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PUBLIC AWARENESS AND RENEWABLE ENERGY MARKETS

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ABSTRACT

Public Awareness and Renewable Energy Markets

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The use of renewable energy sources has become increasingly important in recent years for environmental, economic, and geopolitical reasons. The recent pandemic of Covid-19 and the Russian-Ukrainian war have both disrupted energy security and exacerbated the need for energy transition from fossil fuels to renewables. In order for this transition to be successful, public awareness and social acceptance on renewable markets is necessary. This research attempts an assessment of public awareness, drawing on Anglophone literature on the issue. It utilizes different examples of markets around the globe to observe the public's behavior on renewables and the variables that influence it. The geographical division of this thesis is in conversation with geopolitics and the particularities of territoriality. Through this research, the different reasons why renewable resources may be accepted or resisted can be seen.
Conclusions on previous research and comparative observations are also recorded.

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CHAPTER 1

1.1 Introduction

Energy is demonstrably one of the most important commodities. In the hands of superpower states, it acquires great geopolitical and strategic power. However, it is also primarily important to infinite number of consumers around the world, and as such, it must be affordable, non-harmful and as environmentally friendly as possible. One type of energy that is ecologically preferred to that of cheap fossil fuels is renewable energy (solar, wind, hydro, geothermal, hydroelectric and bioenergy) which has a low, or even zero environmental footprint, and bears its name from sources that are non-exhaustible.

As more and more countries are trying to move from a non-renewable to a renewable energy system, public awareness is an indisputable perquisite in order for this transition to be implemented. The aim of this thesis is to critically examine the existing literature on the issue of public awareness and renewable energy and, more specifically, to study the example of several different energy markets, in order to track public attitudes on renewable energy and the factors that affect them.

1.2 Structure of Thesis

The thesis has the following structure. In the Literature Review, a delving into the existing literature on the topic is attempted. This chapter attempts to review the most important theories on public awareness and its distinct categories. It also surveys the literature on the role of energy in general, the importance of renewable energy, and the geopolitics regarding the issue.

The third chapter briefly describes the methodology of the research, which focuses mainly on some very critical global energy markets, in order to build a field of research on social acceptance and awareness on RES.

The fourth chapter, which is the main part of the thesis, reveals the results of the thesis. This part of the dissertation examines separately the example of each country or region as a global market of interest. Greece is the first country examined, as a separate market and in the context of the EU via comparative research. Following Greece, the global markets of China, the US, India, and Africa are examined. In the Conclusion, the findings of this thesis and a summarization of the main arguments are listed.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter examines the recent literature on the topic addressed in the thesis. In particular, it begins with a commentary on the issue of renewable energy in general in the 20th and 21st centuries (2.2), as well as the issue of renewable energy's importance (2.3).

Section(2.4) takes up the most of the literature review, since it introduces the key issue of the acceptance of RES. Reference is made to the complex and dynamic nature of acceptance, the differences between acceptance at the national and local level. Special reference is made to the NIMBY phenomenon, which will be addressed at various points in the research, as it seems to be deconstructed. The terms of "energy democracy" and "energy citizenship" are explained, as well as the concept of active participation of the community stakeholders. The factors that contribute to increasing acceptance are highlighted, with an emphasis on education and research.

Finally, section (2.5) sheds light on the specific issues of geopolitics concerning renewable energy, one factor that influences energy transition around the world and should not be omitted.

2.2 Renewable Energy in the 20th and 21st centuries

Gan et al (2007, 144) offer a brief historical review on renewables:

> "*Interest in renewable energy began with increased environmental awareness in the 1960s and in debates concerning the relative merits of nuclear power versus fossil fuels. In the mid-1970s and 1980s, interest in renewable energy surged as a result of the "energy crisis", caused by the disruption of oil supplies and the rising prices of oil and other fossil fuels. From early 1990s, interest continued to grow*

> *because of widespread interest in sustainable development following the publication of the report "Our Common Future". In the 1990s, extra stimuli came from international environmental treaties, such as the UN Framework on Climate Change in Rio (1992) and the Kyoto Protocol (1997)."*

The use of renewables was more expensive in the past, but as its price is gradually decreasing, more countries have turned to renewable energy solutions "*in view of facing the everincreasing load demand, soaring oil prices and uncertain resources for conventional power generation with its well-known adverse consequences on climate and human health*" (Kaldellis et al. 2012, 37).

The need for many states to set short-term (by 2030) or long-term (by 2050) national targets for their energy mix was also dictated by the global energy crisis due to COVID-19 and the recent war between Russia and the Ukraine. In addition to the economic drain of consumers and the environmental crisis, "*renewable energy option is seen as an alternative that could bridge the gap between demand and supply if properly harnessed within a country*" (Akinwale et al, 2014, 637), as well as a way to improve the residents' living condition. Renewables contribute to a reduction of carbon emissions and promoting sustainable development. They offer "*widespread availability*" (Paravantis et al. 2017, 639), they create "*more diverse, reliable and competitive energy markets, motivating investments in new technologies, bringing new employment opportunities*" (Paravantis et al. 2017, 639) and finally they ensure a globalized, competitive, and innovative energy transition.

2.3 The Importance of Public Awareness

The energy transition from a non-renewable to a renewable-based system is gradual and public awareness is essential at this stage, because "*in order for the transition towards a low-carbon energy system to be successful, social acceptance by individuals, investors, markets, and society as a whole is a crucial factor*" (Vuichard et al. 2022, 1). A lot of states around the globe

finally understand public acceptance as an integral prerequisite of RE development. The model in which policy makers boosted the share of renewable energy in the energy mix without proper information created a disparity between social acceptance and governmental targets. This led to the cancellation of plans and projects that faced local resistance. On the contrary, accurate and timely information of local stakeholders and those who will undergo a direct impact due to RES can also bring about a much faster integration of RES into the energy mix.

The contribution of research to the subject under study is crucial, as it highlights the gap between government plans and public desire, identifies potential ignorance around concepts and projects. Unfortunately, "*most studies of renewable energy diffusion take a topdown approach, focusing exclusively on the policymakers, while neglecting the grassroots perspectives*" (Oluoch et al. 2020, 1). When surveys overlook the acceptance factor, the results are negative. As Antwi and Ley (2021, 2) point out: "*a series of recent studies have indicated the consistent resistance at national and local levels towards the implementation of renewable energy projects due to recommendations from previous studies that ignored the concept of acceptability*".

On the contrary, when public opinion is taken into account, "*the process of deployment of the RESs projects becomes easier and smooth*" (Kumar and Choudhary 2022, 204). Kumar and Choudhary (2022, 204) underline citizens' contribution to RES projects:

> "*...they play an important role in constructing the renewable energy policies. As they are main stakeholders, their point of view on distinct energy sources is crucial for devising the future energy needs. (...) Their opinion can help in countering the problems arising from the odd distribution of profits and losses generally linked with renewable energy projects*."

However, public awareness on renewable energy must be cultivated and stimulated from the state. The more educated, informed, and alert citizens are, the more they will be able to make

a decisive contribution and act to the extent that they can. Their awareness, therefore, raised by education, the media and government incentives, is a state issue.

One thing to be said is that the concept of public awareness will be used here interchangeably with the concept of social acceptance, "*understood as an active or passive approval of a certain technology/product or policy*" (Bertsch et al. 2016, 466). However, there is a gradation of quality and intensity in the concept of acceptance. Rau et al (2012) distinguish:

> "*The definition hence differentiates between four levels of (non)-acceptance: passive acceptance, called "approval", and active acceptance, called "support", passive non-acceptance, called "rejection", and active non-acceptance, called "resistance"*".

Public awareness includes both knowledge and awareness of RES issues, while the word 'acceptance' implies agreement and "approval". Furthermore, "*it is further necessary to carefully define what is accepted (or not), by whom, in which society, situation, and at which point in time, due to which reasons and motives*" (Lucke as qtd in Schumacher et al. 2019, 316). As this dissertation will demonstrate, resistance and acceptance in each context varies; it may be economic, cultural, or political.

2.4 Social Acceptance and Public Awareness about Renewable Energy

The energy transition, as planned by ambitious (e.g., European) and national plans, is positively viewed by most of public opinion. Questionnaires usually show a high percentage of acceptance of renewable energy (from now on, RE) projects, their development, however, as planned by each country's policy makers, sometimes faces significant obstacles. Some renewable energy projects have encountered solid public opposition worldwide (Kaldellis, 2005), because when moving from global to local this positive view for RES changes considerably (Walker et al. 2010). Social resistance towards new energy technologies,

especially those involving wind energy (Wüstenhagen et al. 2007) has been observed for various reasons and is aggravated by the RE cost, mistrust against policy makers and lack of information on new technologies among many others (Paravantis 2018). Resistance on a local level often concerns fears about the landscape alteration, noise and visual effects, the area's biodiversity, the flora and fauna endangerment and uncertainty about the environmental or economic consequences (Ellis et al. 2023).

Public awareness has thus been suggested as critical for social acceptance and energy project development. It has been said that a state's level of implementation of renewable energy technology is correlated with its population' degree of awareness (Assali et al. 2019). It has also been acknowledged that public acceptability has a significant role in determining the broad adoption of renewable energy technology and the attainment of energy policy objectives (Devine-Wright 2008). In other words, more awareness about renewable energy leads to more positive attitude towards this technology (Assali et al. 2019). Devine-Wright (2008, 11) have insisted that, since social acceptance is a necessary condition of technology development, it demands a deeper understanding of its social and psychological processes facilitated by "*interdisciplinary research using innovative qualitative and quantitative social research methods with a greater emphasis upon the symbolic, affective and socially constructed nature of beliefs about renewable energy technologies*".

Wüstenhagen et al. (2007) conceptualized social acceptance in its three dimensions: *socio-political acceptance*, namely the general broad acceptance (e.g., the positive overall picture for renewable energy), *community acceptance*, referring to local actors, stakeholders and regional authorities siting decisions, and *market acceptance*, which refers to accepting certain smaller-scale renewable innovations or products (e.g., solar thermal collectors). This seminal distinction facilitates identifying the research questions that need to be asked for each aspect, a task undertaken by the authors in the same key thesis. However, many studies moved

beyond this distinction to show "*how these processes evolve or how the actors interact to cocreate different outcomes*" (Ellis et al. 2023,1).

After three waves of research on social acceptance[1], more recent research is directed towards the dynamic aspects of social acceptance of RE projects, meaning the complexity of factors by which social acceptance is influenced. Ellis et al. clarify that the notion of dynamicity does not only refer to individual's change of minds before, during and after the construction of a RES project[2], but also that social acceptance is "*highly context-dependent and influenced by the engagement of different stakeholder groups with the community*" (Ellis et al. 2023, 3). According to Ellis et al. (2023), social acceptance is affected by time, power and scale and a number of other variables, such as socio-economic alterations, the market's evolution and technological progress. Moreover, Dermont et al. (2017, 26) argue that social acceptance depends on "*specific elements of policymaking such as actors' roles (e.g., decision-maker; target; sovereign), timing (e.g., proposal; final decision at the ballot), or the institutional room of maneuver given to the actors (e.g., direct democracy; lobbying)*".

An important issue that arises in many studies regarding social acceptance is the gap between the general acceptance of renewables and the more specific individual negation of accepting specific local projects. Germany is a typical example; Bertsch et al.'s analysis, apart from finding that within the borders of the same country, there is a difference in acceptance between rural and urban areas, observed a chasm between general acceptance of RES on a national level and acceptance on a local level. On the former, renewable energy was generally accepted, so was the power grid technologies. The respondents consented with different power generation mixes with a view to emission deduction. As the questions, however, became more

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[1] See Batel (2020) for a thorough literature review on RE social acceptance theories.
[2] See Wolsink's idea of a "U-shaped curve" attitude, where initial acceptance decreases in the project implementation phase, followed by rebound after completion (Wolsink, 2007).

concrete and related to the acceptance of a specific technological installation near their home, more concern, particularly for reasons of landscape alterations, was observed (Bertsch et al. 2016).

This divergence of views on the same issue, identified by Bell et al. as the "*individual gap*" that exists "*when an individual person has a positive attitude to wind power in general but actively opposes a particular wind power development*" (Bell et al. 2005, 461) may be attributed to various reasons. For Bell et al., this phenomenon is important and must be investigated to the extent that it causes the "social gap", i.e. the gap between the general acceptance of energy development and the low success rate in energy power developments. The social gap may be attributed to other reasons, such as a demographic deficit or the 'Qualified Support' Explanation (Bell et al. 2005, 463-464), but the authors give the possibility that the social gap is indeed the outcome of the individual gap, and the latter is due to a promotion of self-interest on top of the general good. This bias has in its turn attributed to the NIMBY (Not in my Backyard) attitude, the vague approval of a certain renewable energy until its installation becomes a personal affair[3].

However, the objective fact that "*environmental advantages of RES projects are perceived on a global or national level, whereas environmental impacts of such systems only affect the local environment and habitants*" (Kaldelis et al. 2012, 40) should not be overlooked. On the contrary, the experiences, practical knowledge and opinions of local people should be taken into consideration. According to Bell et al., it is not advised to disregard the fears or objections of residents, but to give them the right information to evaluate the proposed RES project themselves, thus information that is "*accessible and comprehensible*" (Bell et al. 2005,

[3] Note that this theory was challenged by Wolsink (2000), who generally discounted the importance of public awareness, due to the existence of institutional factors with greater impact on wind energy facility siting.

469). For this reason, a very interesting way to bridge the social gap and subvert the regional hesitance of local actors towards RET, is the "*collaboration planning*" that "*shifts the emphasis from competitive interest bargaining to consensus building*" proposed by Bell et al. (2005, 487).

This system which promotes dialogue and active participation was implemented in Portugal by Ferreira et al. (2022), who noticed a gap between the abstract national policies and the tangible local reality, which has an impact on respondents' decision-making while answering a survey. Furthermore, in each region, the most affected by and interested in its energy transition are its stakeholders. For abovementioned reasons, Ferreira et al. proposed the direct and rigorous involvement of stakeholders in urban policy and planning. Having asked the stakeholders to identify the biggest urban challenges and suggested intervention methods, the best NBS and their opinion on the benefits, they proceeded to analyze their answers and concluded that stakeholders do have the ability of coherent policy making. However, this bottom-up approach to planning should be questioned when there is no methodological tool to locate discontinuities between the stakeholders' perceptions and preferences. In the study under examination, this problem was solved with the adoption of the CHAID method.

In the context of the democratization of energy planning, a relatively new branch of energy research has developed, invested in what is called "energy democracy" and "energy citizenship". The link between the two notions is rarely articulated, although both concepts reflect active citizen engagement, such as adopting sustainable technology, joining energy communities, supporting local efforts, and taking part in policy decision-making. Wahlund & Palm (2022) define energy democracy as "*new forms of participative governance*", that view people as central agents of change, and energy citizenship as a way to engage individuals in energy systems. According to the aforementioned researchers, the active participation of people will both increase awareness and secure a more fair and inclusive energy transition, a more "*participatory governed*" (Palm 2022) energy.

The most common proposal by research regarding RE public awareness relates to education. Besides, it has been said that RES awareness in school indicates the general RES awareness of a country (Assali et al. 2019). Most specialists insist that at each of the three levels of the formal educational system, mechanisms for disseminating knowledge and educating the public must be implemented (Charters, 2001). Therefore, some studies examine the acceptability of RES in primary education and focus on this specific population group[4], which is still malleable and has the hope of developing healthy energy choices in the future. Some researchers have approached an even more targeted population, engineering students, since they are the aspiring engineers, on whose shoulders the burden of a net-zero carbon future falls (Eshiemogie et al. 2022). A revision of the Engineer Syllabi so that they include "*experimental learning, group projects, hands-on laboratory experiments and industrial attachments*" (Eshiemogie et al. 2022, 5) on renewable energy is highly recommended. A remarkable study in this field was carried out by Jennings (2009), who enumerated various initiatives from universities and states around the world that contribute to renewable energy literacy, such as the Energy Studies academic field, niche technical education or relevant specialist short courses.

Some others persist that "*education should not only be interpreted in terms of school, college or university education but also in terms of knowledge or access to information about different (energy) technologies*" (Bertsch et al. 2014, 475). Akinwale et al. (2014) suggest that the Nigerian government should invest in education through Mass Media and Public Awareness in different communities, while Zyadin et al. (2014) propose community-based initiatives and local ownership's funding RE projects. Finally, the research umbrella of RE public awareness has not omitted the inclusion of public awareness related to the global crisis, gas emissions and

[4] See e.g. Assali et al., 2019.

their own energy footprint. Eco-conscious citizens are more likely to adopt energy-conscious choices, which in turn will enable a shift to RE technologies (Zyadin et al. 2014).

In the ways of raising public awareness, we should not underestimate the value of research itself. Much of the following research contributes to the acceptance of RES and suggests ways to raise awareness widely, while many studies aim to offering suggestions to policy makers (Akinwale et al. 2014). The following surveys from different parts of the world allow us to compare different methodologies, approaches and results as well as observe public awareness from country to country, distinguish between rural and urban social acceptance and locate various economic, social, and regulatory variables that affect the awareness on RE technology.

As will become clear below, the acceptance rate of renewable energy on individuals depends on certain factors, such as demographical, personal, and educational. Age, educational status, income, property, social standing, and size of family are only some of them. An indicator that affects the acceptance of RES is the Willingness to Pay (from now on WTP), a behavioral economics term, which refers to the measurable amount of readiness and willingness of local residents to invest money in renewable energy. In the following surveys, many findings are common. For example, it is expected that young and educated people tend to have more WTP for renewable energy (Akinwale et al. 2014; Ali et al. 2023; Paravantis, 2018). However, it is interesting to identify their differences and especially their similarities, since research from all over the world will be examined.

2.5 The Geopolitics of Renewable Energy

It has been argued by theory that energy transition studies apart from the factors that promote or inhibit sustainable development, should also include a geopolitical perspective in their research, hence include a vision of the power dynamics between actors involved in the transition and their conflicting representations of the sustainable transitions. Through a

geopolitical analysis, the energy transition should be examined in relation to the balances, differences, and hierarchies between actors. This perspective is directly related to public awareness, as it directly involves stakeholders. The French school of critical geopolitics, for example, employs "*fieldworks, interviews and participative observations*" and encompasses "*local and regional authorities, local networks of citizens, national regulators and governments, European bodies, and industrial actors*" (Palle 2021, 2). Geopolitical analysis promotes an understanding of energy as a factor that can influence social structures and energy transition as a dynamic process that will alter power relations. Palle proposes that a "*prism of appropriation and ownership through territorialisation could be used to explore power relations in transitions*" (Palle 2021, 5). This will lead to a better understanding of the "*competing strategies often showcased in clashes over infrastructure projects*" (Palle 2021, 7).

Paravantis and Kontoulis (2020, 34) also contribute to this research, by observing that "*transition to low-carbon energy is expected to alter the geopolitical landscape, shifting the dynamics between producer and consumer countries and setting new energy standards for exporting countries*". The writers stress the need for research to address both geopolitical tensions between powerful states and climate change, referring to institutions established for the cooperation of states and their targeted action, such as the International Energy Agency (IEA) and IRENA. For Paravantis and Kontoulis (2020, 38), with renewable energy, states around the world will not only become more energy secure, but "*they will make themselves more resistant to geopolitical strife and more independent of the vagaries of fossil fuel markets*". Renewable energy is thus the solution to the energy security crisis caused by global geopolitical conflicts.

Vakulchuk et al. (2020, 1) extended the above finding on energy security by raising other questions concerning the consequences of energy change on geopolitical balances: "*Can electricity transmission be used as a foreign policy instrument or weapon similar to how oil and gas resources have been used in the past? Will renewable energy leaders such as China,*

Denmark and Germany strengthen their positions in world affairs? How likely is a backlash from declining petrostates during the transition phase?"

According to Vakulchuk et al.'s distinction (2020, 4), Parvantis and Kontoulis express the "reduced conflict" camp in theory, which views renewables as "*more difficult than fossil fuels to manipulate as they are less dense and more evenly distributed geographically*". However, there is also the "renewed conflict" camp, which attains that energy transition will not reduce conflicts between states but only create new tensions. The agnostic camp believes that "*implications of the energy transition remain uncertain and that it is therefore premature to draw conclusions about future geopolitical tensions*" (Vakulchuk et al. 2020, 4). This rational conclusion coincides with the opinion that "*it is difficult to identify clear-cut losers and winners in the global shift to renewable energy as the picture will be mixed*" (Vakulchuk et al. 2020, 4). However, overall, renewable energy sources will probably democratise and stabilise international relations. Authors finally suggest that researchers should distinguish between the geopolitics of the transitional phase and the geopolitics of a post-transition world.

CHAPTER 3

METHODOLOGY

3.1 Research Questions

The research is guided by key questions designed to explore the relationship between public awareness and the acceptance of renewable energy sources. Specifically, this study asks: *What are the primary factors that influence public attitudes toward renewable energy across different regions? How do geopolitical and cultural contexts affect the level of social acceptance for renewable energy initiatives? What are the most effective strategies for increasing public awareness and acceptance of renewable energy in diverse markets?* These questions are addressed through a geographically organized analysis of existing literature and case studies, focusing on specific markets like Greece, China, the US, India, and Sub-Saharan Africa.

3.2 Methods and Expected Results

The research involved a thorough review of multiple sources, including academic papers and online literature, which were organized geographically. The study compares social acceptance of renewable energy across major global markets, considering factors like public attitudes, willingness to pay (WTP), and geopolitical influences. The expected results include a comprehensive understanding of how public awareness impacts renewable energy adoption, with potential recommendations for policy and educational strategies to enhance public acceptance.

CHAPTER 4

RESULTS

4.1 Introduction

This chapter analyzes the results of examining the key issues raised in the previous chapter within specific global markets. The focus is on understanding social awareness and acceptance of renewable energy in different regions, including Europe, China, the US, India, and Sub-Saharan Africa.

The chapter begins with Greece, considered an average example within the European Union in terms of renewable energy acceptance. It then moves on to comparative surveys within Europe, China's pioneering yet under-researched energy transition, the politically influenced acceptance landscape in the US, the unique challenges and growth in India, and the emerging awareness in Sub-Saharan Africa. Comparative surveys are of great interest, both within a continent and across continents, as they provide insights into the varying levels of acceptance and the factors influencing them globally.

4.2 Public Awareness and Renewable Energy in Europe

The European Union, which is considered to be a global pioneer in terms of Energy Transition (Ioannidis et al, 2023, 1086), has expanded the penetration of RES by adopting the "European Green Deal" in 2019, setting the target up to 40% share of RES in the energy mix of EU countries in 2019, and setting binding energy targets (e.g reducing greenhouse gas emissions by at least 40% until 2030). To increase RE public acceptance, the EU is urging its Member States to involve their citizens more actively "*through a variety of measures, including community-based co-investment and joint ownership models*" (Cote et al. 2022, 2). The way in

which each Member State engages its members, however, is laid upon each country's promotion strategy. Some strategies and instruments have been found to be more effective than others but one should bear in mind that "*there is no "natural" superiority of any instrument because the success depends on the respective framework conditions in the individual Member State on the one hand and the specific style of the used promotion models on the other*" (Reiche and Bechberger 2004, 843). In any case, it is proven that citizens' perceptions and capabilities regarding climate change, energy transition, and renewable energy "*play an important role in both the adoption and support dimensions of acceptance*" (Spandagos et al. 2022, 2). In some European States acceptance is high (Germany, Denmark) and in some there is strong resistance (Ireland, France, UK). Greece is the perfect average example for further analysis, as it is right in the middle of the EU in terms of achieving its RES targets and is also one of the countries where there is acceptance of RES, but also local resistance.

4.3 The Example of Greece

Greece has remarkable RES potential due to its geomorphology and climate, demonstrating one of "*the highest percentages of solar panel adoption*" (Spandagos et al. 2022, 2) and processing some of the most favourable winds for wind energy installations. It has been recently included in the list of countries with the "*highest support for renewables*" (Spandagos et al. 2022, 8), among Denmark, Portugal, Spain and Ireland, but, as it will become evident later on, there is room for raising further public awareness. One of the first surveys on RE public awareness in Greece was conducted during 2009-2010, in Peloponnesus, and spotlighted Megalopolis, an area that already had RES plants in operation, more RES scheduled projects (the largest photovoltaic (PV) power plants in Greece are planned to be constructed there), while its population was familiar with the long-term operation of a lignite-based power plant (850 MW). Citizens were asked about their knowledge on wind, photovoltaic and hydroelectric energy and their perceptions on wind turbines/photovoltaic/hydroelectric systems. The results

indicated an environmentally friendly public group, whose majority acknowledges the benefits and accepts RE technologies as being very important for climate change mitigation. However, a noteworthy minority of 29% was "*rather skeptical towards renewable energy projects in their territory, unless people are convinced on their effectiveness (i.e. they need proof of their usefulness)*." (Kaldellis et al. 2012, 44) This information, financial data or proof must be provided by governmental or municipal authority bodies. Although results were satisfying, the authors clarify that acceptance of RES projects in this area is explained by the preexistence of the thermal power station in the region, "*which impedes a good life quality and economic growth of the people residing in the area.*" (Kaldellis et al. 2012, 47) In other regions, such as the Greek islands, the acceptance rates are not so high.

A lot of research has been indeed carried out in Greece's islands, to elicit residents' energy preferences and WTP for renewable energy sources. Zografakis et al.s' study, for example, is focused on Crete, whose geography and fortunate climatic conditions favor energy production from wind, solar, and agricultural biomass, rendering Crete "*the Greek region and one of the European islands with the highest penetration of renewables*" (Zografakis et al. 2010, 1089). The survey was conducted among 1440 urban households, each of which received a five-part questionnaire. The first three parts of the survey were intended to outline the energy profile of the respondent, the energy profile of the region and to elicit information on the residents' energy saving practices. After the "information session" about the advantages and disadvantages of RE, the WTP question, shaped under the double bound dichotomous choice format, was asked. The fifth part of the questionnaire retrieved socioeconomic parameters such sex, age, family income, education level and others. Results showed that those with higher income and property size, those who are aware and sensitive of climate change, those who have already invested in energy saving measures and those directly affected by electricity shortages, demonstrate higher WTP. The researchers highlighted how raising awareness on RES must be "*linked not only to the general issues, e.g. climate change but also to the local specific*

circumstances, e.g. tourist development or security of energy supply of insular regions." (Zografakis et al. 2010, 1093)

A research that indeed takes into consideration the specific local circumstances is the following, that focusing on the island of Skyros, conducted by Spais and Beltran. Although "*Greece enjoys a remarkable wind power potential with local average wind speeds often exceeding the 8-10 m/s, especially in the Aegean Sea islands*" (Spais and Beltran, 3), there has been strong resistance from local communities against wind farm installations, especially in Cyclades[5]. The aforementioned authors and researchers in this study formulated a questionnaire that sensitively took into account very specific local conditions, such as the fact that Skyrians are very concerned about the protection of wildlife in general and the population of the rare Skyrian pony in particular, or the fact that residents lack trust in local services because they have been deceived from a local doctor. Something also very original was that they measured WTP "*using the decrease in house value as a payment vehicle*" (Spais and Beltran, 9). The results showed that the resistance towards RES observed in the island is due to great concern of installation of the turbines inside Natura, that will affect the ecosystem, the luck of trust in authorities, the high anticipated costs and the anticipated visual externality. This research is the proof that the NIMBY explanation might be too simplistic to explain public attitudes towards RE in some regions.

Making a small geographical digression, in order to compare Skyros in Greece with the-equally fertile in terms of wind energy-Campo de Belchite County of Aragón in Spain, we see that, unlike Skyros, Aragon has already 155 wind farms, meaning that any research is carried out in the form of an evaluation of existing structures. Duarte et al's research, which takes credit of being the first research in Spain that brings together economic, social and

[5] See also strong resistance in Tinos and Andros.

environmental perspectives and analyses "*more intangible but important aspects that are not included in the official statistics*" (Duarte et al. 2002, 12823), such as the perceptions of citizens, environmental impacts, or re-investment effects, showed a wide divergence of opinion between territories, highlighting on the one hand the idiosyncrasy of each county and on the other hand the need for more "*decentralized, participatory and transparent management models*". These models could also apply to Skyros, Andros, and other Greek Islands. Since the citizens of Skyros distrust local authorities, a system of transparency and participatory decision-making could increase public awareness and acceptance of the wind energy technologies.

An active research group that has already conducted two studies on RES in Greece is that of John A. Paravantis, Eleni K.Stigka and Giouli K.Mihalakakou. After collecting all the existing literature on acceptability of renewable energy and its evaluation via the Contingent Valuation Method (CVM), with a focus on the inhabitants of local communities and their own response and perceptions (Stigka et al.2014), they conducted a research employing the CVM method to evaluate the WTP of a specific local community in Western Greece (Paravantis et al. 2017). The parameters that have a great impact on consumer's energy behavior identified in the first research, namely age, gender, educational level, household income and membership in environmental organizations were confirmed to correlate with WTB by the second survey. Income and membership in environmental organizations, in particular, were the ones affecting the WTP for hypothetical renewable energy projects in Western Greece, while age, household ownership, family size affect the WTP for actual renewable energy consumption. Since there is already an existing profile of the typical green energy consumer, in addition to educative campaigns and other measures, the authors suggest a targeted awareness-raising customized for specific societal groups that need extra incentives to invest in RE.

According to the most recent surveys, Greece has managed, within ten years, to increase the percentage of renewable energy in its energy mix, from a RES share in electricity generation section around 10% (Kaldellis et al. 2012, 38) in 2012, to almost 47% in 2022. In fact, "*the*

current installed RES capacity in Greece is 8.62 GW, while by 2030 RES capacity is anticipated to account for 25 GW, exceeding by far European targets" (Ioannidis et al. 2023, 1087). However, Greece ranks almost at the bottom regarding its Circular Economy performance. A very recent national-level survey that was conducted among Greek citizens which, in a first phase, measured the degree of public awareness towards RES, green energy and WTP, and in a second, post-survey phase, identified the public awareness on Circular Economy is that of Ioannidis et al. It is already evident from the sample size that the degree of acceptance is not the same regarding RES in general and Circular Economy in particular, when 1,111 people responded to the first call but only 140 (almost 1/10) to the second call. The results revealed that although "*citizens in Greece have partially accepted the existence of RES as part of their daily landscape*" (Ioannidis et al. 2023, 1092), and are highly aware of climate change, they still falsely believe that renewable energy options are more costly. The majority (60%), however, is willing to pay more for green energy solutions, while pensioners and unemployed opt for the cheapest solution. The researchers advise governmental authorities to inform citizens about the lower LCOE (Levelized Cost Of Energy) of RES, simplify the procedures in order to give incentive for investing, and educate citizens furthermore, from a very early educational stage.

4.4 Comparative Research in European States

As stated earlier, public awareness on RE is not uniform across the European Union. For this reason, comparative studies between countries are important because, on the one hand, they compare the acceptance of each RES technology individually and then help countries to stimulate the involvement of their citizens, by taking an example from other countries. One of such is the tri-national analysis by Schumacher et al, who took samples from households in three different countries in the Upper Rhine region: French, German and Swiss. The comparison between technologies and sub-regions allows the universality of a technology to be verified but

also compares the results with the rest of the global literature. Hence, their comparative research filled a gap in bibliography that of a lack of cross-regional comparability, while contributing scientifically in linking RE public acceptance with "*community energy*" (Schumacher et al. 2019, 315) where the direct engagement of stakeholders is directed towards energy autonomy. However, despite a difference in RE development growth (Germany experiences fastest growth than France and Switzerland) or in language (the questionnaire was distributed in three linguistic versions), the economic and social conditions of these regions are similar and the research "*revealed high levels of general public acceptance of REs in all three sub-regions*" (Schumacher et al. 2019, 318). Going a step further and conducting a crosscultural comparison among continents or at least different regions in Europe (e.g. Upper Rhine with Mediterranean) would be of greater interest.

A research that indeed compares the acceptance and resistance factors among different political contexts and cultural and spatial planning systems is that of Suškevičs et al which puts emphasis on wind energy, since it constitutes "*a third of the total renewable energy (RE) production*" (Suškevičs et al. 2019, 311) and examined WE acceptance in "*four supra-national large regions and eight subordinate regions across Europe*" (Suškevičs et al. 2019, 313). According to this research, of all the various reasons that have been recorded in bibliography for non-acceptance, some apply in certain areas (e.g "*external influence was considered to be the most important concern in the Central and Eastern European (CEE)*) and some in others

(e.g "*perceived encroachment into the landscape was assessed as most relevant in Northern Europe*") (Suškevičs et al. 2019, 313-314). Although concerns about landscape impacts are common across Europe, the priority-levels of acceptance issues are specific to each region and link to the planning quality in that context. One should bear in mind that this was an expert survey, meaning its questionnaire was contributed among members of COST Action TU1401,

who are all qualified either in geographical or environmental sciences. It would have been interesting to measure acceptance among unqualified, non-expert residents.

A comparative approach among three countries "*with different histories, levels of economic development, availability of natural resources, and electricity market structures*" (Vuichard et al. 2), Switzerland, Estonia, and Ukraine, was conducted by Vuichard et al. Their object of study is community acceptance of emerging wind energy markets; hence they approached specific regions with high average wind speed in all three countries. The method was based on qualitative interviews with industry experts and the experiments "*were designed to capture respondents' preferences for a variety of procedural and distributional justice scenarios, the visual impacts of the wind farm, ownership models and the project's ecological impacts*" (Vuichard et al. 7). The results confirmed what was also made clear by the example of Skyros; namely that, despite the differences between countries, the acceptance of wind energy is determined first of all by the ecological impacts while "*the second most important attribute in all three countries was visual impact*" (Vuichard et al. 10) . A difference among the countries is that the respondents from Switzerland, a country with a long history of public participation, ascribe a significantly higher importance to attribute of procedural justice compared to the other two countries, while Ukraine shows greater importance for the attribute of distributional justice. Although assumptions of a gap between countries have been disproved, there are important differences in the way in which the broader concepts of distributive justice and local ownership are put into operation in a particular national context, and this difference affect in turn social acceptability.

In view of the huge energy crisis that arose as a consequence of the war in the Ukraine, a very interesting thought, executed by Choma´c-Pierzecka et al. (2022), was to measure the degree of knowledge and acceptance of renewable energy solutions countries bordering the Russian-Ukrainian turmoil, Poland and Lithuania. In particular, individual opinions on RES issues were collected from residents of towns and villages in both countries, in order for the

researchers to measure not only the extent of their openness to RE, but also the extent in which public awareness impacts individual consumer choices. The results indicated that Lithuanians are more open to RES in relation to Polish, since "*Lithuania's energy transition, oriented towards the path of energy self-sufficiency and strengthening of energy security*" (Choma´cPierzecka et al. 2022, 8) is more developed than Poland's. In both countries however there the level of social awareness determines the popularization of RES solutions in individual use, modelling the energy market.

4.5. Public Awareness regarding China's Energy Transition

Considering China's population and its superpower status in global economy, the fact that it is "*the world's largest energy consumer and CO^2 emitter, accounting for 23% and 29% of global energy consumption and CO^2 emissions in 2019*" (Zhang and Chen 2022, 2) should come as no surprise. What is surprising, on the contrary, is the significant efforts being made on China's part to switch to renewable energy sources and the fact that, according to Global Energy Monitor, it is "*set to double its capacity and produce 1,200 gigawatts of energy through wind and solar power by 2025 reaching its 2030 goal five years ahead of time*"[6], which is indicative of China's intentions and commitment to its renewable energy goals. Nevertheless, as Zhang and Chen observe, China needs huge alterations to its energy system to achieve carbon neutrality and public awareness is a factor of outmost importance in this matter. Apart from issues like the transition costs, it is the public's response towards the required energy policies and their willingness to pay that will determine the feasibility of the decarbonization process, regardless of which path will the state choose to follow to achieve it. As Zhang and Chen remark, "*increased public awareness of carbon neutrality helps to consciously adopt a low-carbon lifestyle and reduce energy consumption and the carbon footprint*" (Zhang and Chen

[6] https://www.theguardian.com/world/2023/jun/29/china-wind-solar-power-global-renewable-energy-leader [7] I.e. tidal energy, wave energy, tidal current energy, salinity gradient energy, and ocean thermal energy.

2022, 11). For example, fuel substitution in the building and transport sectors will be impossible without public acceptance, as it "*fundamentally alters energy use patterns*" (Zhang and Chen 2022, 11).

China will need to consider various alternatives to eliminate carbon from its energy system and the public will need to be aware of them in order to contribute to the transition. In addition to wind, solar and nuclear power, as well as CCS technologies, which tend to be considered "promising solutions", marine renewable energy[7] has been drawing attention to China's Government and researchers as a strong option that can contribute largely to energy transition. Despite its huge potential, public awareness of marine energy markets remains relatively low in China, as the people seem to trust alternative energy markets that they are more familiar with, thinking that they are more trustworthy in terms of stability and costs. Despite the investments of the National Energy Administration, "*considering that the technology of marine renewable generation is relatively immature and there are many unstable factors affecting its power quality, some residents tend to prefer thermal power and*

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hydropower in choosing power consumption mode" (Hou et al. 2018, 12). Specialists insist firstly on the need for more environmental education that will stretch out "*the importance and necessity of a more renewable and plural electrical matrix"* (Hou et al. 2018, 15), secondly, on the media's role, and thirdly, on better and deeper research on marine energy.

One important side of the public awareness on renewable energy is the levels and forms of acceptance in rural China, areas where the use of renewable energy has known significant growth. Ali et al. (2023) were the first ones to examine the public acceptance of renewable energy in Shandong province in China by conducting a questionnaire survey and employing an extended version of the theory of planned behavior. In the already existing variables of awareness about renewable energy, convictions on the advantageous consequences of

renewable energy and subjective norms they included three new variables, i.e. environmental concern, risk perception, and belief about renewable energy costs. The results showed that there is a high level of acceptance of renewable energy, but residents' views are shaped more by economic than environmental criteria. Here, then, a twofold direction is proposed to the government. On the one hand, it should subsidize residents to increase their WTP, and on the other hand it should stimulate their ecological consciousness by advocating the renewable energy benefits.

Another study that examines the case of Shandong region, conducted also as a questionnaire survey, is the one lead by Liu et al., who found that most of the respondents were concerned with rural environmental problems, but a relatively high proportion of 22.6% showed no concern. Furthermore, the study showed that people tend to pay attention to their neighbors' behavior towards renewable energy, as 84% of the respondents answered that they would probably follow their neighbors' lead should they decide to use biogas or solar energy. Regarding Willingness to Pay, as research suggests in Europe, so too here, there are four important variables, "*age, household income, knowledge level and belief about RE costs*" (Lui et al. 2013, 1194). Though people of older age, as well as people of lower income, seem reluctant to accept an additional cost for renewable energy use, it is "*enhanced knowledge and belief (about renewable energy cost) will greatly increase the resident's readiness to support for the deployment of renewable energy (willingness to pay extra) in rural areas.*" (Lui et al. 2013, 1194). The authors highlight the need for "*propaganda and popularization of knowledge*" (Lui et al. 2013, 1195) regarding RES, making it clear that Chinese energy specialists place great emphasis on the role and influence of the Media.

4.6. Public Awareness and Renewable Energy in the US

According to the most recent measurements, after China, the leader in renewable energy installations, the US is second in place, with a capacity of around 352 gigawatts[7].The USA is an example of a country where all social actors, individual and collective are working to achieve renewable development. Both "*governments and regulatory agencies at the federal, state, and local levels have adopted specific policies to support wind, solar, biomass, and other renewable energy sources*" (Gan et al. 2007, 150), such as "*R&D funding, demonstration grants, and other financial incentives* (…) *for electricity produced from wind, solar, geothermal and closed-loop biomass facilities*", "*accelerated depreciation for investments in solar, geothermal, and wind facilities*", "*production incentives, personal and corporate tax credits, grants and loans or leasing programs*" (Gan et al. 2007, 150). In advance, a number of voluntary measures, such as educational and outreach programs, has been adopted (Gan et al. 2007, 150). However, back in 2007, Gan et al (151) were pointing out that "*the United States is behind the other countries in developing a clear national policy framework for renewable*",

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the other countries being Sweden, the Netherlands and Germany. Despite all aforementioned impediments, there was a "*lack of customer awareness on green power products and the abundance of coal and other conventional energy sources*" (Gan et al. 2007, 151).

One of the first broad-scale (telephone and Internet) surveys conducted in the US on social valuation of RE is that of Li et al. in 2009. The researchers examined whether respondents were willing to invest money on research and development (R&D) efforts needed to reduce US reliance on fossil fuels. Using a national advisory referendum format and a survey-based contingent valuation method, they measured "*US households' willingness-to-pay (WTP) for the creation of a national Energy Research and Development Fund (ERDF)*" (Li et al. 2009, 732).

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[7] https://www.statista.com/statistics/267233/renewable-energy-capacity-worldwide-by-country/

Participants in the survey were asked to provide their view on US's energy mix, on alternative energy sources such as "*crop-based fuels from corn, soybeans and other plants, as well as renewable energy such as solar, wind and biomass*" (Li et al. 2009, 733). Subjects who responded to the questionnaire while dependent on fuel for transportation and heating, they found the alteration of the mix of fossil fuels and the R&D investment important. In relation to the variables that influence WTP, this research emphasizes two of them which are not referenced until now in all other articles and studies examined in this thesis, that of gender and ideology. The estimated results suggested that "*being a female and more liberal, having a higher household income, all contribute to greater WTP*" (Li et al. 2009, 740). As will soon become evident, in the US, it is very common in such surveys for respondents to be asked about their ideology and political party of preference. The overall assessment of the survey of Li et al was that, generally, US residents were willing to support research and development regarding climate change and supply security issues.

The first form of renewable energy developed in the US for economic and technical reasons was wind energy. In 2011, "*the number of wind installations in the United States grew 32%*" (Petrova 2013, 575). Therefore, "*understanding the views of local stakeholders, their motives for support or opposition, and the discourses of public participation*" (Petrova 2013, 576) was considered necessary. Petrova, who opposed NIMBY as a reason for not accepting wind energy facilities, enlightened other, socio-economic reasons "*including public beliefs about particular wind farm impacts and the nature of the planning system, the types of communication and public involvement, the position—positive or negative—of a local group, and the level of trust in the developer and the planning process*" (2013, 591). This coincides with Rand and Hoen's broader research in North America. After collecting and analyzing all literature on RE public awareness in the last 30 years, they reached some general conclusions. Among their important observations, they pointed out that acceptance or resistance towards wind energy varies depending socioeconomic factors, such as positive economic effects (e.g.

creation of jobs, local tax revenue) or negative economic effects (reduced property value, decreased tourism, increased traffic). They agreed with Petrova that "*more research is needed to understand inter- and intra-community conflicts* (…) *and the relationships between perceived economic impacts and perceived fairness of planning processes and outcomes*" (Rand and Hoen 2017, 13). The non-acceptance of wind energy has also been related to sound annoyance, to the perception of health risk due to "*the "nocebo" hypothesis, in which the expectation of negative health effects influences symptoms experienced*" (Rand and Hoen 2017, 16) and last but not least, the fear of landscape change. The researchers also critically point out that all theoretical tools and research results are rarely translated into practice and call for immediate political action.

In the US, global warning and energy related issues are viewed as a political matter and a voting issue. According to Leiserowitz et al. (2023, 4), "*more than four in ten registered voters (45%) who voted in the 2022 election say global warming was either "the single most important issue" (2%) or "one of several important issues" (43%) to them when they decided how they would vote*". Along with the responsibility accounted to the Congress, the Governor, and both political parties, 60% of voters believe that citizens themselves can do more to address global warming. More specifically, in relation to renewable energy, from all voters, there is a high percentage (79%) that favors the funding of more research into renewable energy sources as well as the "*generating renewable energy on public land in the U.S*" (Leiserowitz et al. 2023, 5). Regarding Biden's "Inflation Reduction Act" (IRA), which is '*the largest investment the U.S governments has ever made to reduce global warming*" (Leiserowitz et al. 2023, 20), authorizing *"$391 billion for developing clean energy and addressing global warming, including tax incentives and rebates to help consumers and businesses buy energy-efficient appliances, solar panels, electric vehicles, etc*", the majority of the voters have heard only "a little" about this law. This might mean that there scope for improvement regarding for information and awareness, which must go beyond political prejudices.

It is also worth noting that in the case of the US, unlike in Europe and China, the political party plays a key role in all research related to renewable energy. Democrats and Republicans have different attitudes towards renewable development, with the latter opposing US's steps towards carbon neutrality in their majority. Although there is still a general disbelief in total decoupling from fossil fuels, conservative voters are overwhelmingly in favor of the energy mix of fossil fuels and renewables, while democratic voters and democratic leaners are more open to the possibility of US phasing out of fossil fuels completely. The most recent survey and the most representative as it targeted an adult audience of all genders, races, ethnicities, partisan affiliation, and education levels in the US is that conducted by Pew Research Center in 2022. Although most of US citizens support the development of renewable energy sources, they still "*stop short of backing a complete break with fossil fuels and many foresee unexpected problems in a major transition to renewable energy*" (Tyson et al. 2022, 4), such as heat price changes and "*higher costs for consumer goods*" (Tyson et al. 2022, 13). There is also an optimist view among citizens that a possible energy transition will improve the air and water quality and create job opportunities in the energy sector (Tyson et al. 2022, 7). Towards President Biden's energy agenda on achieving carbon neutrality by 2050, 69% of respondents are very positive.

4.7. Public Awareness and Renewable Energy in India

India exhibits a particular interest as an example because, firstly, despite having a low per capita income, it is the biggest democracy in the world, the "*second most populous country after China, home to around 1.30 billion people*" (Kumar and Choudhary 2022, 201) and as such, it is a model country especially for developing countries in Asia. Its energy policy is likely to affect the neighboring countries and set an example. Secondly, India is the third largest renewable energy producer with 40% of energy capacity and the fifth largest wind power producer in the world. India is a pioneer in renewable energy issues, since it is the country

which initiated the International Solar Alliance (ISA), an alliance of 121 countries, it was the first country ever to set up an entire Ministry of Non Conventional Energy Sources (MNES) devoted to renewable energy development and implementation and also developed the Indian Renewable Energy Development Authority (IREDA), a funding agency dedicated to providing innovative financing schemes to support these activities. Regarding its future targets, "*at COP26 in Glasgow in November 2021, Indian Prime Minister Narendra Modi took everyone by surprise by announcing that India will achieve net zero emissions by 2070*" ("Getting India to Net Zero", 7). Such a transition will not be met without a "*rapid decarbonization of the whole energy system and economy, including moving away from fossil fuels to renewable electricity generation*" ("Getting India to Net Zero", 15). Therefore, an assessment of public awareness on renewables in India is remarkable.

One of the earliest studies is that of Khambalkar et al. (2010, 134) "*conducted in the Akola district of the Vidarbha region in Maharashtra State, and concentrated on the renewable energy user and general public attitude in the district towards renewable energy*". According to Kumar and Choudhary (2022, 203), Maharashtra is one of India's states with the "*highest renewable energy potential*" along with Rajasthan, Gujarat, J&K, Karnataka, and Andhra Pradesh. The survey targeted an educated portion of citizens, those who own businesses and farms, government employees or other renewable energy users. They were asked about various sources of renewable energy and power generation, they were urged to compare fossil fuels with renewable energy and offer their opinion and suggestions on how the government should encourage the use of renewable energy. The results revealed that about half of them (53%) knew quite a lot about renewable energy, whereas the other half (48%) knew very little. The interviewees did not know about the benefits of renewables and only a small percentage was aware of the fact that renewable energy sources are non-polluting. Regarding the source of knowledge of this information, television proved to be the most influential, as 59% of the respondents declared that they learned about energy production from TV, while only 13% said

that they received their knowledge from school or college. Despite the relative ignorance, as revealed by this questionnaire, respondents were positively inclined towards renewable energy. A large majority of 93% declared that renewable energy production is much better than fossil energy production. In fact, some of them (31%) "*were found to be renewable energy users already, having installed solar lighting systems, solar water heaters, solar lanterns, and solar wind hybrid systems*" (Khambalkar et al. 2010, 140) in their households.

In contrast to the previous research, one of the most recent studies on RES social acceptance in India is that of the aforementioned Kumar & Choudhary, who prepared a-three segments-questionnaire and they distributed it among respondents from all age groups and from all over the country. Respondents were quite familiar with energy related terms such as "global warming", "climate change", "renewable energy", "greenhouse effect" and "carbon emission" as well as with various types of RES. This familiarity, contrary to the results of the previous survey, was acquired mostly from newspapers and books and secondarily from television, the internet, or radio. Generally, respondents showed very positive attitude towards RES and when asked about whether they approve RES installation in their state, it was found that "*64.33% of the total participants strongly approve and 25.63% slightly approve the renewable projects in their locality*" (Kumar and Choudhary 2022, 207). The factor that most influences their decision for energy transition towards RES is the purchasing and maintenance cost and more of half participants want the government to "*increase interventions in addressing the adverse climatic change*" (Kumar and Choudhary 2022, 208). It should be noted that apart from "*a massive understanding level of the participants towards the RESs*" this research simultaneously highlighted some "*problematic aspects of the FESs*" (Kumar and Choudhary 2022, 208). As this more recent research suggests, there is scope for further awareness, especially in a country and governance with such ambitious energy goals.

4.7. Public Awareness and Renewable Energy in Sub-Saharan Africa

Although sub-Saharan Africa is showing obvious signs of economic growth through the years, it still bears the stigma of a developing region. Unlike the developed regions we have already examined (Europe, North America, China), there are several populations in Africa that still do not have access to electricity. Oluoch (2020, 2) et al. expound on this: *By the year 2017, 19 countries out of 48 had a percentage population with electricity access levels above 50%. This is a marked improvement from a decade earlier when only nine countries (Comoros, Cote d' Ivoire, South Africa, Ethiopia, Mauritius, Sao Tome and Principe, Gabon, Nigeria, and Seychelles) had a percentage population with electricity access levels above 50%.*

It is worthwhile, therefore, to raise public awareness in some sub-Saharan African countries as well, starting with the-struck by energy crisis-Nigeria. In the field-based questionnaire survey conducted in the South Western part of the country, which aimed to investigate public attitudes towards renewable energy, it was found that the public has a certain degree of awareness about renewable energy but not a deep understanding of it. The vast majority of Nigerians are aware of hydro and solar PV but have "*poor knowledge of the efficient use of biomass and wind technologies*" (Akinwale et al. 2014, 641). The researchers' proposal to the government is to educate the public on the relevant issues and to fund renewable energy technologies (RETs). A study by Eshiemogie et al. that examined the education of undergraduate engineering students on renewable energy issues also took place in Nigeria. As the researchers were dismayed to find out, there is no such course in the official curriculum of the university and students' awareness of similar issues is lacking. This ignorance carries the risk for future engineers to reproduce techniques that are harmful to the ecosystem. However, the overwhelming majority of students want for a RES course to be added to their curriculum. Authors (2022, 9) suggests that "*the Federal Ministry of Education and the NUC, should collaborate with the Ministry of Power and Energy resources, as well as with members of the*

Renewable Energy Association of Nigeria, and draft a workable roadmap for the renewable energy future of Nigeria, factoring budding engineers into the plan".

Kenya can also function as a study case, since it is "*one of the fastest-growing countries in terms of electricity access growth, due to the Kenyan government's political commitment and planning processes that have maximized electrification through renewable energy sources*" (Oluoch et al. 2020, 2). Furthermore, local resistance due to unproductive negotiations between investors, local stakeholders and the government once resulted in the closure of a wind farm project in Kinangop. Taking into consideration the public's attitude and perceptions in such a country is crucial. The recent survey by Oluoch et al targeted citizens of urban, periurban and rural counties in Kenya, using the "*random stratified sampling technique that organizes the sample in hierarchical geographic units of Kenya for national representativeness*" (Oluoch et al. 2020, 5). The questionnaire was distributed in-person, since internet facilities are not common in rural areas, and 1020 responses were considered to be valid. Regarding the familiarity of respondents' with energy related terms, they were found to be most aware of "climate change" and least aware with "sustainable development". Generally, as it is expected, awareness levels were higher in urban areas (78%) in comparison to awareness levels in rural areas (61%) and this information is obtained mostly from the radio (68.5%) and the Press (62.5%), secondarily from word of mouth (57%) and television (58%), and lastly from the internet (45%). The last percentage is certainty affected by the fact that 73% of the rural respondents are lacking access to electricity. When it comes to approval, the majority (73%) strongly approves RES developments; the minority slightly approves (21%) or slightly resists (2%). A 4% does neither approve nor resist. The authors point out (2020, 11) that "*the next step of engaging the public will be to require their input in the process of assessing the benefits of different attributes of renewable energy technologies such as impacts on the environment, job creation, distance and visibility and ownership*".

An interesting study on sub-Saharan Africa is that of Antwi and Lay, who do not insist only on technological and economic difficulties as reasons for resistance to renewables, but also examine how cultural perceptions also contribute to resistance. Following Wüstenhagen et al's three-dimensional aspect of social acceptance (political, market and community), they integrate the notion of community, gender roles and leadership roles into the discussion. The two researchers firstly observe that, if in developed countries RES bring great benefits, all the more this is the case with developed countries where they can enjoy "*quality education, poverty alleviation, good health, sustainable cities and communities, water security, responsible consumption and production, and decent job creation*" (Antwi and Ley 2021, 1). However, the solution is not to impose development simply because there is nature and empty land, but to rather respect and examine the social-cultural dimensions of local communities and their everyday practices (e.g way of cooking) which may also indicate the desired type of renewable energy source. The authors use some interesting examples (Antwi and Ley 2021, 3):

> "*A case in point is in Niger, where preparing meat on naked fire is a cultural way of cooking, hence, for successful clean cookstove project in the country, there needs to be the possibility to dry and roast meat without significant challenges. Thus, the acceptance of a cookstove project will primarily be based on the cookstove/ technology's ability to enable meat roasting and drying.*
>
> *[…]Traditionally, cooking of "Banku" or "konkonte" in Ghana, and "Jollof" in Nigeria are best-prepared using biomass source of energy on coal pots due to the cooking process and to some extent the taste it comes along with it. This also influences the fuel type needed by a household to meet household energy need.*"

The existence of such customs, habits, and practices that constitute everyday life for residents, instead of being bypassed, should be incorporated into RES programming and development.

However, the same research sheds light on other unexplored aspects of acceptance, particularly in the African example. The renewable technical options and equipment chosen for a

community often do not take into account the technological and climatic conditions of a region. For example, "*some energy consumers avoided certain brands of solar kits due to prolong faults and extra cost associated with its repairs and accessories in Niger*" and "*2.5 MWp Navrongo solar photovoltaics (PV) project in Ghana equally faces technical challenges because of unfit inverters used by the contractor*" (Antwi and Ley 2021, 4). The authors also highlight the political issue that applies to various African countries. The government decides to invite investors for the country's energy development, but the direct consequences of this investment are experienced by communities that have neither knowledge nor awareness on the issue. Thus, the authors propose community acceptability as a suitable approach in designing and implementing renewable energy projects in local communities, which, in their opinion, attains the trinity of energy access, project sustainability and sustainable development.

CHAPTER 5

CONCLUSIONS

This thesis has attempted a thorough analysis of public awareness in relation to renewable energy sources. The thesis firstly attempted to bring together a significant part of the English-language literature on the issues of renewable energy and social acceptance. Definitions and classifications of acceptance were searched, some phenomena related to public awareness were studied and the relationship between renewables and geopolitics was also analysed. Borrowing the meaning of territoriality from geopolitics, the main part studied specific geographic regions and research was classified geographically.

As demonstrated by this thesis, each region, continent, or country presents different conditions from the others in relation to renewables. All the countries studied here are either entering or already are in the state of "energy transition" from fossil fuels to renewable energy. However, the levels of acceptance vary depending on the awareness of the public, their knowledge, their involvement in the transition and other factors that have been extensively studied. It was also observed that in each state the reasons for resistance are different and may involve political, economic, cultural, or environmental reasons. Even within the geographical range of the same country, there are differences in people's acceptance depending on whether they are living in an urban or rural area and whether they are immediately or indirectly affected by the renewable energy establishment. Therefore, one conclusion of the research is that regional comparison is constructive to the extent that it highlights the specific conditions surrounding each region.

However, despite the differences between states, there are some conclusions common to all the literature we came across. A shared feature of the surveys studied was the call for the state to better educate its citizens. The need to raise awareness from an early age in order to develop an environmental and pro-sustainability culture was stressed. Researchers were also complaining about the lack of adequate research regarding public awareness. A typical example

is China, which has a disproportionately small number of surveys in relation to how promising its energy targets are. A small number of surveys were also observed in India and Africa, while most of the surveys found during research were in Europe. Another common theme of the surveys is that the general public perception of RES is positive. In all the questionnaires studied, without exception, there was no doubt that this type of energy is preferable. There were, however, some hesitations, mainly economic.

In relation to these hesitations, most of questionnaires under examination, measured the variables that determine whether a citizen is willing to invest in energy transition. Willingness to pay (WTP) was thus found to be affected mostly by age, level of education, income and wealth, but also size of family, and social status. Gender was deemed to be influential only in a small number of surveys. Some research also recorded the importance of ideology and political support, especially in the US, where whether one supports the Democratic or Republican Party plays an important role for RES.

Many studies have looked at community participation and stakeholder involvement in the decision-making process, which has improved acceptance rates and involved the public. However, it has also been argued that a "community" is not homogeneous, and that research should take into consideration all the nuances within a community that create differences such as religious or cultural differences. A still unexplored part of research on RE public awareness concerns social norms and their relation to perceived justice. There is a part of theory that demands the investigation of this topic.

In conclusion, the importance of coordinated information and awareness-raising among citizens should be highlighted. State institutions, the media, organisations working on environmental issues, governments and multinational institutions must work together to ensure that knowledge and information are available for people. The better-informed citizens are, the more likely they will be to support and embrace renewable alternatives.

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