021. One of the arguments was the one that follows by Thomas:

> *"It is one of the jobs that will be done. We are waiting. The work of ENET must be completed, the crews and materials and the activity in these areas must be removed…I imagine that it will happen throughout this year…."*

These abovementioned examples contradict with energy democracy practices and the theory of accountability, which is about experts and policy makers being responsible towards the citizens (Szulecki, 2018). Also, the feeling of distrust of Maria and Stelios is in line with the findings of the study of Ervasti et al. (2019) that showed the low level of trust of Greek inhabitants towards impartial and political institutions. Especially, when there is a private construction company that caused some environmental issues, it is reasonable that distrust is cultivated.

5.3.3. Compensatory measures

PPC Renewables published the compensatory measures for the citizens of Ikaria in 2019, and the most well-known is the construction of a road of 7,2 km, passing from Proespera village. Another decision made by PPC is about the financial support of the local community by providing 3% to the municipality of Ikaria, reduction of CO_2 emissions and the improvement of the electricity grid system (PPC, 2019).

a) Road construction

During the interviews, many participants referred to road construction as a measure that lessened mobility issues, considering that it was gravel in the past, as in other areas of the island. However, for instance, Maria mentioned with some critisism:

> *"All they told us was about the road that would be built as it happened. So definitely people waited for the road to be completed to come and go easily in the villages, etc. So, it helped the locals a lot […] All I know is about the road. Which, of course, was not done to serve the people, right? It was made to avail the project."*

On the day of interviewing at the village of Proespera, it was surprising to notice that the road was still under construction, as shown in Figure 8.

Figure 8. Parts of the road construction work in Proespera.

Moreover, as Mr Kostas from Nas reassured me, there are still some safety measures needed to be taken:

> "*The road needs some improvements. I think it needs protectors, bars and such. I think it needs some of these on the slopes so that soil and stones do not come down."*

Consequently, even if road construction has favoured the commuting of locals, it was still under construction. Finally, though, in November, Mr Adam mentioned that the road construction, including the required facilities for safety measures, had been completed.

b) Financial benefits

PPC Renewables had announced that 3% of the total NAERAS revenues would be used to support the local community (PPC Renewables, 2019). Some of the local citizens did not know about it, and the answers I got from the informed participants about the management of this amount, varied. For instance, an engineer who was not interviewed but worked for NAERAS, said that 1.7% is sent to the municipality. However, on the other hand, his co-worker, Thomas, mentioned:

> *"Of 3%. [hesitates] Well, it must be 1.5%. I cannot be sure because it is also an issue that does not concern us. [inaudible] HEDNO takes…this money and gives it as required by the state."*

On the other hand, the Mayor stated:

> *"The Municipality does not receive the percentage that should have been given to it because it is exactly in the pilot phase and not in the operational phase […] I think there is no contribution [to the Municipality] in the trial [phase]. I do not know 100%, but I think it is still in the testing phase."*

Moreover, later on, he explained how he considers using this source of income from the NAERAS project:

> *"It should mainly enhance the locals' quality of life […] It could be an improvement of the road construction, a reduction in some reciprocal fees, possibly of the residents there, who pay to the Municipality. That is, it will be something; it will be a decision that will be collective. That is, either the financial committee of the Municipality or the municipal council of the Municipality will be asked to receive it so that they can decide how we can use these compensations to benefit the residents of the area."*

Therefore, decision-making about this profit is another example of top-down approach, where people are entirely excluded from speaking up about the benefits they should receive. Some of the local

citizens did not know about it and even two years after the project's inauguration, this amount is questionable, showing that PPC Renewables has abrogated from the initial promise to share 3% of the revenues. Regarding the financial benefits, there is a gap in information sharing between the Municipality and PCC Renewables. The Mayor does not even mention any income source from the project, while the engineers from PPC refer to half of the amount initially promised. Also, Mr Kalampogias, the Mayor, does not consider citizens as potential active participants in decisions about those revenues, consorting with the views of some interviewees, like that of the local journalist.

c) Decarbonization

A third vital compensatory measure promised was about lowering CO_2 emissions by 13,800 t annually (PPC Renewables, 2019). Mr Nick used techno-arguments to explain in further detail:

> *"The energy that produces is […] 7.8 MW. In winter, it covers Ikaria [needs] because, in winter, it requires around 5 to 5.5 MW due to reduced activity. During summer, it can cover 40-45%. In the winter, though, it covers it completely, almost it covers it completely. There is a machine in Agios Kirykos, and it works as a standby. So, it can cut down petroleum [usage] for at least five months […] and cover this energy on the island. First, there is economic benefit. You do not buy oil, which is expensive, and secondly environmental, because you do not emit sulfur dioxide and carbon dioxide.*"

The local journalist (Dimitris) told me what he has heard, expressing at the same time some level of distrust about its effectiveness:

> *"I think that in the offseason, i.e., outside the tourist season, that it covers us up to 90% or at least this is what I have read. So it is positive, very positive if we can [do that]. However, there is information, I will say it in that way, because I am not a scholar of the subject, that in the end, the fuel oil consumption for PPC has not decreased or is not reduced in similar cases….my question is…if we achieve this […] In other words, has PPC finally reduced the production of mazut? It is a crucial question, after all. Because, when such a decision is made, one of the main arguments is that we will get rid of it, this dirty energy*."

And he continued:

> *"But my reservations are due to the results. The main argument of this investment was that it would reduce or even zero fuel oil consumption to generate electricity. We do not see it, not even in winter. The factory is working. […] Mazut is constantly unloaded. Does the hybrid not work?"*

Also, there was doubtfulness about decarbonization from many other participants. Stelios, for instance, said:

> *"It gives [power], but it is not enough. They said that it was enough, but it is not. I know it because I also have friends who work at the power station. And the power does not reach [the required], and they are forced and use more power from the network. So, in essence, they draw electricity to produce electricity."*

The engineer Thomas explained:

> *"The main source of the island is and remains petroleum. As long as you add RES, you reduce oil consumption.* […] *It works, but not at 100% of its potential, because at the same time, there are improvements, adjustments, problem solutions. It evolves. Nevertheless, an effort is made to operate daily and produce as much as possible."*

When all the data from the respondents were collected, document review was done about the annual records of electricity production, published by HEDNO. The following table shows the rate of contribution of RES in the electricity production of Ikaria from January 2018-2021 (HEDNO). Specifically for the entire year of 2020, contribution by RES was only 23%.

Table 1. RES contribution to electricity production in Ikaria for January.

Year	Rate of Contribution of RES in Electricity Production
2018	11,14%
2019	3,81%
2020	45,30%
2021	30,30%

Consequently, even if Mr Nick highlighted that it covers the island's energy needs during the winter period, it seems that this has not been accomplished yet, as engineers Thomas and Stelios verified. Nevertheless, the NAERAS project has brought some increased the total share of RES in electricity production. However, another compensatory measure is still incomplete, arising the question of why, even after two years from the inauguration of the NAERAS, electricity needs are not even covered during January that energy demand is much lower than that of the touristic period. Last, the decision-making processes applied by PPC challenge democracy, as people are entirely excluded from speaking up about the benefits they should receive (Stephens, 2019).

5.3.4. Electricity distribution and cost

A significant fair outcome from the NAERAS project is that it is connected with the island's electricity grid, as different participants mentioned, meaning that every citizen has access to energy produced by it. It can therefore be considered an example of distributional justice (Jenkins et al., 2016). Also, most participants referred to great reduction in power outages, which might be the result of one of NAERAS goals (PPC, 2019). On the other hand, before visiting the island, one consideration was that Ikaria citizens would have some benefits related to the price of electricity from the hybrid project. However, it was surprising when participants started narrating that they noticed no decline in the electricity bill. For instance, two residents of Nas, Mr Marios and Mrs Nataly, said respectively:

> **"***To us, ordinary people, I do not think there was any change. While at the beginning they said that they will have reduced [the cost of] electricity in Ikaria. So far, we have not seen it. I do not think anyone has. Still at least, benefit and reduction. Apart from PPC. I do not know what profit PPC has operationally."* (Mr Marios)

> *"As a resident of this island, I do not see anything that serves me and gives me fewer energy costs."* (Mrs Nataly)

Their narration is a crucial paradigm of distributional injustice, as citizens are not benefited from financial returns yet. Some other interviewees would reasonably expect at least some decline in the electricity cost, but at the same time, they doubted that this will occur. For example, Mr George, who had met some of the people who worked for NAERAS, said:

> *"PPC does not make such favours […] I do not care how many got a lot of money. I thought that the electricity would be distributed here and that we would pay less to the PPC [laughter] And we allowed them to do the project […] When I leave you in my yard to make a seizure, a job, I must have a benefit. I am not in favour of exploitation, but at least to have a benefit."*

The journalist had a similar view, saying:

> *"I believe that after such an intervention in a place, that there should be a compensatory benefit, and only due to this great intervention, the provision of electricity should be at least at a better price, if not for free. Alternatively, at least to those who are closer, it should be free. Free of charge […] Probably though, electricity becomes more expensive."*

Moreover, as Mr Dimitris mentioned, the electricity prices in Greece have already been increased since August (Tolia, 2021). Citizens of Ikaria had not been exempted till the beginning of September, as HEDNO, the subsidiary of PPC, controls the electricity prices, as Thomas said:

> *"HEDNO is responsible. A company that buys electricity from producers and sells it to homes and consumers […] It is paid following the law, as it is now, in this way to the Municipality, in discounts and subsidies."*

Also, regarding the electricity prices, Mr Nick mentioned that there would be a decline in the future and the Mayor mentioned that the Municipality will request for this benefit:

> *"Yes, I will tell you. Based on the existing legislation on RES, the former Municipality of Raches, before merging, and now the Municipality of Ikaria, is entitled to 3% of the gross revenue from energy sale from the hybrid project to [the] distribution [system]. And now we are in the process of starting to collect. Because now, the project will pass into the hands of PPC. It is a serious economy for the Municipality and the residents of Raches. They will have a reduction in the electricity tariff from the distribution. I do not know how much it will be, but it will decrease."* (Mr Nick)

> *"It [the project] should help, it should help. We will be in the direction of insisting that there should be a reduction since it is a project that does not consume. We do not buy oil to burn. In essence, we are exploiting RES. So, its price should be reduced as much as possible […] I imagine the pricing decisions have nothing to do with the local level, but with the central ones, PPC."* (Mayor)

Consequently, Mr Nick highlighted the financial benefits that will soon derive from the project's revenues, mentioning the decline in electricity prices like it is inevitable that this will happen. On the contrary, Mr Kalampogias (Mayor) expressed that the Municipality will ask to reduce the electricity tariffs without reassuring that this attempt will be successful. Also, he referred to the top-down approach of decision-making regarding electricity distribution in Greece.

So far, the primary compensatory measures have not been accomplished to address two main issues in Ikaria, energy poverty and fossil fuel dependence (Gakis, 2018). And despite that, one of the upcoming plans for the NAERAS project is the interconnection with the neighbouring island, called Samos, as the engineers (Mr Nick, Thomas and John) informed me. However, other citizens I interviewed were not aware of this proposal and interestingly, the Mayor shared a different plan related to the energy autonomy of Ikaria Island:

> *"We have received funding from the EU in order to make a plan. That is a study, in essence, to see if we can take advantage of renewable energy sources if it is possible for the island to be energy self-*

sufficient. No longer need to burn oil. […] This will only apply locally, without major projects that could transfer energy or network Ikaria."

Therefore, this is a repeated example of no cooperation between PPC Renewables and the Municipality of Ikaria and lack of information disclosure towards the inhabitants of Ikaria. While the Municipality of Ikaria is planning about the exploration of the potential of geothermal energy and studies about wave energy to address energy poverty, PPC is instead planning to interconnect Ikaria with Samos, and RAE is imposing authoritarian policies by certifying the licensing of a large-scale wind farm and targeting for interconnection of Ikaria with the mainland (NESOI, 2021; RAE, 2021)

CONCLUSION

Due to sovereignty and energy justice potentials, Ikaria island and the small-scale project NAERAS were used as a case study. In this thesis, I explored whether the hybrid system is a prototype of energy sovereignty and justice. First, I investigated the triggering factors for the idea conception for NAERAS and if those were linked to energy sovereignty. The analysis showed that it resulted from a top-down approach, as Ikarian engineers conceived the idea about NAERAS, and the local government and prefectural executives promoted it. Other citizens of Ikaria, especially the most affected ones, were not involved in those decisions of form, scale and design of the project and therefore, fundamental elements of energy sovereignty were not fulfilled.

Then, I proceeded by questioning how the decision-making processes evolved, which gave further insight into the role of the different stakeholders. The findings showed a lack of procedural justice and energy democracy, as citizens were neither involved nor encouraged to participate in decision-making. Also, there was no coordination between the Mayor of the island and the PPC Renewables company, aiming for different energy transition paths for Ikaria.

The last research question was about the impact that NAERAS had on Ikarian society. The empirical data showed that it contributed to a few environmental and social issues, including slight decarbonization and improvement of road infrastructure. Furthermore, unlike with the land-scale energy projects in Greece, NAERAS did not foster social problems like land-grabbing, dispossession of people and great opposition against energy transition. However, on the other hand, there was a lack of accountability about promises like land restoration. Also, a reduction in electricity costs has not been achieved yet, failing to address the energy poverty issues of Ikaria. Therefore, there were a few benefits in this small-scale energy system that do not necessarily align with the conceptual framework of energy sovereignty, democracy, and procedural justice due to the lack of citizen participation in decision-making processes. It is crucial that NAERAS has not caused severe environmental degradation and, therefore, civil disobedience, but at the same time, there were no indications that it improved the wellbeing of Ikarians through, for instance, discounts in electricity bills or reductions in taxes.

Finally, this empirical work could be used to further research whether NAERAS will eventually alleviate energy poverty in Ikaria and enrich the current empirics that may not adequately provide enough data. Also, it could be further explored if the project's revenues will be used for green policies

embedded with degrowth principles, like introducing electric buses for better commuting on the island.

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APPENDICES

Appendix A: Participants of the study

Table 2. List of key actors interviewed and major information related to NAERAS.

Pseudonym	Role of the key informant	Organization/Company	Village/Town
Nick	Former Chief Inspector at PPC	Public Power Corporation (PPC)	Proespera
Dimitris	Local journalist	Radio Station	Agios Kirykos
Thomas	Member of the supervision echelon for NAERAS project	PPC Renewables S.A.	Agios Dimitrios
John	Electrical engineer	Construction company ENET	Proespera
Nikolaos[4]	Mayor of the island	Municipality of Ikaria	Agios Kirykos

Table 3. List of other inhabitants interviewed and their role as stakeholders.

Pseudonym	Role of the stakeholder
Akis	Former worker at ENET
George	Resident of Christos
Jannis	Resident of Agios Kirykos
Stelios	Resident of Proespera
Maria	Resident of Proespera
Adam	Resident of Proespera
Marios	Resident of Nas
Nataly	Resident of Nas
Kostas	Resident of Nas

[4] The real name of the mayor of Ikaria has been used, as it was vital to identify his role.

Appendix B: Protocol for interviews with inhabitants of Ikaria

Materials required

- ✓ Questionnaires
- ✓ Recording device
- ✓ Pen and clipboard

Objectives

- To inform the interviewee about the objectives of the research
- To understand their involvement in the NAERAS energy project
- To assess their opinion about the energy project
- To assess which are the obstacles that slow down the implementation of fair energy transition

Participant selection

Each interview was performed face-to-face and conducted at an individual level. During the interview, there was the possibility that other inhabitants or tourists of Ikaria were around and maybe sometimes gave comments and answered the questions. However, only the answers of the interviewee were taken into consideration.

Interviews lasted approximately 30-60 minutes, depending on the knowledge level of the interviewee.

The participants included:

- ✓ Both men and women
- ✓ Inhabitants of Ikaria of all ages

Introduction and explanation

I introduced myself, mentioning that I am from Trikala (a Greek city) and studying Climate Change at the University of Copenhagen. First, I briefly explained my empirical research about NAERAS and the main discussion topics of the interview. Next, I informed them about their right to anonymity and confidentiality. They could also interrupt the interview and avoid answering questions in the case that they were willing to. Finally, I explained why I preferred to audio record the participants and avoid keeping notes while the interview was ongoing.

Appendix C: Questionnaire for Ikarian citizens

Demographic information

Age:

Occupation:

Educational background:

Warm-up question

- I would like to know your opinion about oil and diesel for electricity production on the island.

Part 1: Drivers of the idea conception for the NAERAS project

1. Did you have the same opinion two decades ago, when the conception of the idea about the project was first introduced?
2. I would you tell me if you had ever experienced the need for energy transition before 1999 that the NAERAS project was suggested. If so, what made you think about it?
3. How do you think that the idea about the energy project came up?
4. When you first heard about this energy plan, did you have the chance to express your opinion about implementing the NAERAS project and how?
5. How well-informed were you about this initiative of the energy transition on the island? What kind of information had been shared with you, how and by whom?
6. Did you know that the NAERAS project lies on a NATURA 2000 protected area? If so, how did you learn about it and when? Did that make you change your view about the project?
7. How did the development of the project and its fulfilment evolve? Were there any disagreements? If yes, how were those resolved? If not, how did the stakeholders agree?
8. Do you know which were the reasons that delayed the completion of the project?

Part 2: Impacts of NAERAS on Ikarian society

1. Have you heard if the region has been evaluated for the environmental impacts before the project's approval?
2. I wonder if you consider it a project that caused land-grabbing, as it happens in many large-scale energy projects in Greece. Can you give me a specific example?
3. How many Ikarian residents do you think to have access to renewable energy produced by NAERAS? Are you one of those?

4. Could you tell me if you have noticed any changes in the overall cost of your electricity bills? If so, was there an increment or decline? Which do you think are the reasons behind that?
5. Could you give me one or two examples where you would alter electricity consumption levels if there were changes in the price of the electricity bill?
6. Have you experienced a decline in power outages since the completion of the energy project? Do you consider that it can be related to the NAERAS project and why?
7. Was tree planting organized after the inauguration of NAERAS to protect the environment?
8. Did you hear about any other ecological restoration measure that started after the implementation of the NAERAS project?
9. Have you heard if there is technical knowledge shared with residents who are interested in the project?
10. I would like you to tell me if you know if the project is utilizing local resources (materials), capacities (technical knowledge) and people (local workers).
11. Has anyone informed you about follow-up projects being planned? And if so, what kind?
12. Also, are you informed about how the 3% income from the project goes to the local community? Do you know how it is used? Who gets to decide how it is used?

Part 3: How is it unfolding in terms of management and decision-making?

1. Are you able to participate in any decision-making processes? How do you consider the whole procedure? (i.e. Is it happening with transparency?)

2. Do you feel that you can express your opinion about any socio-environmental issues related to NAERAS? For example, how has the project affected community cohesion?

Closing section

- Is there anything that you would like to add?
- Would you like to ask me anything about the research I am doing?

Appendix D: List of codes created

1. Incentives to set up a hybrid project
2. Reasons of delay
3. Electricity by fossil fuels
4. Willingness for energy transition
5. Chance to speak up about NAERAS
6. Information sharing
7. Natura 2000 area
8. Opinion about the project
9. Conflictual events
10. Land-grabbing
11. Electricity cost
12. Power outages
13. Electricity production
14. Energy autonomy
15. Road construction
16. Safety issues
17. Changes in energy consumption
18. Tree planting
19. Local resources
20. Local workers
21. Ecological deterioration
22. Follow-up plans
23. 3% annual revenues
24. Decarbonization
25. Decision-making participation
26. Politics and interests
27. Right to speak up about socioenvironmental issues
28. Lack of trust