



Re-vitalising Energy Transition in Touristic Islands

Comprehensive report on Island Dynamics **Deliverable 2.1 - Public**

Lead Beneficiary: ITER, SA

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List of Acronyms

Acronym	Meaning
CETA	Clean Energy Transition Agenda
CBA	Cost-Benefit Analysis
EC	European Comission
ERDF	European Regional Development Fund
ET	Energy Transition
EU	European Union
EV	Electric Vehicle
GA	Grant Agreement
GHG	Greenhouse Gases
NECP	National Energy and Climate Plan
LEAP	Long Term Energy Alternatives Planning
MAGGIOLI	GENERA Project partner
MCDM	Multiple Criteria Decision Making
RD	Royal Decree
RES	Renewable Energy Sources
SECAP	Sustainable Energy and Climate Action Plan
SDG	Sustainable Development Goals
UAST	Urban Adaptation Support Tool
Univercities	GENERA Project partner
UAST	Urban Adaptation Support Tool
UPV	Universitat Politècnica de València – GENERA Project partner
WP	Work Package

Executive Summary

This document has been developed as part of **LIFE21-CET-LOCAL-GENERA** project, funded by European Climate, Infrastructure and Environment Executive Agency - LIFE Project Grants, under **Grant Agreement No. 101077073**.

It corresponds to Work Package 2 (WP2) – *Understanding Touristic Island Dynamics* and to Deliverable D2.1 – *Comprehensive report on Island Dynamics*. This deliverable includes the information gathered through the activities: *T2.1 Building on existing tools. Identification of actual monitoring tools*, *T2.2 Stakeholders mapping, Policy and Regulation*, *T2.3 Energy Transition awareness* and *T2.4 Financing mechanisms for municipalities*.

The document focuses on the first phase of GENERA, and it is intended to be the source of information to promote and improve the decision making of energy policy makers and public authorities, considering the appropriate design and implementation of sustainable energy policies. The main objective is to define the gaps in knowledge, skills and competences in order to identify the main weaknesses, challenges, barriers and opportunities to accelerate sustainable energy development in tourist islands.

Hence, the primary audience of the document is municipalities, data analysts, monitoring and evaluation experts and all related stakeholders of the information lifecycle.

In order to carry out the information gathering, a comprehensive search for information on existing energy planning tools has been carried out, identifying the points that have not yet been addressed. In addition, regulatory framework, existing financing mechanisms and stakeholders were studied to define a context for action in each island of the consortium. Citizen surveys and interviews with public authorities were carried out to find out the level of awareness, as well as good practices and other initiatives.

As these surveys will remain open throughout the project to gather as much information as possible, a new deliverable D2.1 document will be presented at M30, updating this new information obtained.

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1. Introduction

1.1 Purpose and Scope

The main objective of this deliverable is to improve the level of information and guidance on Energy Transition in municipalities located in tourist islands; specifically in the islands that are part of the consortium: Balearic Islands (Spain), Canary Islands (Spain), Sardinia (Italy) and the South Aegean Region (Greece).

In this document a review of the regulatory framework, current policies, identification of stakeholders and existing tools for assessing the energy transition and existing financing opportunities will be carried out. All this gives an insight into the state of the Energy Transition in the Tourist Islands.

1.2 Structure of the Deliverable

- **Chapter 2 - Contextualization of tourist islands in the European Union.**

Contextualise the role of European islands in the energy transition, current policies at national and regional level. It also includes details that highlight the interest in the study of tourist islands.

- **Chapter 3 - Characterization of municipalities located on tourist islands**

This section presents the key role of municipalities in ET. Firstly, it highlights the importance and key role of energy planning at the municipal level and, specifically, in islands. In addition, guidelines for mapping stakeholders in the ET process will be given together with a review of existing mechanisms for energy planning and financing mechanisms.

- **Chapter 4 - Analysis of Energy Transition on Tourist Islands: Case Studies**

This section focuses on the study of municipalities located on tourist islands, mainly the islands belonging to the project will be studied: Spanish, Italian and Greek islands. For each case, the regulatory framework, the level of ET awareness of stakeholders and an initial mapping of citizens will be assessed. Finally, a comparative study of the energy transition on the different islands will be carried out.

- **Chapter 5 - Conclusions**

Finally, the conclusions drawn on the state of ET mainly in islands, and specifically at the municipal level.

2. Contextualisation of tourist islands in the European Union

This chapter aims to establish the baseline scenario to determine the state of the energy transition in terms of existing regulations and barriers that apply to tourist islands. On the one hand, the current regulations to deal with the Energy Transition (ET) at European and national level will be dealt with, in order to show the current trends towards which Europe is heading. In addition, the different barriers at national level that hinder the ET are also discussed. On the other hand, and as a final section of this chapter, the characteristics that make tourist islands within the European Union special and that make them of special interest when it comes to applying regulations or creating actions for the ET are defined. In this way, tourist islands are contextualised by addressing regulatory and normative aspects at European and national level, as well as the main barriers to be addressed both at national and island level.

2.1 EU Regulatory framework

The European Union (EU) is swiftly tackling one of the biggest challenges facing the world: climate change. To this end, the EU intends to accelerate the process towards ET by setting ambitious objectives such as decarbonisation of the electricity system by 2030 or carbon neutrality by 2050 as presented in 2019 at the European Green Deal [1].

Following political commitment, the EU launched the 'Clean Energy for All Europeans' energy regulation [2] in favour of clean energy and the reduction of fossil fuels in 2019. This package of measures aims to prioritise energy efficiency, increase renewable energies and present new opportunities to decarbonise the whole EU economy in line with the European Green Deal objectives. In addition, it seeks to create synergies between the different member countries, resulting in a legislative balanced impact at all levels: EU, national and local. The most revolutionary point of this package is not the measures towards the 2030 targets but achieving long-term climate neutrality by 2050. The visualisation and planning of these 2050 targets greatly affect all governance processes and schemes, and cities are collaboratively developing cross-cutting roadmaps that affect all areas and sectors of society [3]. Considering that cities account for 2/3 of all energy use worldwide, energy and infrastructure decisions must be long-lasting and have a long-term impact on emissions reduction [4]. In this aspect, the actors in favour of ET range from the municipalities' mayors themselves to high-level political leaders. This encourages the creation of initiatives that favour the involvement of all actors and start working on climate change and the ET from the local level.

As part of the European Green Deal [5], the European Commission committed to reduce greenhouse gas emissions to at least 55% compared to 1990 [6]. Since this commits all sectors and involves cross-cutting actions, it is also affected by the other two targets set:

a minimum of 32% renewable energy supply and at least 32.5% improvement in energy efficiency.

This new proposal, which increased the targets previously set (to reduce greenhouse gas emissions by at least 40%), is accompanied by the impact assessment, which provides a basis for adapting climate and energy policies to contribute to the decarbonization of the European economy.

To assist Member States in guiding them towards the 2030 goals, guidelines were established for planning, reporting and monitoring based on the same template, covering five dimensions: decarbonisation, energy security, energy efficiency, internal energy market and research, innovation and competitiveness [7]. In this way, energy and climate policies were included at the national level, and National Energy and Climate Plans were created. Following the review of the national plans between 2018 and 2019, an update is expected by the end of June 2023 and new measures and ambitions for 2024 can be reflected.

In addition, the European Commission (EC) adopted the European strategy for adaptation to climate change [8] to make Europe more resilient to climate change and to create policies consistent with this issue. Among the main actions to achieve this goal are:

- Achieving **smarter adaptation** through robust data and assessment tools, in addition to leveraging the Climate-ADAPT platform [9] for adaptation knowledge.
- More **systemic adaptation** by supporting sustainable development policies in different fields and creating local adaptation actions.
- **Faster adaptation** to mitigate climate risks and increase protection.

On the one hand and in relation to local actions, the Covenant of Mayors for Climate and Energy initiative (2015) was supported by the EC after bringing together two different initiatives "The Covenant of Mayors (2008)" and "the Compact of Mayors (2014)" [10]. The Covenant of Mayors for Climate and Energy [11] aims to increase support for local action at the municipal level, provide a consistent and transparent platform to engage more cities, raise public awareness and, therefore, is proposed as an action as part of the European adaptation strategy.

On the other hand, the Clean Energy for EU islands initiative [12] was launched in 2017 to create a long-term framework to help existing islands to sustainably generate their own energy. This initiative aims to achieve greater energy security on the islands, improve air quality, reduce greenhouse gas emissions, reduce energy costs and create new opportunities for the islands, among others. The initiative has been formalized through a political declaration and a Memorandum of Understanding (2020) between the different participating countries and the European Union. It provides support for the improvement of ET in the islands through methodologies, reports and other documents that have been of interest for the preparation of this deliverable.

2.2 Particularities and barriers of tourist islands

The EU is taking a special interest in helping islands to define their paths towards energy sustainability and decarbonisation. Due to their location, they are more vulnerable to climate change and ecologically more fragile [13]. Rising sea levels or changing rainfall patterns negatively affect their economy.

The EU has a wide variety of islands which, despite their common characteristics, vary greatly in terms of electricity grids, geographical specificities, local population, tourism and other aspects, all of which affect the stability of the energy grid and create energy planning challenges [14].

Facing the necessity of developing a Sustainable Energy and Climate Action Plans (SECAP), island communities present important differences and difficulties compared to mainland communities. Factors such as small size, remoteness, high environmental impact and climate vulnerability make islands susceptible to external factors and therefore more vulnerable to climate change. However, although the costs of grid connections are high, islands offer opportunities for energy autonomy that are rarely available in mainland communities [13], i.e., they enjoy a high natural potential for renewable energy sources that can be harnessed to lead decarbonisation. Despite having access to renewable energy sources, such as wind and wave power, many of them rely on costly fossil fuel imports for their energy supply. A further point that affects all island communities is that political decisions are essential when it comes to investing funds to establish sustainable scenarios.

In particular, tourist islands are facing crucial energy challenges:

- **Island typology** in terms of (usually small), distance to mainland, available resources, accessible renewable energy sources, climatology, etc.
- **Energy challenges** such as limited space for the implementation of renewable energy sources (RES), weak connections of the energy grids with the mainland, energy dependence, etc.
- **Protected areas** in natural areas such as environmental parks, architectural restrictions in cultural heritage areas, impact of climate change due to sea level rise. In addition, islands are now valued by people as homes for rare and endangered wildlife.
- **Citizen participation** in the energy transition through awareness-raising measures, existing initiatives to promote self-consumption, etc.
- **Economic development** represented through variations in tourism flow, productive capacity of the island, harbour and maritime connections, land use, etc.

As presented in Figure 1, dealing with ET in tourist islands requires managing and taking into account a number of additional particularities to those found in terrestrial municipalities.

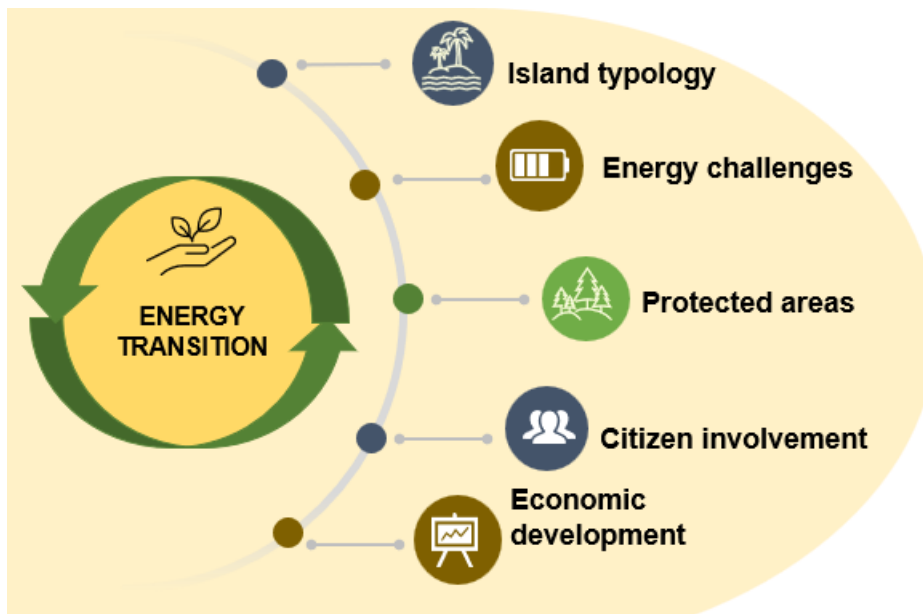


Figure 1. Particularities of tourist islands

2.2.1 Barriers toward an ET approach

Once the particularities that apply to tourist islands have been defined, their specific nature means that there are certain barriers that hinder the implementation of measures and slow down the ET process. Some of these barriers have been compiled by the "Clean Energy for EU islands" initiative [15] and have been studied at the national level, although some of the most common barriers that apply to different nations are:

- **Strategic and systematic planning, coordination, monitoring of energy transition on the islands with local input.** This barrier is present through the National Energy and Climate Plans (NECP), where it is noted that these plans in which islands are mentioned do not provide concreteness, implementation and monitoring of actions. This denotes that local needs, challenges and priorities should be identified and made visible at the local and regional level. The GENERA project is expected to address this barrier, creating a tool to support municipalities and providing support for the creation of municipal plans in accordance with national regulations.
- **Grid constraints and security of supply.** Island electricity grids are often underdeveloped due to the fact that grid modernization procedures are not adapted to island regions and hinder the implementation of renewable energies.
- **Spatial planning and stringent constraints.** In this aspect, it should be noted that there are conflicts over land use, since the islands and, more specifically, the tourist islands, have major restrictions for environmental protection. Therefore, it

is important to know the existing resources on the islands in order to know strategically how to use and manage them in a way that does not threaten the ecosystem, but also allows the introduction of renewable energies both regionally and nationally.

- **Community involvement in energy projects.** In this aspect, supporting local stakeholders is a key point to favor ET. It is interesting the creation of participation and collaboration platforms that help to build a consensual and socially inclusive vision of the future of the islands, taking into account local stakeholders. Among the actions stated in the "Declaration of Smart Islands" [16], it also shows the need to implement a regulatory framework that assists islands and allows local participation as a means to favor sustainable projects.

The GENERA project aims to support local island communities through social participation and awareness actions, the creation of a support tool for authorities and support for the development of action plans, it is expected to address these barriers and those identified locally.

2.3 EU Instruments to Energy Transition in islands

The EU is taking a special focus on the islands, as they offer specific opportunities very well suited for modern energy planning, both in terms of the potential for energy efficiency, renewables and innovative solutions, as well as the creation of a broad and strong community-driven transition process. To cope with the challenge towards sustainability, the EU is proposing measures to reduce emissions and instruments to engage in climate change adaptation and mitigation policies. The challenge of addressing climate change is even greater for tourist islands, whose energy patterns vary seasonally.

Some initiatives or programs provide a framework for islands and for improving the quality of life through sustainable solutions. Some of these initiatives are:

The **Clean Energy for EU islands** is an initiative of the European Commission and a central platform for the ET of EU islands. Through this initiative and its secretariat, the island communities are informed about policy and regulatory issues, and it provides advice for capacity building in ET. In addition, it also provides advice on the Clean Energy Transition Agenda (CETA), support tools for self-assessment, webinars and other advice. Thus, as part of the Clean Energy for EU islands program appears the **Manual for the Energy Transition** on how to tackle transition on EU islands [17].

The **Smart Island Initiative** [18] aims to improve island life through sustainability and accelerating the transition to energy decarbonization. Some of the areas of intervention of this initiative are energy, transportation, water, waste, governance and economics. The interesting point of this initiative is that it offers the islands as living labs to provide lessons and replicate scenarios.

In order to improve cooperation between the regions of the different countries that make up the EU, there are programs financed or co-financed by the European Union. One that applies directly to island regions is the Interreg **EURO-MED programme** (2021-27) [19], with the aim of fighting against the impact of climate change on the resources of the Mediterranean, achieving sustainable growth and the welfare of its citizens. Other cooperation initiative related to the INTERREG-MED region and the Mediterranean strategy is the United Nations Environment Programme – Mediterranean Action Plan and the Barcelona Convention [20], which is implemented through Programmes of Work and a Medium-Term Strategy (2022-2027) to progress towards a healthy, clean, sustainable and climate resilient Sea and Cost.

EU initiatives have been set up to help islands to define their **Energy Transition Agendas** and encourage and attract other stakeholders to join these strategies [21] [22]. Citizens will take on the role of prosumers [23], bringing flexibility to the electricity grid and ultimately becoming a stakeholder that deals with societal challenges. However, in order for citizens to benefit from the opportunities offered by the EU, and to be able to act effectively against climate change, Public Authorities have an important role to play [24]. Local governance is important for encouraging behaviour change among individual residents and industries, raising the visibility of initiatives and offering guidance and support to communities. In this regard, the EU has promoted and supported the creation of the Covenant of Mayors for Climate and Energy to develop transversal roadmaps and highlight the power of local and regional authorities to support the energy transition. The Covenant of Mayors promotes the creation of a **Sustainable Energy and Climate Action Plan (SECAP)** that defines a set of actions to achieve the objectives of mitigation and adaptation to climate change. This facilitates the achievement of the objectives set by the EU, however, the definition of a SECAP requires the creation of an ecosystem involving all citizens, businesses, political authorities and other funding bodies. This calls for the creation of urban governance, in which all stakeholders must be involved in public decision-making [25]. However, the Covenant of Mayors initiative also involves follow-up and monitoring to achieve the objectives. This is done through reports in which all stakeholders must participate, yet in recent years there has been a notable lack of commitment to this monitoring task [26].

3. Characterization of municipalities located on tourist islands

This chapter focuses on the importance of municipalities in ET, especially those located on tourist islands, as mentioned in the previous section.

On the one hand, the role of municipalities and their contribution to promote ET at the local level will be addressed, implementing measures and actions that favour the process to mitigate climate change from the most specific points that involve citizens, and can be replicated later at the city level. In relation to this, the importance of mapping the main stakeholders that may exist at the municipal level and specifically in islands will be discussed. To this end, guidance will be provided to classify stakeholders and to perform continuous monitoring according to their role in the progress towards sustainability. In addition, existing mechanisms that can be put in place to address ET at the municipal level, involving different stakeholders in the process of creating action plans, will also be discussed.

On the other hand, existing financing mechanisms will be identified that are mainly directed at the municipal level, in order to know which mechanisms municipalities can benefit from in order to decarbonize and start their path towards sustainability.

Finally, the importance of citizens at the municipal level should not be overlooked, and therefore, existing initiatives to create awareness among citizens, mainly at the municipal level, will be studied.

3.1 The role of municipalities in the Energy Transition

The importance of municipalities as part of ET has increased considerably in recent years, as contemplated in the latest European regulations. Local ET strategies are driven by multiple actors whose importance varies from city to city (and country to country), depending on different administrative and policy-making structures and civic cultures [27]. This is more pronounced in municipalities, as they vary widely in size and capacity, so progress in each municipality will involve different measures and actions. Mayors, city councils and municipal agencies are key players in planning, enacting regulations and implementing policies and projects. In addition, utilities and energy companies are other important actors; their role and influence can vary considerably, depending on whether they are strictly local entities or operate on a larger scale (provincial, national or international) and whether they are publicly or privately owned. At the municipal level, the stakeholders involved in ET are of great importance in order to carry out transition plans effectively and efficiently.

One of the biggest challenges cited by municipalities is the difficulty in securing funding for transition and decarbonization [28]. This is related to the availability of national and

international funding, which, together with political support, is intermittent rather than sustained, providing periodic opportunities that municipalities need to take advantage of.

Municipalities have a key role to play in facilitating the ET and greater public commitment, although they need more resources, national and EU support, and decision-making power to realize this potential. An important factor to facilitate ET is the remunicipalisation (return to local public ownership) of key energy infrastructures and services, as it allows for holistic action on structural means. The difficulty in accessing adequate data to assess progress towards ET at the European level, as well as the lack of specificity in plans and other municipal documents, does not allow to establish the baseline state in which municipalities currently find themselves.

All of this focused-on municipality located on tourist islands is even more accentuated, given the particularities of the islands in terms of progress in ET. Therefore, addressing the ET in municipalities located on tourist islands requires the involvement of all stakeholders and policy makers in order to gather maximum resources, raise public awareness and define common objectives. It is also important to define methods and tools to assist municipalities in defining their municipal action plans and agenda.



Figure 2. Guide to define the municipal action plan

3.2 Stakeholders Mapping

Mapping island's stakeholders facilitates the definition of a relevant governance structure, avoiding duplication of efforts. It also benefits the decision-making on selecting the most promising ET measures to be implemented in the municipality and the development of sustainable and energy action plans. Mapping is carried out by building a comprehensive datasheet of relevant actors according to the following point.

A guideline for mapping stakeholders according to a common procedure is presented below.



3.2.1 Guide for stakeholder mapping at the municipal level

1. First of all, the municipality(ies) and/or the study region will be selected.
2. Next, stakeholders will be surveyed and ranked according to the following dimensions:

STAKEHOLDER'S MAPPING	
Dimension 1	Local councils and public bodies <i>These are technicians, mayors, public servants working for municipalities or other public bodies.</i>
Dimension 2	Power Generation Companies <i>These are large energy generation and distribution companies, as well as retailers that facilitate access to electricity in municipalities.</i>
Dimension 3	Energy service companies <i>Technical Private companies offering self-consumption energy services or consultancy services are classified in this section.</i>
Dimension 4	Citizens' typologies <i>This dimension includes citizens, who in turn can be divided into stationary or permanent, seasonal and tourists (less than 1 week in the municipality).</i>
Dimension 5	Active organizations or entities <i>These are organisations that can actively collaborate with public authorities, municipalities and technicians.</i>

Table 1. Defining the dimensions for classifying stakeholders

3. Once stakeholders have been identified and ranked, they will be located on a power-influence grid.

The position that you allocate to a stakeholder on the grid shows you the actions you need to take with them:

- **High power, highly interested people (Manage Closely):** you must fully engage these people, and make the greatest efforts to satisfy them.
- **High power, less interested people (Keep Satisfied):** put enough work in with these people to keep them satisfied, but not so much that they become bored with your message.
- **Low power, highly interested people (Keep Informed):** adequately inform these people, and talk to them to ensure that no major issues are arising. People in this category can often be very helpful with the detail of your project.
- **Low power, less interested people (Monitor):** again, monitor these people, but don't bore them with excessive communication.

3.3 Municipal Decision-Making Mechanisms for ET

Revitalising the economy of tourist islands with a green approach and accelerating the ET requires the active involvement of stakeholders and, crucially, policymakers in setting the agenda and defining ET solutions. To this end, methods and approaches to energy assessment and planning have been developed over time to facilitate the path towards ET.

3.3.1 Governance Approach

A governance approach is considered as a method that directly addresses policymakers in order to advise their mandate towards the ET. These approaches are easily understood by policymakers and all related stakeholders in ET and provide valuable information for climate policy decisions.

In this regard, and directly addressed to the islands, the EU Clean Energy Islands Secretariat offers a range of support materials and a wide database of good practices that allow for synergies between the islands themselves. Among the studies carried out, the Methodological Handbook was created to advise islands on how to move towards ET [17]. This handbook is a methodology-driven guide to steer projects in any of their stages towards the ET and initiate, restart and boost the decarbonisation of islands. The methodology focuses mainly on three actions or phases:

- **Explore.** This phase aims to initiate the islands' path towards ET by creating a Clean Energy Transition Agenda (CETA). Firstly, it aims to create a baseline scenario, and to start defining possible alternatives to achieve the objectives set. To this end, it provides the islands with templates and technical assistance in energy system analysis, stakeholder mapping and transition governance. In addition, it has also created an easily accessible and user-friendly self-assessment tool, which allows the monitoring of actions.
- **Shape.** The second phase is focused on identifying the specific actions required to achieve the CETA. To this end, templates and information are provided as guidance to identify the technologies needed, and conduct a feasibility study of the project and the business and financial model. Easy support tools for the business model, such as the CANVAS method or the SWOT analysis, are also provided.
- **Act.** This phase focuses on implementing the plan, establishing contacts with stakeholders and securing the necessary funding.

Ultimately, this methodology guides policymakers on how to develop a CETA. Furthermore, it is a support guide to define actions and provides simple tools that policymakers can use, but it does not provide technical information on future scenarios or relevant data that could reflect the impact of the actions. It is a very disaggregated methodology, i.e. it provides many accessible documents but is not integrated into a single platform. A similar methodology was developed under the RenewIslands initiative

[29] and was envisaged as a complement to an energy planning system. More technical models that can support policymakers are discussed below.

3.3.2 Modelling approaches

To define the impact of actions implemented in a SECAP, modelling models are provided. Among the different modelling methods, two main types can be distinguished: simulation and optimisation. The main difference between these two methods is that simulation allows a system to be represented and its performance to be estimated under certain conditions, while optimisation minimises or maximises an objective function subject to constraints [30].

In the case of simulation modelling, there are several scenarios that can be given as a solution. The most relevant options and recommendations are presented to policymakers in order to choose the most appropriate scenario. Simulation models are typically fast and detailed in their ability to compare different future options. Furthermore, it can be used to obtain the future implications of some current choices or, to find out what possibilities exist to reach a set goal in the future.

As for the optimisation modelling, this is a computational process prior to policy decisions. Mathematically, most optimisation models use the linear programming (LP) approach, which aims to maximise or minimise a function given a set of constraints. It is also possible to use mixed integer linear programming (MILP) or even for an optimisation model to be non-linear. On the other hand, heuristic optimisation models can also be used, which differ from traditional optimisation models in that the optimum solution is not necessarily found [31]. Experts analyse the data and politicians receive the information from them. The process is complex: models are slow and detailed in describing current systems, but in theory, they are well suited for forecasting in order to prescribe the optimal future on the basis of the built-in assumptions.

Both models are advisable for energy planning, but simulation modelling allows more variables to be included in the analysis and gives a more qualitative result of the scenario.

3.3.3 Decision-Making Methods

The models described below provide more than one solution (not pure optimisation models) and also mobilise the knowledge and experience of policymakers and stakeholders to consider the various risks and uncertainties of implementation and their consequences. For this reason, it has been called the decision-making method, as it allows to obtain an analysis of the different scenarios generated, highlighting the value of the authority's decision, an important approach to dealing with ET at the municipal level.

➤ Multiple Criteria Decision Analysis

This method, also called "Multiple Criteria Decision Making (MCDM)", is a method of measuring, scaling, weighting and aggregating criteria to obtain a relative final result that

fulfils a set of objectives. It is mainly used to support decisions in complex problems where several criteria must be considered to reach a satisfactory solution.

In the last decade, its use has increased in studies related to climate change mitigation and adaptation, mainly due to the increase of experts involved in the climate area and in modelling activities [32]. In addition, the multi-criteria approach is having a major impact in the EU due to the need for sustainable development, not only sustainability and its implications for the environment are intertwined with decarbonisation and climate change mitigation, but also have an impact on different sectors of the economy. This approach can help in various phases of decision-making, such as modelling preferences or designing interactive solution procedures.

MCDM methodology is implemented by various techniques such as WSM, WPM, PROMETHEE, ELECTRE or TOPSIS, although AHP is the most popular method [33]. In particular, the Analytic Hierarchy Process (AHP) method can help policymakers obtain the best strategy for a given issue [34], following a simple procedure that consists of ranking the problem, assigning weights to the evaluation criteria (weighting) and finally obtaining a final overall relative score for each alternative.

Therefore, it can be observed that these methods help better understand the inherent characteristics of the decision problem, involve stakeholders in decision making and encourage and facilitate commitment. It is a method for analysing a scenario in a realistic way, although it is not as objective as optimisation models.

➤ **Multi-objective (MO) analyses**

Multi-objective (MO) analysis is another methodology used to illustrate the trade-off between parameters and help select a compromise solution. This method is less typical in energy planning, and, unlike linear optimisation models, these models require newer heuristics to find solutions, such as evolutionary or genetic algorithms [35].

➤ **Fuzzy Cognitive Maps (FCMs)**

FCM is a semi-quantitative or quasi-quantitative modelling technique, consists of fuzzy structures similar to neural networks and are often used as a powerful tool for modelling complex systems, such as climate change mitigation policies. There are several studies on climate change issues related to policy-making and the consequent generation of different scenarios [32]. This is due to their high flexibility, low dependence on data availability and the fact that they are based on human experience and knowledge. This approach facilitates policymaking, brings policymakers and experts closer together, and thus increases trustworthiness between them. The aim of this approach, beyond avoiding the quantitative models needed to optimise, evaluate and select policies to help achieve the desired energy transition objectives, is to complement quantitative methodologies by linking them to qualitative, experience-based models.

There are studies involved in climate policy development using this approach [32] [36]. They show the methodology used: using quantitative models, a number of policy pathways are defined to achieve objectives. The objective of the FCMs will be to help select the optimal policies, through expert knowledge and experience on the feasibility and applicability of different sets of policies.

➤ **Cost-Benefit Analysis (CBA)**

Cost-Benefit Analysis (CBA) is considered an analytical method that can be used in the decision-making process of energy projects to evaluate design alternatives from a social point of view. The procedure is as follows: first, the items under consideration are converted into costs and benefits, then, to account for the variation in costs and benefits over time, a discount rate is applied, which converts the amounts into an estimated net present value (NPV) that provides a fair basis for the time value of money. Finally, the benefit-cost ratio (BCR) is calculated [37]. However, in this criterion, the weighting of non-fungible values applies a subjective value and therefore generates a fair degree of uncertainty in the results. Furthermore, the efficiency outcome of the CBA is considered a valuable input for public spending decisions, which is why this tool is mainly used by policymakers (mostly governments) [38].

3.3.4 Existing Energy Planning Tools

Through the above approaches and models, the aim is to involve policymakers and stakeholders in energy modelling processes and to improve the understanding and assessment of uncertainty. Even more, these approaches can be integrated together, resulting in models in which energy, climate economics and decision support frameworks all contribute key drivers, creating a composition that fits together and should be considered in climate policymaking [31] [32]. These models have been applied as tools for ET policy on climate change. Below are discussed some of these models which are of particular interest to this research work and which are used by a large number of users.

The **EnergyPLAN software** is a simulation model that allows the evaluation of different future energy system alternatives by testing different energy mixes. The model has been in continuous expansion since its development and approximately 16 versions have been created. It is intended for use by experts in the field but can be downloaded free of charge, and training can last from a few days to months (depending on the type of analysis). The main objective of the tool is to assist in the design of national or regional energy planning strategies by simulating the entire energy system [39]. This model has a very wide scale of geographical coverage: from the European level to the scale of cities and municipalities and even small islands. It has been used to analyse the integration of strategies, as well as the optimal mix of renewable sources or integrated energy systems and local markets [40]. This tool was also deployed after following the application of the methodology for energy assessment of the PRISMI project on the island of Malta [41]. After its application, it became clear that political decisions are essential when investing funds to establish

sustainable scenarios. Therefore, the creation of a tool where political decisions are taken into account in the development of energy transition plans would facilitate the path towards achieving the set targets. However, the use of powerful tools such as EnergyPLAN and their combination with other ones that provide the variable of political decisions can be a viable solution.

Another powerful tool used for scenario simulation in all sectors is **LEAP (Long Term Energy Alternatives Planning)**, usually used to analyse national energy-systems [40]. LEAP can be used to estimate climate impacts, estimate different scenarios associated with air-pollution health impacts, explore mitigation scenarios addressed to policy analysts to reduce air pollutants or greenhouse gases (GHG) and characterize national emissions of greenhouse gases and pollutants. Through this tool, interesting economic analyses can be obtained for experts, which can later be beneficial if the proposed measures are implemented. However, it is mainly focused on the emission of pollutant gases from different sources, which at the national level works very well, but at the city and municipal level, it has shortcomings [42]. LEAP does not currently support optimisation modelling, although this capability is currently being developed. However, an extension LEAP-IBC (Integrated Benefits Calculator), which allows energy planning and greenhouse gas mitigation assessments for 25 years, has also been implemented in this tool. In addition, this extension was proposed as part of a guide for the development of climate change mitigation policies and was used for the development of the national plan to reduce short-lived climate pollutants in Ghana [43]. In addition, an application case was also carried out on the island of Crete, although other tools were used to complement the LEAP results [44]. Among its conclusions, the lack of technical infrastructure to support new investments, the problems related to the legal status of properties and the obstacles with the use of suitable areas for the installation of new RES units were highlighted. It is therefore a useful tool for quantifying the impact of the various schemes already in place but requires an elaborate database on the study site and a mid-level of knowledge from users.

TRNSYS is an open source, modularly structured transient system simulation software that simulates the power and heat sectors of an energy system [40]. It has been commercially available since 1975, and to date there are 18 versions. It is a tool that allows the transient simulation of many plant configurations, which can be modelled from its database and system components. Another important feature is that it has an extensive meteorological database. There are a large number of building applications for modelling electrical and heating systems, but one application of interest is the simulation of renewable systems on the island of Gran Canaria [45]. In the latter case, in order to understand the dynamic behaviour of the system, an integrated TRNSYS-Matlab model was performed and an optimisation was carried out to identify the best system in terms of RES exploitation. The results obtained were positive and could be of interest to policymakers and their stakeholders, so this tool is designed to be adapted to small and

isolated islands and their specific needs, in various locations and at multiple scales. However, the need to enter the island's energy demand data and the use and handling of the tool make it difficult to replicate, unless experts are familiar with its use.

Another tool that is not as widely used but of interest for this article is **H2RES**, a planning tool for island energy systems. This tool is specifically designed to increase RES integration in island systems operating as stand-alone systems. In addition, it is also used as a planning tool for individual energy systems [40]. The H2RES model is designed as a support for ADEG/ RenewIslands methodology [46]. The main problem is that H2RES is not yet sold to external users but is provided to internal users to complete their research. In addition, the training period required to use the tool is up to two months for experts only. It is therefore a tailor-made tool for island systems, but its technically difficult use and understand.

METIS is a multi-model simulation software tool covering the European energy system for electricity, heat and gas. This software was created through the research project of DG ENER to analyse the effects of different policies and trends on regional, national and European level by running several scenarios both in different time horizons (short, medium and long term) [47]. It is a powerful tool made up of different modules created to cover supply, transport, distribution and final demand, as well as all associated markets, and to be able to assess the impacts in terms of CO₂ emissions. Regarding the use of the software or data provided by third parties other than the EC, it is expected that licensed access will gradually be provided to review some results, replicate simulation results and define alternatives [48]. Although it is a user-friendly tool so that it can be used by previously trained policy makers and other experts, the focus at the municipal level is out of scope, as the results it provides are of a broader nature (not focused on measures carried out at the municipal level).

Finally, a powerful tool aimed at helping cities take action on climate is **CURB**. This interactive tool is divided in mainly 5 modules: **Setup** to enter the basic data about the overall situation in the city and specific sectoral profiles, **Inventory** to use the information provided in the Setup module and to estimate the sector in which action should be taken, **Context** to define the drivers of emissions and energy demand in the city, **Actions** is the main module for selecting the sector in which action is to be taken, and makes it possible to exploit the different interventions that can be carried out and **Results** enables different scenarios to be represented according to the actions that have been taken [49]. In addition, the main feature of this tool is that it is city-specific (it uses local data), requires minimal training and is free and accessible. However, CURB is independent of the political mechanisms used to achieve the measures, nor does it provide any monitoring of the actions.

The following table summarizes the main characteristics of the tools discussed in this report:

Features	Energy Plan	LEAP
Main aim	Simulate the operation of national energy systems on an hourly basis, including the electricity, heating, cooling, industry, and transport sectors	Estimate climate impacts, estimate different scenarios associated with air-pollution health impacts, explore mitigation scenarios addressed to policy analysts to reduce air pollutants or greenhouse gases (GHG) and characterize national emissions of greenhouse gases and pollutants.
Geographical Coverage	European level, cities, municipalities and small islands.	From cities and states to national, regional, and global applications.
Dissemination	Freeware	Free of charge to academic, governmental and not-for-profit organizations based in the developing world.
User profile	Researchers, consultancies, and policymakers	Government agencies, academics, non-governmental organizations, consulting companies, and energy utilities.
Requirements	Extensive training in the use of the tool (depending on the type of analysis).	Extensive database developed at the study site and a medium level of user expertise.
Features	TRYNSIS	H2RES
Main aim	Software environment used to simulate the behaviour of transient systems.	Linear optimization program to minimize the (discounted) yearly operation and system costs.
Geographical Coverage	Simulates the power and heat sectors of an energy system but can equally well be used to model other dynamic systems such as traffic flow, or biological processes.	Island energy systems
Dissemination	Subject to quote request	Freeware
User profile	Researchers and practitioners in the energy simulation community.	Experts on energy systems and planning.
Requirements	Need to enter the energy demand data of the island (or study area) and the use and operation of the tool.	High technical difficulty to use.
Features	METIS	CURB
Main aim	Multi-model simulation software tool covering the European energy system for electricity, heat and gas.	Interactive tool that is designed specifically to help cities take action on climate by allowing them to map out different action plans and evaluate their cost, feasibility, and impact.
Geographical Coverage	Regional, national and European level	City Level

Dissemination	Free database but visualisation via Artelys Crystal Super Grid Platform	Freeware and accessible
User profile	Researchers and policymakers	Researchers, technicians and policymakers
Requirements	Requires the support of the Artelys platform for full use.	In case there are some data gaps, a common problem in many cities, CURB provides alternative data that can be used from comparable cities, countries or regions

Table 2. Comparative table of the different existing energy planning tools.

3.3.5 New initiatives and opportunities to address

Following the study carried out in task “T2.1 Building on existing tools. Identification of actual monitoring tools” it is observed that there are few alternatives on tools for adaptive energy planning at the municipal level that integrate different models or approaches aimed primarily at policy makers to elaborate and monitor their plan towards ET, that is freely accessible, integrates a specific database for each island, allows the visualisation of future scenarios behind the strategies and also incorporates the policy makers' decisions into its criteria.

The tools previously studied allow for a simulation or analysis of the current energy situation and its future trend in accordance with the established measures or plans. However, monitoring the measures in order to know the real impacts would be a useful tool at the municipal and regional level. For example, the Covenant of Mayors for Climate and Energy initiative itself has guidance material and tools such as the Urban Adaptation Support Tool (UAST) to help cities, towns and other local authorities develop, implement and monitor climate change adaptation plans [50]. The UAST is not intended as a tailor-made climate adaptation strategy for municipalities, but rather as a detailed guide on the key points to consider when developing adaptation strategies and self-assessment tools. In addition, some regions, such as the Canary Islands, are developing parallel support tools for the management of action plans, which help to monitor actions and keep a register of the plans and actions taken.

This highlights the need and value of creating an innovative tool that homogenises a multidimensional approach at national level, focuses on the specific municipal needs of the islands, defines a wide range of up-to-date indicators and, in addition, allows for monitoring of actions at municipal level. Focusing on the municipal level, through established good practices and plans, makes it possible to specify areas of action and to analyse the progress of local measures within the specific context of each municipality.

3.4 Financing mechanisms for municipalities

In financial terms, addressing ET requires much higher levels of both equity and debt. However, investment towards sectors such as electricity, where debt financing is more common, tips the balance more towards debt [51]. Therefore, greater emphasis needs to

be placed on financing models that support domestic purchases of electric vehicles and upgrades to buildings and factories. Mobilizing investment in all sectors will depend on improved financial flows from local sources as well as international suppliers.

At this point, financing mechanisms are key to help consumers and businesses mobilize and become part of ET, doing their bit for sustainability and boosting the economy. This is even more evident in municipalities whose revenue sources are more limited and require more support to manage decarbonization and ET. This section reviews the existing financing mechanisms at the European level and also in the different countries that make up the consortium: Spain, Italy and Greece.

3.4.1 Mechanisms at the European level

European Energy Communities Facility	
Target groups	<i>Organization/Municipality/Region</i>
Objective	<p>Under this topic, a 'European Energy Communities Facility' shall be set up and run to deliver financial support to third parties and appropriate support services for the early stages of energy community projects in the EU.</p> <p>Energy communities can be an effective tool to attract private investment to renewable energy and energy efficiency, increase the public acceptance of sustainable energy projects and engage citizens in delivering a fair and clean energy transition locally. Given the speed and scale at which the clean energy transition needs to happen and the benefits of engaging and empowering consumers through energy communities, it is essential to create tools to help a large number of community energy projects to take off and contribute to the European climate and energy targets.</p>
Website	EC Funding
Renewable Energy Financing Mechanism Technology specific - Solar PV	
Target groups	<i>Organizations/Regions</i>
Objective	<p>The RENEWFM is an EU financing programme contributing to the clean energy transition and the European Green Deal objectives, including the goals and objectives of the Paris Agreement, 2030 climate and energy targets and long-term decarbonisation objective.</p> <p>In this context, the RENEWFM allows EU countries to work more closely together in the take-up and promotion of renewables, improving the efficiency of investment, pooling resources and finding the right mix between public and private finance. It facilitates a more cost-effective roll-out of renewables across the EU, particularly in areas that have a greater access to natural resources or are better suited for it in terms of geography.</p>
Website	EC Funding
Project Development Assistance for sustainable energy investments	
Target groups	<i>Organization/Municipality</i>
Objective	Project Development Assistance (PDA) offers technical assistance to public and private project developers to deliver energy efficiency and renewable energy investments of ambition and scale.

	<p>While LIFE-CET topics such as <i>LIFE-2023-CET-LOCAL</i> or the European City Facility focus on the elaboration of transition plans such as Sustainable Energy and Climate Action Plans (SECAPs) or the elaboration of investment concepts and building investment pipelines, respectively, the PDA topic aims to support project developers across Europe to deliver a highly ambitious sustainable energy project pipeline. Projects are expected to develop replicable solutions that are mobilising private capital, blending public with private financing, setting up long-term and scalable financial instruments and at the same time overcoming legal and structural barriers. Projects shall demonstrate an innovative approach, for example in advancing existing procurement procedures, in aggregating and structuring investment projects, in advancing market boundaries or changing organisational and regulatory structures</p>
Website	EC Funding
Alleviating household energy poverty and vulnerability in Europe	
Target groups	<i>Municipality</i>
Objective	<p>In recent years, European households have continued to spend an increasing share of income on energy, leading to higher rates of energy poverty and negatively affecting living conditions, well-being and health. Most recent estimates suggest that 6.9% of Europeans are unable to keep their homes adequately warm. Following the recent surges in energy prices, the number of vulnerable households^[2] overburdened by their energy costs is likely to be on the rise. These higher prices, combined with low incomes and poor energy efficiency of buildings and appliances, are root causes of energy vulnerability. In addition to its causal multidimensionality, the phenomenon cuts across different policy sectors beyond energy, such as health, housing and social policy, requiring coordinated, holistic efforts at all governance levels, and involving different sectoral actors. While increasing the uptake of building renovation measures can bring significant long-term benefits to vulnerable households, more immediate energy efficiency measures at the household level and increased use of renewable energy are also key tools in addressing energy vulnerability and can lead to lower energy bills and improved living conditions.</p> <p>In this context, efforts should focus on offering support to build the concrete skills and capacity of vulnerable households to afford their energy bills and ensure adequate comfort levels, as well as supporting relevant actors, including public authorities, in designing longer-term strategies and frameworks to mitigate energy poverty at the sub-national levels, including dedicated financing schemes specifically addressing energy performance improvements for energy poor households. As obligated parties under energy efficiency obligation schemes have potentially at their disposal the necessary data and means to identify energy vulnerability among their customers, supporting the obligated parties is needed in order to spread such schemes across the EU.</p>
Website	EC Funding

Technical support to clean energy transition plans and strategies in municipalities and regions	
Target groups	<i>Organization/Municipality/Region</i>
Objective	<p>The topic aims to provide local and regional authorities with the necessary capacity, skills and organisational structures to deliver and implement plans and strategies for the clean energy transition (CET).</p> <p>Local and regional authorities (LRAs) are a decisive lever for achieving the EU Green Deal objectives, such as the 2030 climate and energy targets as set out in the European Climate Law and the relevant 'Fit for 55'^[1] legislative revisions, in particular the recast of the Energy Efficiency^[2] (EE) and the Renewable Energy^[3] (RES) Directives, as well as the climate neutrality objective by 2050. In this context, many municipalities and other public bodies have already committed to such ambitious targets, for instance through the Covenant of Mayors for Climate and Energy initiative^[4].</p>
Website	EC Funding
NESOI (New Energy Solutions Optimised for Islands) European Islands Facility	
Target groups	<i>EU islands</i>
Objective	<p>The NESOI Facility aims to facilitate the clean energy transition on EU islands and go one step forward by providing islands with training, technical support, cooperation opportunities and robust funding opportunities to concretely convert Island Sustainable Energy Action Plans into Renewable Energy Sources (RES) plants, building and energy infrastructure retrofitting, energy bill reduction, local job creation and more.</p> <p>NESOI Facilitating web-platform (NEF) will be the most visible and important tool of the facility. It includes a suite of scalable components that will stimulate collaboration, open innovation, and visibility of investment opportunities. It delivers the following services only to share best practices and information, offering tools and describing the process to local operators in order to enable them to develop their own projects:</p> <ul style="list-style-type: none"> - Profile and Smart Matching: The NEF platform's fundamental structural element will manage the discoverable profiling of all NEF participants' actors. - Online collaboration space and capacity building. - Equity crowdfunding. <p>NEF aims to communicate and enable interaction with wide range of relevant stakeholders such as Citizens, experts, Investors, Institutions, Project Promoters, tech – providers.</p>
Website	https://nesoi.eu/

Table 3. Financing Mechanisms at the European Level

3.4.2 Financing mechanisms in Spain

Royal Decree 451/2022 - In the framework of the Recovery, Transformation and Resilience Plan	
Funded by the European Union - NextGenerationEU	
Target groups	<i>Balearic and Canary Islands</i>

Application level	Regional Level
Objective	<p>The budget allocated for the financing of each of the programmes is managed in one percentage by the autonomous community, by means of agreements, calls for aid, tenders or any other modality that the autonomous community establishes within its powers, and in another percentage centrally, by means of calls or other lines of aid that the Energy Diversification and Saving Institute (IDAE) will carry out jointly for both archipelagos or in a differentiated manner, depending on the actions to be carried out.</p> <p>The actions regulated by this Royal Decree will be in force from the day following the publication of RD 451/2022 in the "Official State Gazette" until the end of its validity, which will occur on 30 June 2026.</p>
Website	https://www.idae.es/ayudas-y-financiacion/para-la-transicion-energetica-en-las-islas-prtr/rd-4512022-de-concesion
Balearic Islands	<p>PITEIB:</p> <ul style="list-style-type: none"> - Public call for subsidies for the promotion of combined actions in renewable energies, energy efficiency and electric mobility promoted by public administrations. https://www.caib.es/govern/sac/fitxa.do?codi=5405249&coduo=2390767&lang=ca - Public call for subsidies for the promotion of photovoltaic installations for self-consumption in public or private car parks and electric vehicle charging points. https://www.caib.es/govern/sac/fitxa.do?codi=5438309&coduo=2390767&lang=ca - Public call for subsidies for the promotion of renewable energy communities, citizen energy communities, communities of owners, business associations and non-profit organisations. https://www.caib.es/govern/sac/fitxa.do?codi=5365025&coduo=2390767&lang=ca
Canary Islands	<ul style="list-style-type: none"> - Call for subsidies for the promotion of shared self-consumption and the development of energy communities in different productive sectors (except industry). https://sede.gobiernodecanarias.org/sede/procedimientos_servicios/tramites/7897 - Call for subsidies for the promotion of energy self-sufficiency in Public Administrations. https://sede.gobiernodecanarias.org/sede/procedimientos_servicios/tramites/7898
Non-competitive grants for energy rehabilitation actions in existing buildings in municipalities with demographic challenges (PREE 5000 programme)	
Target groups	<p><i>Citizens, Business and Local authorities and the institutional public sector of public administrations, such as City and Town Councils and Councils, also when they act on behalf of communities of owners or other owners of buildings.</i></p> <p><i>Municipalities with up to 5,000 inhabitants and non-urban municipalities up to 20,000 inhabitants, whose single population entities up to 5,000 inhabitants.</i></p>

Application level	Regional/National
Objective	Improvements for the energy efficiency of the thermal envelope. Energy efficiency improvements and use of renewable energies in thermal installations. Improvements to the energy efficiency of lighting installations.
Website	https://sede.gobiernodecanarias.org/sede/procedimientos_servicios/tramites/7140
RD 266/2021 – MOVES III	
Target groups	<i>Citizens, companies, public administrations and homeowners' associations.</i>
Application level	Regional/National
Objective	Subsidies for VEA vehicles (Alternative Energy Vehicles) and implementation of electric vehicle charging infrastructure.
Website	https://sede.gobiernodecanarias.org/sede/tramites/6942 https://www.idae.es/ayudas-y-financiacion/para-movilidad-y-vehiculos/programa-moves-iii
RD 853/2021 – P3- REHABILITATION ACTIONS AT BUILDING LEVEL	
Target groups	<i>Owners of dwellings, public administrations and public companies, homeowners' associations, owners of buildings, cooperative societies. The tenant or concessionary companies of the buildings.</i>
Application level	Regional
Objective	The purpose of this programme is to finance, both in urban and rural areas, the financing of works or actions in buildings predominantly for residential use in which an accredited improvement in energy efficiency is obtained, with special attention to the building envelope in collective residential buildings, including their dwellings, and in single-family dwellings.
Website	https://sede.gobiernodecanarias.org/sede/procedimientos_servicios/tramites/7249#
RD 853/2021 - P4 - ACTIONS TO IMPROVE ENERGY EFFICIENCY IN DWELLINGS	
Target groups	<i>Owners, usufructuaries or tenants of dwellings, public administrations.</i>
Application level	Regional
Objective	The purpose of this programme is to finance actions or works to improve the energy efficiency of dwellings, whether they are single-family homes or multi-family buildings.
Website	https://sede.gobiernodecanarias.org/sede/procedimientos_servicios/tramites/7250#
Incentives for self-consumption and storage with renewable energies	
Target groups	<i>Citizens, homeowners' associations, legal entities and public administrations without economic activity, self-employed and energy communities.</i>
Application level	National/Regional

Objective	Subsidies for the deployment and integration of renewable energies as well as storage with renewable energy sources.
Website	https://sede.gobiernodecanarias.org/sede/tramites/7011

Table 4. Financing Mechanisms in Spain

3.4.3 Financing mechanisms in Italy

National Recovery and Resilience Plan (NRRP) –Green islands	
Target groups	<i>Municipalities of small islands</i>
Application level	National
Objective	€200 million of total investment cost. Transform 19 small islands into an equal number of laboratories for the development of models that are "100% green" and self-sufficient. The interventions, scaled to each island, involve the electrical and water network, renewable energies, the management of waste and zero emissions transportation (boats and buses included). The motto: integrated and efficient management of resources.
Website	https://www.italiadomani.gov.it/content/sogei-ng/it/en/Interventi/investimenti/sole-verdi.html
National Recovery and Resilience Plan (NRRP) – Promoting renewables for energy communities and self-consumption	
Target groups	<i>Citizens, Municipalities, SMEs</i>
Application level	National
Objective	€2.2 billion of total investment cost. Support energy communities, that is, organized coalitions of users who collaborate with each other to produce, consume and manage clean energy through one or more local facilities. The communities can have very varied composition (cooperatives, non-profit associations, condominiums, commercial activities and regional companies...) but they all have the same goal: provide renewable energy at affordable prices to their members.
Website	https://www.italiadomani.gov.it/content/sogei-ng/it/en/Interventi/investimenti/sviluppo-agro-voltaico.html
National Recovery and Resilience Plan (NRRP) – Promotion of innovative installations (including off-shore)	
Target groups	<i>Regions, Municipalities, Industries</i>
Application level	National
Objective	€675 million of total investment cost. Support the construction of innovative "off-shore" facilities, which are installed several miles from coast, to produce clean energy employing technologies with high development potential and experimental technologies, for example systems that use the currents and the motion of the waves.
Website	https://www.italiadomani.gov.it/content/sogei-ng/it/en/Interventi/investimenti/promozione-impianti-innovativi-incluso-off-shore.html

National Recovery and Resilience Plan (NRRP) – Ecological transition for Italian ports, a look into the future	
Target groups	<i>Municipality</i>
Application level	National
Objective	€ 270 million of total investment cost. The goal of the investment is to make port activities more compatible and harmonious with urban activities and life, thanks to interventions to reduce energy consumption and increase environmental sustainability, also using renewable energy. These measures will help reduce greenhouse gas emissions by 55% by 2030.
Website	https://www.italiadomani.gov.it/content/sogei-nq/it/en/Interventi/investimenti/interventi-per-la-sostenibilita-ambientale-dei-porti-green-ports.html
Call for tender for innovative integrated projects for non-interconnected smaller islands - Ministry of the Environment and energy security	
Target groups	<i>Islands' municipalities, energy companies</i>
Application level	National
Objective	€ 10 million for the implementation of projects for the progressive coverage of energy needs through energy from renewable sources
Website	https://www.mase.gov.it/energia/incentivi/isole-minori
Public announcement "Actions for the development of experimental smart grid projects in the municipalities of Sardinia"	
Target groups	<i>Region - Sardinia</i>
Application level	<i>Regional - Sardinia</i>
Objective	The call finances interventions for the design and construction of micro electricity networks in buildings already equipped with a photovoltaic system in operation. The action is implemented through support to the creation of micro electricity networks by the municipalities of Sardinia that, thanks to the use of systems of accumulation and appropriate management systems, implement the integration between production, accumulation and consumption, in order to maximize the self-consumption of energy. The intervention consists in the installation of a electrochemical storage system, suitably sized, and its management system.
Website	https://old.regione.sardegna.it/j/v/28?s=1&v=9&c=1425&c1=1425&id=58418

Table 5. Financing Mechanisms in Italy

3.4.4 Financing mechanisms in Greece

«ELECTRA» program	
Target groups	<i>Municipalities</i>
Application level	National

Objective	The «ELECTRA» Program aims at the energy upgrade of the public sector buildings by promoting the exemplary role of the State in the field of energy efficiency of buildings.
Website	https://hlekttra.gov.gr/home
Ελλάδα 2.0 -Next Generation EU	
Target groups	<i>Municipalities/ Regions</i>
Application level	National
Objective	<p>Greece 2.0 is a fundamental economic and social transformation, which affects economic activity, but also technologies, attitudes and institutions The National Recovery and Resilience Plan Greece 2.0 was approved on 13 July 2021 by the Economic and Fiscal Affairs</p> <p>Council of the European Union (Ecofin). "Greece 2.0" includes 106 investments and 68 reforms, distributed in 4 pillars and collects 31.16 billion euros, of which 30.5 billion euros European funds (17.8 billion euros aid and 12.7 billion euros loans) to mobilize €60 billions of total investment in the country over the next five years.</p>
Website	https://greece20.gov.gr/
ΕΞΟΙΚΟΝΟΜΩ (Energy Saving) 2021- residential energy upgrade program	
Target groups	<i>Citizens</i>
Application level	National
Objective	<p>This program is part of the flagship projects subsidized by the Recovery and Resilience Fund by improving the energy class of households, by at least 3 energy categories (over 30% Primary Energy Saving). The design of the Program takes into account the integrated approach of energy saving interventions in the domestic building sector and aims to reducing the energy needs of buildings and pollutant emissions that contribute to the worsening of the greenhouse effect, saving costs for citizens, improving daily living conditions and comfort as well as the safety and health of citizens when using these buildings and achieving a cleaner environment. The Program provides incentives for energy saving interventions in the domestic building sector, with the aim of reducing energy needs and the consumption of conventional fuels, in the context of the transition to an "Energy Efficient Home". The total project investment will contribute to energy savings of at least 213 ktoe per year and the energy renovation of at least 105,000 homes by 2025.</p>
Website	https://exoikonomo2021.gov.gr/
Εξοικονομώ – Ανακαινίζω για Νέους (Energy Saving Retrofit for young people) 2023:- residential energy upgrade program focusing on young people between 18 and 39 years old	
Target groups	<i>Citizens between 18 and 39 years old</i>
Application level	National
Objective	<p>This program is part of the flagship projects subsidized by the Recovery and Resilience Fund by improving the energy class of households, by at least 3</p>

	energy categories (over 30% Primary Energy Saving). The design of the Program takes into account the integrated approach of energy saving interventions in the domestic building sector and aims to reducing the energy needs of buildings and pollutant emissions that contribute to the worsening of the greenhouse effect, saving costs for citizens, improving daily living conditions and comfort as well as the safety and health of citizens when using these buildings and achieving a cleaner environment. The Program provides incentives for energy saving interventions in the domestic building sector, with the aim of reducing energy needs and the consumption of conventional fuels, in the context of the transition to an "Energy Efficient Home". The total project investment will contribute to energy savings of at least 213 ktoe per year and the energy renovation of at least 105,000 homes by 2025.
Website	https://exoikonomoneon.gov.gr/
ΑΝΑΚΥΚΛΩΝΩ-ΑΛΛΑΖΩ ΘΕΡΜΟΣΙΦΩΝΑ (Recycle Change Water Heater):- replacement of domestic electric water heaters with new solar water heaters	
Target groups	<i>Citizens</i>
Application level	National
Objective	This program is part of the flagship projects subsidized by the Recovery and Resilience Fund by improving the energy class of households, by at least 3 energy categories (over 30% Primary Energy Saving). The Program subsidizes households for the replacement of energy-consuming Electric Water Heaters, with new modern technology Solar Water Heaters, while simultaneously recycling the old water heaters that are being replaced. As part of the Program, Electric Water Heaters with a capacity of ≥ 40 liters are eligible for replacement. For each new solar water heater subsidized, the old one must be recycled through an approved alternative waste management system and associated equipment at a recycling facility. The main objectives of the Program are the saving of financial resources from the reduction of energy consumption, as well as the reduction of greenhouse gas emissions. On the one hand, the replacement of the most energy-consuming household appliance is expected to significantly reduce the average energy costs of the Greek family. The Public Expenditure of the operation amounts to € 100,000,000 with the co-financing of Greece and the European Union
Website	https://allazothermosifona.gov.gr/
Εξοικονομώ για Επιχειρήσεις (Energy Saving for Business) 2023: forthcoming energy upgrade program for buildings and equipment of small and medium-sized enterprises from the sectors of Tourism, Commerce and Services	
Target groups	<i>Small Business</i>
Application level	National
Objective	The program focuses on small business in specific sectors. Investments for the energy upgrade of buildings and equipment of small and medium-sized enterprises from the sectors of Tourism, Commerce and Services can be included in the "Save for Business" program, with a public expenditure budget of 200 M€. Supporting rates are calculated at 40% to 50% for investments up

	to 100,000 euros for the Trade and Services sectors and from 50,000 euros to 500,000 euros for the Tourism sector (unit capacity up to 100 beds). The budget of the program will be allocated separately, by 100 M€ for the Trade and Services sectors and by 100 M€ for the Tourism sector.
Website	Expected during July 2023

Table 6. Financing Mechanisms in Greece

3.5 Related EU Projects

European projects provide support for the development of different sectors in ET and decarbonisation. Currently, in addition to the GENERA project there are also other projects in which project partners are involved such as:

- **UP2030 – Urban Planning and Design Ready for 2030.** This project aims to help cities drive the socio-technical transitions needed to achieve their climate neutrality goals by leveraging urban planning and design. In this case, an innovative methodology (5UP approach) will be developed and applied through the joint development and application of science-based but practical tools and methods. To this end, UP2030 will guide cities (stakeholders and local authorities) to meet the values of equity, resilience, neutrality and sustainability. The partner MAGGIOLI is involved in this project.
- **SYNERGIES.** This project is of particular interest to GENERA as it presents a reference implementation of the energy data space that will seek to unlock the potential for innovation and data sharing across the energy data value chain, harnessing data and intelligence from various actors in the energy sector (prioritising consumers and introducing them as data owners/providers) and associated sectors (buildings, mobility) and making them effectively accessible and widespread. The partner MAGGIOLI is involved in this project.
- **EnTRAINER.** Another project of interest especially for the industrial sector, with the aim of favouring decarbonisation in companies through the improvement of energy efficiency with innovative methodologies. This project involves the partner Univercities and UPV.

The following projects are of interest to GENERA because of their objective and the target groups to which they refer. Although no GENERA partner is involved, synergies can be established through these projects:

TOMORROW	
Objective	TOMORROW is a Horizon 2020 funded project, aiming at empowering local authorities to lead the transition towards low-carbon, resilient and more liveable cities. In the framework of the project, six cities will develop 2050 transition roadmaps together with citizens and other local stakeholders and serve as pilot for the transition of European territories.

Website	https://www.citiesoftomorrow.eu/what-tomorrow/
GREEN HYSLAND	
Objective	<p>GREEN HYSLAND aims to deploy a fully-functioning Hydrogen (H2) ecosystem in the island of Mallorca, Spain, turning the island into Europe's first H2 hub in Southern Europe. This will be achieved by producing green hydrogen from solar energy and delivering it to the end users, such as the island's tourism, transport, industry and energy sectors, including gas grid injection for green heat and power local end-use.</p> <p>The project will also deliver a roadmap towards 2050 that compiles a long-term vision for the development of a widespread H2 economy in Mallorca and the Balearic Region, in line with the environmental objectives set for 2050. Indeed, hydrogen will help to increase the penetration of renewable energy in the Balearic energy system, demonstrating sector coupling and sectorial integration, and moving towards full decarbonization of the economy.</p> <p>Finally, the GREEN HYSLAND demonstrations will provide Europe with a blueprint for decarbonization of island economies, and an operational example of the contribution of H2 towards the energy transition and the 2050 net zero targets. The development of replication experiences and business models are foreseen in five other EU islands (Madeira – PT, Tenerife – ES, Aran – IE, Greek Islands and Ameland – NL) and beyond (Chile and Morocco).</p>
Website	https://greenhysland.eu/about-green-hysland/
SOCLIMPACT	
Objective	<p>The SOCLIMPACT project aims at modelling downscaled Climate Change effects and their economic impacts in European islands and archipelagos for 2030 – 2100 in the context of the EU Blue Economy, and assess corresponding decarbonisation and adaptation pathways, thus complementing current available projections for Europe, and nourishing actual economic models with non-market assessment.</p>
Website	https://soclimpact.net/partners/
REACT Renewable Energy for self-sustAinable Island Communities	
Objective	<p>REACT is a four-year research project funded by the EU Horizon 2020 programme. Its goal is to achieve energy independence for the islands by combining RES and storage systems with a demand-response platform for optimal consumption management and involving users in a local energy community. The technical and commercial model developed in REACT will demonstrate that these technologies can bring important economic benefits, contribute to the decarbonisation of local energy systems, reduce greenhouse gas emissions, and improve ambient air quality.</p> <p>Islands are heavily dependent on continental energy markets, but energy transfer is inefficient and expensive. For this reason, achieving a secure and reliable energy supply is a priority. In this context, the EU-funded REACT project will develop the large-scale deployment of renewable energy sources and storage resources on islands in order to contribute to the decarbonisation of local energy systems. Its overall objective will be to develop a holistic cooperative energy management strategy at community level. In particular, REACT will provide a scalable and adaptable cloud-based</p>

	information and communication technology platform for renewable energy and storage-enabled infrastructures, combining traditional and renewable systems and allowing synergies between different energy networks and micro-networks.
Website	https://react2020.eu/it/
ROBINSON	
Objective	ROBINSON aims to help decarbonise islands through developing an intelligent, flexible and modular Energy Management System (EMS), better integration of Renewable Energy Sources (RES), biomass and wastewater valorisation, industrial symbiosis, and the optimisation and validation of innovative technologies. To support islands' decarbonisation, ROBINSON's EMS will integrate across different energy vectors (electricity, heat and gas) existing and newly developed energy and storage technologies, such as a small gas turbine based Combined Heat and Power unit (CHP), Anaerobic Digester assisted by Bio-Electrochemical Systems (AD+BES) to enable the conversion of liquid waste into biomethane, a mobile innovative wind turbine, a gasifier to convert bio-waste, and hydrogen-related technologies (electrolyser and storage system).
Website	https://www.robinson-h2020.eu/concept/

Table 7: Related EU projects

4. Analysis of Energy Transition on Tourist Islands: Case Studies

Chapter 4 focuses on the analysis of the state of ET in the different tourist islands participating in the consortium. For this purpose, 3 different blocks have been organised, including the analysis of the Spanish islands: Balearic and Canary Islands, in Italy: Sardinia and in Greece the focus will be on the island of Chalki, although information will also be provided for other islands given the number of islands belonging to this region.

First, information is provided at the national level on regulations and applicable standards, existing barriers at both national and regional levels, and key stakeholders that need to be engaged to make progress on ET.

The second section focuses on a comparative study of the different regions in terms of citizen awareness in order to define the current state of ET in each region. For this purpose, surveys were carried out in the different regions and the results are shown in this section.

4.1 Study of the Spanish islands: Balearic and Canary Islands

4.1.1 National Policies and Regulatory Framework

Spain primarily located in Southwestern Europe, with parts of its territory in the Atlantic Ocean and across the Mediterranean Sea. The largest part of Spain is situated on the Iberian Peninsula; its territory also includes the Canary Islands in the Atlantic Ocean, the Balearic Islands in the Mediterranean Sea, and the autonomous cities of Ceuta and Melilla in North Africa. Due to the vastness of the territory, the geography and climatology of the different regions varies considerably. As a decentralised government, regional administrations have autonomy in implementing and developing energy policies.

The central strategic document guiding Spain's energy and climate policies in the next decade is the Integrated National Energy and Climate Plan (INECP) for the period 2021-30 [52]. Its 2030 targets include a 23% reduction in greenhouse gas emissions compared to 1990 levels; a 42% share of renewables in energy end-use; a 39.5% improvement in energy efficiency; and a 74% share of renewables in electricity generation. It can be highlighted that despite the considerable progress made to date in decarbonisation and the increase of renewable energies in the electricity sector and ultimately progress in ET, Spain's total energy mix remains heavily dominated by fossil fuels. renewables in the electricity sector and ultimately progress in ET, Spain's total energy mix is still heavily dominated by fossil fuels [53]. In terms of electricity and energy, it should be noted that Red Eléctrica operates the Spanish electricity system, both on and off the mainland, guaranteeing the security and continuity of supply.

In Spain there are multiple support programmes for RES technologies. Many programmes are regulated at national level, but the Autonomous Communities and Municipalities also administer specific funds and support schemes, such as tax exemptions or subsidies to cover, for example, 50% of the total costs of photovoltaic installations (for self-consumption).

The Institute for Energy Diversification and Saving (IDAE), in cooperation with the ERDF (European Regional Development Fund), manages programmes to grant non-refundable subsidies for RES-E projects. For example, there is a special programme for wind and photovoltaic projects located exclusively in non-peninsular territories (such as islands).

The following are some of the most relevant regulations of interest for ET in Spain:

REGULATORY FRAMEWORK IN SPAIN	
NAME OR REFERENCE	DESCRIPTION
Renewable energy support (RES)	<ul style="list-style-type: none"> • Many programmes are regulated at the National level, however, Autonomous Communities and Municipalities also administrate funds and specific support schemes, such as tax exemptions or subsidies to cover for example 50% of the total costs of PV installations (for self-consumption). There is one special programme for wind and PV projects exclusively located in non-peninsular territories (such as islands). • Discounts on Real Estate Tax for the Installation of Solar Use Systems • Discounts on the Tax on Constructions, Installations and Works (ICIO) for the Installation of Solar Use Systems • Reductions on the Tax on Mechanical Traction Vehicles (IVTM) for Low Emission Vehicles • Deduction in the income statement (IRPF): For energy rehabilitation works and reform of the habitual residence, it is possible to deduct in the income statement, both at regional and state level, a certain percentage of the budget of the installation, according to the level of efficiency achieved after the action.
Grid-related policies	<ul style="list-style-type: none"> • RD 1183/2020 established that the criterion for awarding the concession of access to the grid will be that of temporary priority, however, in order to promote the penetration of renewable energies. • Circular 3/2020 recalculation of tolls involving a substantial reduction in the costs associated with distribution and transmission networks. • RD 738/2015 regulates the electricity production activity and the dispatch procedure in non-peninsular electricity systems. • RD 413/2014 promoting self-consumption with distributed generation from renewable sources, including new forms of self-consumption and regulations. • Law 24/2013 producers of electricity from renewable energy sources and high-efficiency cogeneration shall have priority access and

	<p>connection to the grid, under terms to be determined by regulation, based on objective, transparent and non-discriminatory criteria.</p> <ul style="list-style-type: none"> • Law 17/2013, for the guarantee of supply and increase the competences in insular and extra-peninsular electricity systems. • Order of November 15, 2006, that sets the technical/administrative conditions required for the repowering of existing wind parks. • Order of November 29, 2006, sets the technical/administrative conditions required for the wind installations in the Canary Islands. <p>Specific to the Canary Islands:</p> <ul style="list-style-type: none"> • Law 6/2022 climate change and energy transition in the Canary Islands • RD 6/2015 Regulates the installation and operation of Wind Parks in the Canary Islands. • Law 17/2013 that regulates the Canarian electric sector • RD 141/2009 regulates the administrative procedures regarding the execution and operation of the electric installations in the Canary Islands. • Strategy for Energy Storage in the Canary Islands: aims to foster the development and implementation of energy storage technologies in the region. Recognizing the importance of energy storage for enhancing the efficiency, reliability, and integration of renewable energy sources, the strategy outlines key objectives and actions to support the deployment of energy storage systems. <p>Specific to the Balearic Islands:</p> <ul style="list-style-type: none"> • <u>In 2020, Red Eléctrica commissions the new submarine electricity link between Menorca and Majorca and thus connects the entire Balearic Islands electricity system with the Spanish mainland and the European transmission grid.</u>
<p>Energy efficiency policies (EE)</p>	<ul style="list-style-type: none"> • RD 390/2021, approving the basic procedure for the certification of the energy performance of buildings Regulation on thermal installations in buildings (RITE) • RD 56/2016, transposing Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, as regards energy audits, accreditation of service providers and energy audits and promotion of efficient energy supply. <p>Spain implements different energy efficiency measures, which can be found across all energy sectors, where the IDAE plays a key role on the administration and granting of aid.</p> <ul style="list-style-type: none"> • Energy efficiency measure (Energy renovation of public buildings)

	<ul style="list-style-type: none"> • Energy efficiency measure (Aids Program for Energy Retrofit of Existing Buildings – PAREER II) • Energy efficiency measure (Energy Efficiency in outdoor lighting) <p>Specific to the Canary Islands:</p> <ul style="list-style-type: none"> • Law 6/2022, of 27 December, on climate change and energy transition in the Canary Islands. <p>Specific to the Balearic Islands:</p> <ul style="list-style-type: none"> • Law 10/2019, of 22 February, on climate change and energy transition in the Balearic Islands • Basic guidelines for energy saving and efficiency in buildings and facilities of the Autonomous Community of the Balearic Islands and the instrumental public sector.
<p>Community energy policies</p>	<p>The Spanish legal system recognises the right to self-produce and self-consume renewable energy in multiple forms, which allows for flexibility in the self-consumption design.</p> <p>First, consumers can install generation units and self-consume what they generated (individual self-consumption - prosumers). Consumers can decide between two modalities: “with surplus” or “without surplus”. In the former case, any energy surplus can be compensated (through the electric bill) or sold on the market. In the later modality, the prosumer must install an anti-spill mechanism to prevent the injection of any energy surplus. Storage systems are allowed in all modalities.</p> <p>Second, self-consumption can also be collective, i.e., several consumers are associated with one or multiple RE generation units (energy sharing and energy communities). Collective self-consumption can also adopt a “with or without surplus” modality. Prosumers can also share energy through internal networks but also using the public grid, which allows for energy sharing between buildings. There are, however, geographical limits.</p> <ul style="list-style-type: none"> • Order TED/1247/2021, for the implementation of variable distribution coefficients in collective self-consumption, in annex I of the RD 244/2019 that regulates the administrative, technical and economic conditions for the self-consumption of electricity • RDL 23/2020 modified Law 24/2013 and introduced some first references to Renewable Energy Communities. • RD 244/2019 regulates the administrative, technical and economic conditions for the self-consumption of electricity. <p>Specific to the Canary Islands:</p> <ul style="list-style-type: none"> • Strategy for Photovoltaic Self-Consumption in the Canary Islands The Strategy for Photovoltaic Self-Consumption in the Canary Islands



	<p>aims to promote and facilitate the development of solar energy generation for self-consumption purposes in the region. The strategy recognizes the potential of solar power and its contribution to a more sustainable and resilient energy system in the Canary Islands.</p> <ul style="list-style-type: none"> • Law 6/2022, of 27 December, on climate change and energy transition in the Canary Islands. It mentions self-consumption, including collective self-consumption, and how it should be promoted by the public administrations of the Canary Islands and its public institutional sector in accordance with the applicable state regulations <p>Specific to the Balearic Islands</p> <ul style="list-style-type: none"> • Law 10/2019, of 22 February, on climate change and energy transition in the Balearic Islands. It includes a chapter dedicated to self-consumption, including collective self-consumption, in accordance with the applicable state regulations.
<p>Other clean energy supporting policies</p>	<ul style="list-style-type: none"> • Training programmes for Installers of RES installations (National System of Qualifications and Vocational Training) • Training programmes for Installers of Energy Efficiency installations (National System of Qualifications and Vocational Training) • Certification Programmes for RES installations (Mandatory certification for thermal solar collectors)
<p>Draft Law on Climate Change and Energy Transition in the Canary Islands</p>	<p>The Draft Law on Climate Change and Energy Transition in the Canary (LCCTEC) Islands is being processed, which will be the framework for implementing effective policies to reduce the impacts and mitigate the impacts of climate change, which will be the framework for implementing effective policies to reduce the impacts and mitigation of GHGs in the Canary Islands, whose text has been published in the Official Gazette of the Parliament of the Canary Islands the 23 November 2021.</p> <p>The LCCTEC contemplates several planning instruments that should cover the necessary measures to be implemented in climate action. under the umbrella of European legislation and the basic national legislation:</p> <ul style="list-style-type: none"> -The Canary Islands Climate Action Strategy, as the framework instrument for regional planning in the Canary Islands, on which the other instruments depend, aims to establish the long-term contribution of the Canary Islands to the fulfilment of climate action commitments and regulate its content. <p>The Canary Islands Energy Transition Plan and the Canary Islands Climate Action Plan. Both plans will develop the guidelines established by the Canary Islands Climate Action Strategy. The first plan focuses on achieving the greenhouse gas emission reduction objectives within the specified timeframe,</p>

	<p>while the second plan aims to minimize or absorb the identified impacts, risks, and vulnerabilities, both current and potential, as outlined in the Strategy.</p> <p>The Canary Islands Just Transition Strategy, as an instrument for adapting to the new economic and social model resulting from the ecological transition.</p> <p><u>The Insular and Municipal Climate and Energy Action Plans</u>, as complementary plans to the Canary Islands Climate Action Strategy, within the scope of insular and municipal competencies, which should include a sustainable urban mobility plan.</p>
<p>Draft of the Energy Transition and Climate Change Plan the Balearic Islands</p>	<p>Decree 140/2007, of November 23, amending Decree 60/2005, of May 27, creating the Interdepartmental Commission and the Technical Committee on Climate Change.</p> <p>In August 2008, the Council of Government of the Balearic Islands approved the 2008-2012 Action Plan to Fight Climate Change, which identifies 99 measures to support efforts to reduce greenhouse gas emissions.</p> <p>In 2012 the document "<u>Balearic Islands Climate Change Strategy 2013-2020</u>" was drafted, after an internal process by the Interdepartmental Commission and the Technical Committee on climate change. The General Directorate of Natural Environment, Environmental Education and Climate Change drafted the document using the information received from the members of the Committee and the documents "Roadmap of the Balearic Islands Climate Change Strategy" and "Closing of the Action Plan 2008-2012".</p> <p>After the approval of Law 10/2019, of February 22nd, on climate change and energy transition, the drafting of an Energy Transition and Climate Change Plan was foreseen.</p> <p>The Energy Transition and Climate Change Plan constitutes the integrated and cross-cutting framework for the planning and management of objectives, policies and actions that will enable the purposes of the law to be fulfilled.</p> <p>The Energy Transition and Climate Change Plan is in final draft and is expected to be published during 2023.</p>
<p>Relevant energy sector authorities</p>	<ul style="list-style-type: none"> - <u>OMIE, OMI Polo Español S.A. (is the Spanish Nominated Electricity Market Operator)</u> - <u>Transmission System Operator – Red Eléctrica de España</u> - <u>Directorate General for Energy Policy and Mines</u> - <u>National Commission for Markets and Competition</u> - <u>The Directorate General of Energy of the Government of the Canary Islands.</u> - <u>Municipalities</u> - <u>Autonomous Communities</u>

Table 8. Regulatory Framework in Spain

4.1.2 National Barriers toward an energy transition approach

Based on the Clean Energy Transition initiative [54] which studied the current regulatory framework and had a consultation with relevant Spanish stakeholders (surveys, interviews and joint meetings), the most important regulatory barriers to a clean energy transition on Spanish islands were identified, and are ranked by order of priority in the following table:

REGULATORY BARRIERS - Case: SPAIN	
Barrier 1	Grid constraints and inflexible thermal plants
Barrier 2	Lack of legal frameworks for system integration of renewable energy
Barrier 3	Complex and lengthy permitting and authorisation procedures
Barrier 4	Confusion and misunderstandings about the price signal
Barrier 5	Spatial planning: Lack of long-term vision on how different land uses on islands are coordinated to assure sustainable economic development
Barrier 6	The lack of coordination of energy sector priorities between the national and regional governments
Barrier 7	Lack of clear regulation for energy communities

Table 9. Regulatory Barriers in Spain

4.1.3 Regional ET case study: Tenerife Island

The Canary Islands are composed of eight main islands: El Hierro, La Gomera, La Palma and Tenerife, which form the province of Santa Cruz de Tenerife; and Gran Canaria, Fuerteventura, Lanzarote and La Graciosa, which make up the province of Las Palmas. The island territories of the Chinijo Archipelago (Alegranza, Montaña Clara, Roque del Este and Roque del Oeste) and the island of Lobos, all belonging to the province of Las Palmas, are also part of the Canary Islands.

Tenerife is located just over 300 km from the African continent, and about 1,000 km from the Iberian Peninsula. Triangular in shape, Tenerife is the largest island of the Canary archipelago, with an area of 2,033.2 km² and a coastal perimeter of 269 km. It is also the highest: in its centre rises the Mount Teide, which with its 3,718 meters above sea level is the highest point in Spain. It has small islets or rocks around it, such as those of Anaga, Garachico, Fasnia, etc.

➤ Current status

The Government of the Canary Islands has recently approved the Canary Islands Climate Action Strategy (ECAC), which is articulated in section 14 of Law 6/2022, of 27 December,

on Climate Change and Energy Transition in the Canary Islands, which defines the framework for climate action planning in the archipelago.

The ECAC is the regional planning framework instrument that aims to fulfil the commitments made in the fight against climate change. It is a roadmap for moving towards a climate-neutral and climate-resilient Canary Islands society by 2040. To this end, it identifies the main risks in the Canary Islands, sets targets for emissions reduction, carbon sequestration, energy efficiency, implementation of renewables and sustainable mobility. It proposes strategic lines and measures for mitigating and adapting to climate change and defines research, development and training needs in the field of climate action. The ECAC also sets out the determinations to which all sectoral plans, programmes and policies must conform in order to achieve the objectives of the Canary Islands Climate Change and Energy Transition Law.

The Strategy will be developed through the future Canary Islands Climate Action Plan (that is which is currently under development) and the Canary Islands Energy Transition Plan ([initial version](#) currently in the public information phase), as well as the Island and Municipal Climate and Energy Action Plans.

The Canary Islands Energy Transition Plan (PTECan), with a time horizon up to 2030, will be the sectoral planning instrument that will aim to advance the decarbonisation of the Canary Islands, promoting the development of a sustainable energy model based on energy efficiency and renewable energies, identifying the actions that will contribute to the decarbonisation of the economy by 2040.

Likewise, and in support of the preparation of the PTECan, eight sectoral energy strategies have been developed: photovoltaic self-consumption; energy storage; electric vehicles; manageable generation; geothermal energy; marine renewable energies; green hydrogen; and demand management and smart grids, whose main purpose is to determine the development potential of the technologies considered to be of special interest in the challenge of decarbonisation.

As for the Sustainable Energy Strategy of the Canary Islands, within the framework of the Recovery, Transformation and Resilience Plan, it provides for the mobilization of 467.67 million euros. This amount will be allocated to actions in various priority areas to advance towards a fair energy transition that reaches all citizens and promotes a more efficient public administration and services.

Tenerife has set a target to reduce carbon emissions by 40% by 2025, and 100% by 2050. The following initiatives and policies are being implemented by government aimed at achieving this target.

- **Promotion of Renewable Energy Sources**

The government of Tenerife promotes the use of renewable energy sources, such as solar and wind energy. It offers incentives for citizens and businesses to invest in renewable energy sources, such as tax credits and subsidies. The installation of solar panels is becoming increasingly popular in Tenerife. The government provides incentives for citizens and businesses to install them. The use of solar panels helps reduce reliance on fossil fuels and contributes to the island's goal of achieving energy independence. The government of Tenerife has set a target of generating 45% of its energy from renewable sources by 2025.

- **Smart Grid Projects**

Tenerife is implementing smart grid projects that allow for better management of energy distribution, reduce energy losses, and increase efficiency. These projects involve the use of advanced technologies, such as sensors and automation, to monitor and control energy usage in real-time.

- **Sustainable Transport**

The government of Tenerife is investing in electric vehicle infrastructure, such as charging stations and parking spaces. It offers incentives for citizens to purchase electric vehicles, such as tax credits and free charging. The government is investing in public transport infrastructure and offering incentives for citizens to use public transport, such as free or reduced fares.

- **Energy Efficiency**

Tenerife is promoting energy efficiency through various initiatives, such as energy audits, energy-saving campaigns, and the use of energy-efficient appliances and equipment.

- **Research and Development**

Tenerife has invested in research and development of renewable energy sources and sustainable technologies. It has established partnerships with research institutions and universities to develop new technologies and promote innovation in the energy sector.

➤ **Current plans for ET**

Regarding existing ET plans, only the island of La Palma has so far defined its [CETA](#) and continues to work with the "Clean energy for EU islands" initiative. This island is working on a methodology for the assessment of utility-scale Energy Storage Systems (ESS) for technology selection and cost-benefit evaluation of a virtual transmission line project for reliability-based planning purposes.

On the other hand, at the regional level and focusing on the island of Tenerife, there are 20 municipalities that participate in the Covenant of Mayors initiative and that have developed their action plan or are in the process of doing so. Among the municipalities involved in this initiative are Adeje, Arona, Consorcio Isla Baja, Ayuntamiento de Güímar, Candelaria, Buenavista del Norte, Icod de los Vinos, El Rosario, Matanza de Acentejo, la

Orotava, los Realejos, la Victoria de Acentejo, Puerto de la Cruz, San Cristóbal de la Laguna, san Miguel de Abona, Santa Cruz de Tenerife, Santa Úrsula, Santiago del Teide or Tacoronte.

The main lines of action are buildings, equipment/facilities (public and private), outdoor public lighting, alternative transportation, local electricity production, public and private transportation, territorial planning such as biological corridors and connection between neighbourhoods, tourism management, environment and education. In addition, actions such as the promotion of energy consumption monitoring in neighbouring communities and companies, conscious and appropriate use of energy, the organization of seminars and training activities on sustainability for public employees and companies, awareness-raising at the municipal level are also highlighted and promotion of agreements with the sectors to facilitate their involvement in the development of SECAP.

Specifically, the latter measures are in line with the activities carried out by GENERA and, therefore, a priori indicate a good reception of the project.

➤ Stakeholder mapping

TENERIFE STAKEHOLDER MAPPING	
Dimension 1	<p>Local councils and public bodies</p> <ul style="list-style-type: none"> - <i>Consejería de Transición Ecológica, Lucha contra el Cambio Climático y Planificación Territorial del Gobierno de Canarias</i> - <i>Área de Desarrollo Sostenible y Lucha contra el Cambio Climático del Cabildo de Tenerife</i> - <i>Agencia Canaria de Acción Climática</i> - <i>Comisión Interdepartamental de Acción Climática</i> - <i>Tenerife Island Council</i> - <i>Municipalities (31 in total).</i>
Dimension 2	<p>Power Generation Companies</p> <ul style="list-style-type: none"> - <i>Red Eléctrica de España (REE) - Electricity Transmission System Operator</i> - <i>Endesa - Electricity Distribution and Supply Company</i>
Dimension 3	<p>Energy service companies</p> <ul style="list-style-type: none"> - <i>Energia xxi comercializadora de referencia S.L.U. (endesa)</i> - <i>Comercializadora regulada, gas & power, S.A. (naturgy)</i> - <i>Curenergía comercializador de último recurso S.A.U. (iberdrola)</i> - <i>Comercializador de referencia energético, S.L.U.</i> - <i>Régsiti comercializadora regulada, S.L.U</i> - <i>Baser comercializadora de referencia, S.A</i>
Dimension 4	<p>Citizen's typologies</p>

	<ul style="list-style-type: none"> - <i>Permanent Citizens: Residents, community Organizations, Neighbourhood Associations</i> - <i>Local Energy Community of Tacoronte</i> - <i>Stationary citizens</i> - <i>Seasonal Citizens</i> - <i>Tourists</i>
Dimension 5	<p>Active organizations or entities</p> <ul style="list-style-type: none"> - <i>Canary Green</i> - <i>Office of Renewable Energies of the Cabildo de Tenerife (Covenant of Mayors coordinator)</i> - <i>ITER - Institute of Technology and Renewable Energies</i> - <i>ITC - Institute of Technology of the Canary Islands</i> - <i>Oficinas Verdes of the Canary Government</i>

Table 10. Stakeholder identification for the ET of the island of Tenerife

The following is the power-interest matrix to situate the stakeholders of the island of Tenerife, and thus establish an action procedure to support the ET.

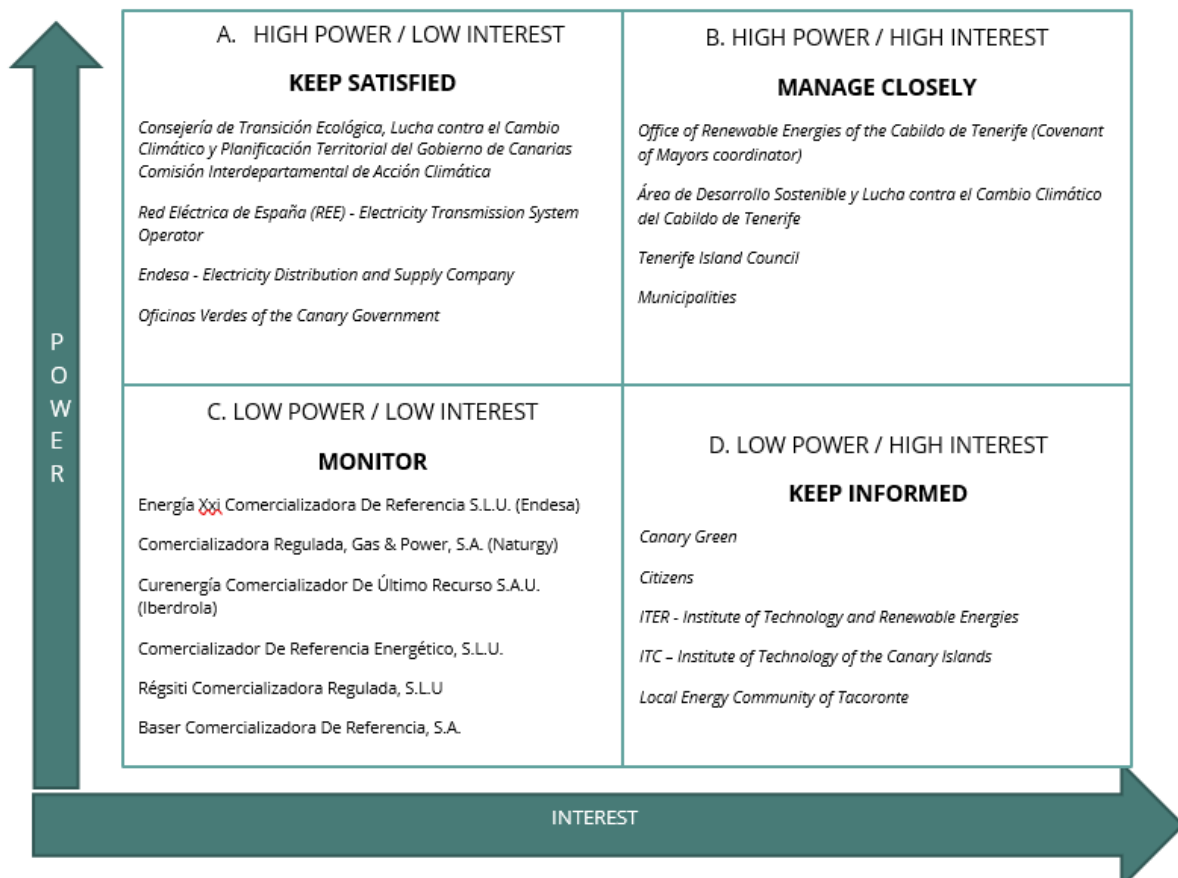


Figure 3. Power-interest matrix for Tenerife stakeholders.



➤ **Best Practices**

BEST PRACTICES IMPLEMENTED IN TENERIFE
<p>ENERGY EFFICIENCY</p> <p>Tenerife is promoting energy efficiency through various initiatives, such as energy audits, energy-saving campaigns, and the use of energy-efficient appliances and equipment.</p> <p>Energy Counseling Program of Personas + Sostenibles:</p> <p>The Energy Counseling Program is an initiative that aims to help businesses and households improve their energy efficiency and reduce their energy consumption. The program offers free advice to participants and provides recommendations for the implementation of energy efficiency measures.</p>
<p>ELECTRICITY</p> <p>The government of Tenerife promotes the use of renewable energy sources, such as solar and wind energy. It offers incentives for citizens and businesses to invest in renewable energy sources, such as tax credits and subsidies. The installation of solar panels is becoming increasingly popular in Tenerife. The government provides incentives for citizens and businesses to install them. The use of solar panels helps reduce reliance on fossil fuels and contributes to the island's goal of achieving energy independence. The government of Tenerife has set a target of generating 45% of its energy from renewable sources by 2025.</p>
<p>COMMUNITY ENERGY ACTIONS</p> <p>The local government promotes sustainable tourism practices among tourists and local businesses. It provides information and advice on sustainable tourism practices and encourages businesses to adopt sustainable practices, such as using renewable energy sources and reducing waste.</p>
<p>TRANSPORT</p> <p>The government of Tenerife is investing in electric vehicle infrastructure, such as charging stations and parking spaces. It offers incentives for citizens to purchase electric vehicles, such as tax credits and free charging.</p> <p>The government is investing in public transport infrastructure and offering incentives for citizens to use public transport, such as free or reduced fares.</p> <p>The office of sustainable development and Fight against Climate change is promoting sustainable mobility in Tenerife through initiatives such as the creation of bike lanes and the promotion of public transport.</p>
<p>SMART GRIDS</p> <p>Tenerife is implementing smart grid projects that allow for better management of energy distribution, reduce energy losses, and increase efficiency. These projects</p>

involve the use of advanced technologies, such as sensors and automation, to monitor and control energy usage in real-time.

AWARENESS

The Personas + Sostenibles programme organizes workshops and Seminars aimed at the population of the island with the aim of raising awareness about the importance of adopting sustainable habits in everyday life. These workshops address topics such as waste management, energy efficiency and sustainable mobility.

The same program also conducts awareness campaigns to encourage the adoption of sustainable habits. These campaigns are disseminated through social networks and other media and address issues such as reducing plastic consumption, the importance of sustainable mobility and responsible waste management.

This initiative promotes the circular economy on the island, encouraging responsible consumption and the reuse of products. The office organizes events to promote the consumption of local products and the reuse of objects, with the aim of reducing the environmental impact of production and consumption.

Another energy awareness campaign in Tenerife is "Actúa Contra el Cambio Climático," which is a campaign that aims to raise awareness about the impacts of climate change and to encourage individuals to take action to reduce their carbon footprint. The campaign provides information and resources on sustainable practices and offers incentives to individuals who take action to reduce their carbon footprint.

In addition to these campaigns, there are various events and workshops held throughout the year to promote energy awareness and conservation. For example, the "Feria de Energías Renovables y la Eficiencia Energética" is an annual event that showcases the latest technologies and practices in renewable energy and energy efficiency. The event features workshops, demonstrations, and exhibits to educate individuals on the benefits of renewable energy and energy conservation.

Table 11. Best practices implemented in Tenerife

4.1.4 Regional ET case study: Ibiza Island

The Balearic Islands are composed of four main islands: Mallorca, Menorca, Ibiza y Formentera. The Balearic Islands have an extension of 4,492 km² and give rise to one of the most touristic archipelagos of the Mediterranean as well as being an environment endowed with a great diversity.

Specifically, the island of Ibiza has an area of 571.8 km², being the third largest island in the Balearic archipelago. In terms of population density, the island of Ibiza has a population of 112,000 inhabitants, concentrated in the five municipalities into which it is divided: Ibiza the capital, Sant Antoni de Portmany, Sant Joan de Labritja, Sant Josep de sa Talaia and Santa Eulària des Riu.

➤ Current status

The Energy Transition and Climate Change Plan aims that by 2023 the Balearic Islands will have the basis for a sustainable, decarbonized and climate change resilient economic model, which will allow a socially fair, intelligent, and democratic growth. Thus, this Plan aims to shape the planning of the Balearic Islands' energy transition and climate change policy, so that the commitments arising from the Law on Climate Change and Energy Transition of the Balearic Islands can be fulfilled.

Although the Energy Transition and Climate Change Plan is expected to be published in 2023, the Island Council of Ibiza published in January 2023 the Island Territorial Strategic Plan of Ibiza. This document includes energy efficiency measures, water saving and promotion of renewable energies to advance the mitigation and adaptation of the effects of climate change. Among the measures include:

- **Preliminary delimitation of priority areas for the implementation of renewable energies and parking lots.** The definitive zoning is not yet known, but the Ibiza council is expected to compile the information soon. The plan prioritizes urban development areas for industrial use and transition areas not currently occupied by forest on land no larger than 3 hectares.
- **Buildings required to have energy certification B or C,** also as part of RD 390/2021.
- **Buildings required to incorporate grey water reuse system.** This is due to the scarcity of water resources on the island of Ibiza. Since most of the water for urban consumption comes from desalination plants with its high energy cost.

➤ Current plans for ET

Regarding existing ET plans, on the one hand, part of the Balearic Islands joined the "Clean Energy for EU Islands" initiative in February 2019: Mallorca, Menorca and Ibiza. In early April 2019 Menorca was the first island to publish its ET roadmap [55]. Meanwhile, the island of Ibiza also developed the first version of the roadmap in October 2020 [56].

On the other hand, at the regional level on the island of Ibiza, some municipalities are also part of the Covenant of Mayors initiative and have developed or are developing their action plan. These municipalities are Ibiza, Sant Antoni de Portmany and also the island of Formentera.

From the three municipalities it can be appreciated that the measures in common (known so far, since there is only one action plan available) are those related to the change of lighting fixtures for more efficient ones, both exterior and interior in municipal buildings, change of the fleet of municipal vehicles for more efficient ones and other awareness and mobilization measures for the mitigation of energy poverty.

In addition, on behalf of the municipality of Sant Antoni de Portmany there are a variety of actions, differentiated according to whether they depend directly on the municipality

or not. The actions that depend directly on the city council are mainly the implementation of energy management systems in municipal buildings, boiler renovation, facility maintenance, installation of renewable energy on municipal roofs, promotion of local energy communities, energy training courses for public employees and awareness-raising on energy efficiency and savings. In addition, it is also proposed the creation of the figure of an energy manager to assist citizens in energy matters. Other actions that do not depend directly on the city council are the implementation of campaigns to raise awareness and sensitize citizens on good practices for energy saving, renovation of household appliances, etc. In addition, they also propose the municipal implementation of Electric Vehicle (EV) recharging.

➤ Stakeholder mapping

IBIZA STAKEHOLDER MAPPING	
Dimension 1	<p>Local councils and public bodies</p> <ul style="list-style-type: none"> - <i>Direcció General d'Energia i Canvi Climàtic</i> - <i>Balearic Energy Institute</i> - <i>Committee of Experts on Energy Transition and Climate Change</i> - <i>Regional ministry of energy transition, productive sectors and democratic memory</i> - <i>The Balearic Climate Council</i> - <i>The Interdepartmental Commission on Climate Change</i> - <i>Consell Insular d'Eivissa</i> - <i>Consell Insular de Formentera</i> - <i>Municipalities (6 in total) and Sant Francesc (Formentera)</i>
Dimension 2	<p>Power Generation Companies</p> <ul style="list-style-type: none"> - <i>Red Eléctrica de España (REE) - Electricity Transmission System Operator</i> - <i>Endesa - Electricity Distribution and Supply Company</i>
Dimension 3	<p>Energy service companies</p> <ul style="list-style-type: none"> - <i>BonpreuEsclat Energía, S.A.U.</i> - <i>ENDESA ENERGIA S.A.U.</i> - <i>IBERDROLA CLIENTES, S.A.U.</i> - <i>NATURGY IBERIA, S.A.</i> - <i>TOTALENERGIES CLIENTES S.A.U.</i> - <i>ENERGIA NUFRI, S.L.</i> - <i>Repsol comercializadora de electricidad</i> - <i>Comercializadora Regulada Gas & Power (Naturgy)</i> - <i>Comercializador referencia energético – Cor energético</i> - <i>Curenergía comercializador de último recurso S.A.U. (iberdrola)</i> - <i>Energía xxi comercializadora de referencia S.L.U. (endesa)</i> - <i>Imagina Energia</i> - <i>GAOLANIA SERVICIOS, S.L</i>

	<ul style="list-style-type: none"> - <i>TELECOR S.A.</i> - <i>EDP CLIENTES, S.A.U.</i>
Dimension 4	<p>Citizen's typologies</p> <ul style="list-style-type: none"> - <i>Permanent Citizens: Residents, community Organizations, Neighbourhood Associations</i> - <i>Stationary citizens</i> - <i>Seasonal Citizens</i> - <i>Tourists</i>
Dimension 5	<p>Active organizations or entities</p> <ul style="list-style-type: none"> - <i>PIMEEF (Federació Empresarial de la Petita i Mitjana Empresa d'Eivissa i Formentera):</i> - <i>Amics de la Terra - an environmentalist association of Ibiza</i> - <i>Ibiza Preservation</i> - <i>Posidonia Green Project</i> - <i>Ibiza Free Plastic</i> - <i>Sustainable Balearic Islands</i>

Table 12. Stakeholder identification for the ET of the island of Ibiza

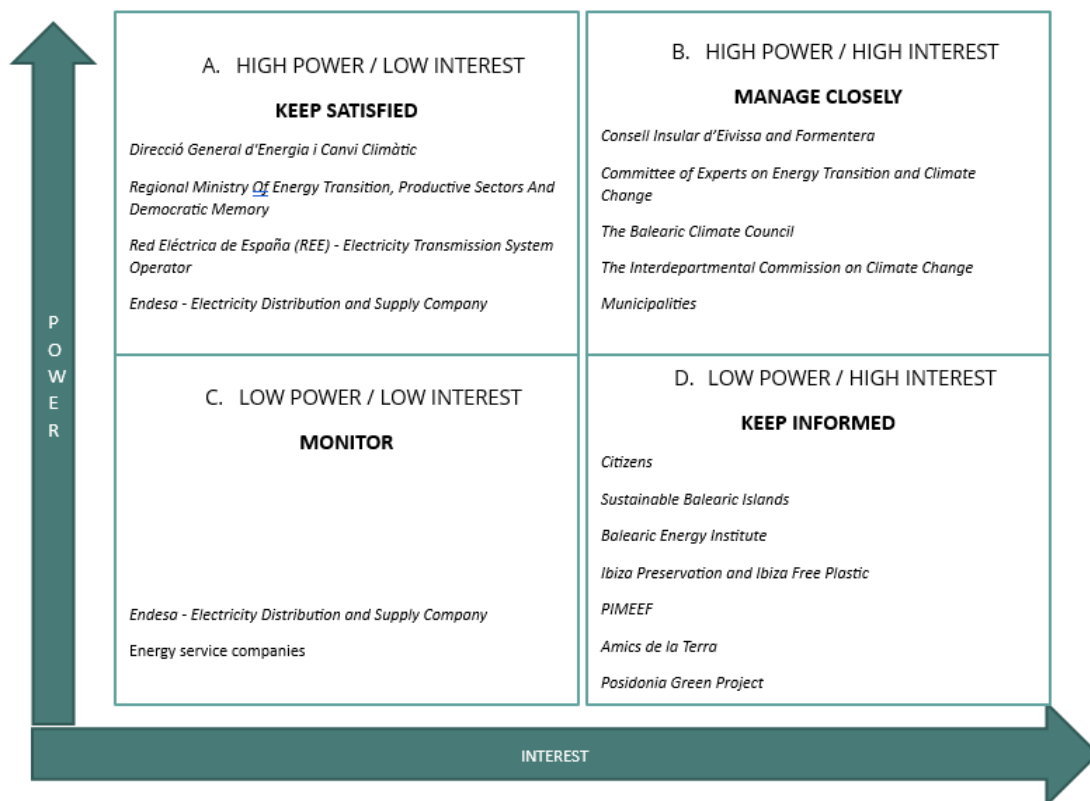


Figure 4. Power-interest matrix for Ibiza stakeholders

➤ **Best Practices**

BEST PRACTICES IMPLEMENTED IN IBIZA
<p>ENERGY EFFICIENCY</p> <p>The government of the Balearic Islands promotes the improvement of energy efficiency in buildings for individuals, companies and public administrations. Among its incentives are the improvement of the industrial sector to reduce electricity bills and CO2 emissions, the rehabilitation of housing in small municipalities (for individuals, companies and public administrations).</p>
<p>ELECTRICITY</p> <p>The government of the Balearic Islands promotes the use of renewable energy sources by providing incentives and aid to companies and individuals. Among the aids are the incorporation of renewable energy systems for air conditioning and Domestic Hot Water, self-consumption with photovoltaic panels and batteries to store energy.</p>
<p>COMMUNITY ENERGY ACTIONS</p> <p>The Balearic Energy Institute, a public business entity of the Government of the Balearic Islands and attached to the Ministry of Energy Transition, Productive Sectors and Democratic Memory, promotes collective self-consumption by supplying green, cheap and local electricity at the cost price of neighbourhoods. It has a website where you can see the status of the facilities in the different islands. In Ibiza there are two municipalities: Santa Eulalia (in tender) and Sant Antoni de Portmany (under construction).</p> <p>It also provides information on the different aids to produce energy either individually or collectively and provides a framework to promote collective projects.</p>
<p>TRANSPORT</p> <p>MELIB is the management system of the public network of EV charging points in the Balearic Islands. This public network is managed through a mobile application that allows to see the real-time status (streaming) of each of the points and enable energy recharging for vehicles.</p> <p>On the other hand, the government of the Balearic Islands also provides aid for the acquisition of EVs to companies, public administrations and individuals.</p>
<p>SMART GRIDS</p> <p>Within the National Plan for Intelligent Territories, aid was granted for the project "Ibiza, Smart and Sustainable Tourism" [57].</p> <p>The projects that have been beneficiaries promote the application of information and communication technologies to the operation of local entities eminently touristic, so</p>

that these are configured in intelligent territories, with differential and competitive services.

The main objective is to create an APP with integrated tourist information on unique points of the island with proximity warning, beach status, status of park-and-ride parking lots, information on bus arrival times and water status sensors.

AWARENESS

The **Ibiza&Formentera Preservation Foundation** promotes the socio-environmental conservation of Ibiza and Formentera. To this end, they propose initiatives to develop sustainable lifestyles and protect the environment. One of the projects is the "[Ibiza Sustainability Observatory](#)" started in 2018, it gathers data on biodiversity, waste, water, energy, territory and tourism.

They also provide solutions and best practices to promote sustainable tourism, save water, reduce waste, support solar energy and create energy-efficient housing, among others.

Table 13. Best practices implemented in Ibiza

4.2 Study of the Italian islands: Sardinia

4.2.1 National Policies and Regulatory Framework

Italy is a peninsula that juts out from southern Europe and juts into the Adriatic, Tyrrhenian and Mediterranean seas, among others. Its location has played an important role in its history. Italy is surrounded by the sea and mountains run through the interior dividing it into regions. Depending on the different regions there are more wooded areas, warm and dry coasts and fertile plains.

Italy's economy had one of the lowest growth rates among EU countries in the past 15 years. The 2021 data show that income inequality is higher than in most advanced economies, and there are large differences between the different Italian regions, with the southern regions and the large islands being generally poor, with less quality infrastructure and services [58].

However, measures are being promoted from the government to mitigate this situation, on the one hand, through the Integrated National Energy and Climate Plan (INECP) 2030 developed in 2019 [59], the aim is to contribute to a broad transformation of the economy, combining decarbonization, circular economy, efficiency and rational and fair use of natural resources. Measures aimed at the decarbonization of the energy sector also seek to protect the most vulnerable sectors of the population, with a particular focus on energy efficiency and distributed generation from renewable sources. On the other hand, the Government has prioritized the implementation of the National Resilience Plan 2021-2026 [60] in order to accelerate the efforts to expand renewable energy and improve energy efficiency envisaged in the EU package of measures to help member countries recover from the Covid-19 socioeconomic crisis and prepare for a green and sustainable economy.

The following table shows the Italian policy framework in the different sectors that have an impact on ET:

REGULATORY FRAMEWORK IN ITALY	
NAME OR REFERENCE	DESCRIPTION
Renewable energy support (RES)	<ul style="list-style-type: none"> • Auction and Registry (FER1 Decree) - The incentives provided in the FER 1 decree are accessible through two types of auctioning systems: auctions for large plants and registers for medium-sized plants. • Feed-in tariff (Ritiro dedicato) - Electricity generated from renewable energy sources fed into the grid can be sold on the free market or to the GSE on a guaranteed minimum price. • Net-Metering (scambio sul posto) - A scheme that allows prosumers to feed their excess (not used) electricity into the grid and get compensated for it. • Tax regulation mechanisms (Reduction in value-added tax - renewable energy generation is promoted through VAT tax deductions.

	<ul style="list-style-type: none"> • Subsidy (Conto termico) - Installing heat pumps, biomass and solar thermal installations for heating purposes is supported through subsidies aimed at the redevelopment of buildings. • Tax regulation mechanism (Superbonus) - Promotes greater efficiency and the renewable energy sources for heating and cooling, by providing a 110% tax deduction of the expenditure. • Support of RES-H infrastructure - Municipalities must include RES technologies in district heating and cooling networks in their development plans. • RES-H building obligations - All new buildings and buildings undergoing major refurbishment must integrate installations generating heating or cooling from renewable energy sources. • Subsidy (eco bonus) - Vehicle buyers receive incentives if they purchase environmentally friendly vehicles, including electric vehicles. • Subsidy (decreto biometano) - Producers of advanced biofuels receive a subsidy which can be increased through expansion investments. • Biofuel quota (obbligo di immisione) - This scheme defines the share of biofuels that suppliers need to include in their fuel supply to the transport sector.
Grid-related policies	<ul style="list-style-type: none"> • art. 29.1 Annex A ARG/elt 99/08 Plant operators can request the grid operator to expand the grid if the connection of a plant requires this expansion. As renewable energy plants have priority in terms of connection, they also enjoy priority in terms of grid expansion needs. • 12 Annex A ARG/elt 99/08. art. 25.1 Annex A ARG/elt 99/08 The costs of connection are borne by the applicant for connection. Renewable energy plants have a discount on connection fees compared to plants fuelled by other fuels • Arts. 9, 21 and 26.2 ARG/elt 9 In the case of renewable energy sources, the grid operator bears the costs for expanding the grid. • art. 64, 30.7 and 31.7 Annex A AEEG 111/06 Intermittent sources (wind, solar and geothermal energy, running waters, biogas) have the second-highest priority, after electricity generated by units deemed essential for system security, in the hours in which they are declared indispensable (art. 64, 30.7 and 31.7 Annex A AEEG 111/06). Therefore, when various operators offer their electricity at the same price renewable electricity has priority as long as grid security can be maintained. This is followed by electricity produced at combined heat and power (CHP) plants.
Energy efficiency policies (EE)	<p>Italy has two main EE sets of measures:</p> <ul style="list-style-type: none"> • FNEE, the National Energy Efficiency Fund is a financial fund to be spent on incentivising investment to implement energy efficiency measures on production plants, production processes and buildings. • Tax regulation mechanism: Superbonus - Promotes greater efficiency and the renewable energy sources for heating and cooling, by

	<p>providing a 110% tax deduction of the expenditure, along with additional PV installations and electric vehicle charging stations.</p>
Community energy policies	<p>The Italian law recognises both energy cooperatives and energy sharing prosumers. Similar rules apply to both as in the energy production should not constitute as commercial and/or main industrial activity and should aim at satisfying the energy need of its nearby members. The same or really similar benefits and tariff structure apply to both. The most significant support mechanisms are feed-in tariffs, premiums from grid injection and self-consumption and the net-metering scheme (Scambio sul Posto).</p> <ul style="list-style-type: none"> • Energy sharing in Italy is defined as a group that produces energy for their own consumption with plants powered by renewable power sources not exceeding 200 kW. • Energy cooperatives - End users, consumers of electricity, can join forces to produce locally, through renewable sources, the electricity necessary for their need. • Prosumer is defined as an end-user who produces renewable electricity for its own consumption at a private site located within defined boundaries and can store or sell self-produced renewable electricity.
Other clean energy supporting policies	<ul style="list-style-type: none"> • Training programmes for Installers of RES installations - professional qualification for installer of biomass boilers, fireplaces and heaters, building-mounted PV and solar thermal plants, low enthalpy geothermal plants and heat pumps. • Certification Programmes for RES installations - there is a legal obligation to produce certification of RES installations within buildings. • Exemplary role of public authorities (PREPAC) - All new buildings and buildings under refurbishment must consider to integrate RES, for public buildings, such obligations are more binding and higher. • Exemplary role of public authorities - at least 50% of vehicles acquired by public administrations should be electric, hybrid or hydrogen powered. • RD&D Policies (4.0 Research and Development Tax credit) - Tax credit for research and development, technological innovation, design and aesthetic development and betterment of production process.
Relevant energy sector authorities	<ul style="list-style-type: none"> - MIMIT- Ministry of Enterprises and Made in Italy (ex MiSE) - MASE - Ministry of the Environment and energy security (Ex MITE) - MIT - Ministry of sustainable infrastructures and mobility - MIC – Ministry of Culture (ex MiBAC) - MASAF - Ministry of Agriculture, Food Sovereignty and Forestry (ex MiPAAF) - ARERA- Italian Regulatory Authority for Electricity gas and water system - ENEA - Italian National Agency for New Technologies, Energy and Sustainable Economic Development. - GSE - Manager of energy services in Italy - TERNA - National Electric Grid S.p.A. - Regional authorities - The Revenue Agency

	<ul style="list-style-type: none"> - CMA - Customs and Monopolies Agency - CSEA - The Energy Sector Clearinghouse ex 'Cassa conguaglio per il settore elettrico'
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Table 14. Regulatory Framework In Italy

4.2.2 National Barriers toward an energy transition approach

Based on the Clean Energy Transition initiative [61] which studied the current regulatory framework and had a consultation with relevant Italian stakeholders (surveys, interviews and joint meetings), the most important regulatory barriers to a clean energy transition on Italian islands were identified, and are ranked by order of priority in the following table:

REGULATORY BARRIERS - Case: ITALY	
Barrier 1	Spatial planning and stringent and generic restrictions
Barrier 2	Lack of attention for the local level within national strategic energy planning
Barrier 3	Complex and lengthy permitting procedures
Barrier 4	Unified prices and regulated monopolies
Barrier 5	Grid constraints due to congestion
Barrier 6	Support measures focus on household level and not on community level
Barrier 7	Regulation on energy communities is underdeveloped

Table 15. Regulatory Barriers in Italy

4.2.3 Regional ET case study: Sardinia Island

Sardinia is an island and region of Italy, second in size only to Sicily among the islands of the western Mediterranean. It has an area of 24,090 km² and a population of 1,579,181 inhabitants in 2022.

Sardinia has unique geographic, economic and demographic characteristics, which are partly responsible for some of its structural differences with respect to other Italian regions. It has good natural resources such as wind, water and solar energy to generate significant amounts of green energy. In addition, the low population density favours distributed generation, the creation of many small, interconnected renewable energy plants.

➤ Current status

The Sardinia Regional Strategy, coordinated by the Regional Directorate for Environmental Defense was approved on October 6, 2021. On the one hand, in accordance with the sustainable development method under the 2030 Agenda and its Sustainable Development Goals (SDGs), the Regional Strategic Objectives of the Sardinia 2030 Strategy were based on environmental protection, social well-being and inclusion, and economic prosperity and equity. In this regard, the Regional Strategy for Sustainable

Development represents an important opportunity to integrate climate change mitigation and adaptation aspects into regional programming and planning. With all this, for 2030 the five Strategic themes of the Regional Strategy [62] on which it has focused, and which are in line with the European policy for the period 2021-2027 are:

- Achieving a **smarter Sardinia** with greater administrative and competitive capacity.
- **Green Sardinia** through conservation, management and improvement of resources and land for ecological transition.
- Greater **inclusive** connectivity with sustainable mobility.
- In the **social** field, to achieve a welfare system based on health, education, training and work, under social inclusion, equality and culture.
- Invest in **governance plans** close to the citizens.

The governance system for 2030 was also defined through the Regional Forum for Sustainable Development, which is made up of local authorities, companies, associations and civil society as a whole. The latter was defined in the Voluntary Local Review [63], a process in which the local and regional government evaluate the progress of the implementation of the actions of the 2030 actions.

Another important fact that demonstrates Sardinia's start in the progress towards TE is that in 2022, in the framework of the United Nations High Level Dialogue on Energy, a project was approved to contribute to Sustainable Development Goal 7 "Affordable and Clean Energy". The 'Green electrification of Sardinia' project was promoted by Enel and Roma Tre University to create a sustainable Sardinia and turn it into a completely green region [64]. Among the objectives of this project in terms of sustainability is to completely eliminate the use of both coal and natural gas, starting with the promotion of sustainable and ecological solutions for energy production.

➤ **Current plans for ET**

Regarding the "Clean Energy for EU islands" initiative, in Italy there are already some islands that are participating by developing their CETA, such as Pantelleria, Ventotene and Salina, in addition to the Egadi archipelago with the islands of Favignana, Levanzo and Marettimo. Most of these islands have already begun to move towards sustainability by conducting an analysis of available resources and renewable potential.

As for the island of Sardinia, it is heavily involved in the Covenant of Mayors initiative, as 187 municipalities have so far made some degree of commitment to participate. In order to identify the main measures included in the action plans, the plans of the municipalities located near Stintino have been analyzed, such as Sassari, Porto Torres, Sorso, Sennori, Olmedo, Uri, Tissi, Usini and Alghero, among others. The main reason for focusing on these municipalities is that the municipality of Stintino is one of the partners of the

GENERA project, so understanding the state of this particular region will facilitate assistance and support to Stintino, and to municipalities in a similar situation.

The main actions defined in the Action Plans are divided into different categories such as: planning, municipal, green public procurement (GPP), public lighting, residential, tertiary, agriculture, mobility, local energy production. The following are some of the measures defined in most of the plans:

- **Actions at municipal level** such as the introduction of photovoltaic systems or the improvement of insulation through the replacement of windows or coverings, as well as thermal systems, are highlighted. All this implies an energy requalification of municipal buildings.
- In the **area of mobility**, the use of alternative mobility systems is promoted, e.g. carsharing/carpooling, as well as incentives for the purchase of low-emission vehicles. The use of bicycles and walking is also promoted. In some cases, the use of electric vehicles is also promoted.
- More efficient **public lighting**: replacement of luminaires with LEDs, and replacement of traffic lights with more energy-efficient ones.
- In the area of **energy**, energy monitoring systems and the adoption of environmental regulations are promoted, in addition to the promotion of alternative energies (biomass, solar, wind).
- At the **awareness level**, the adoption of good practices for energy saving in public offices and for citizens, for waste control or for sustainable mobility, among others, is promoted.

Moreover, the island of Sardinia also participated in a European project DESTI-SMART (Interreg Europe Program) defining its [action plan](#) to achieve responsible and sustainable tourism.

➤ Stakeholder mapping

SARDINIA STAKEHOLDER MAPPING	
Dimension 1	<p>A. National public bodies/authorities:</p> <ul style="list-style-type: none"> - <i>MIMIT- Ministry of Enterprises and Made in Italy (ex MiSE)</i> - <i>MASE - Ministry of the Environment and energy security (Ex MITE)</i> - <i>MIT - Ministry of sustainable infrastructures and mobility</i> - <i>MIC – Ministry of Culture (ex MiBAC)</i> - <i>MASAF - Ministry of Agriculture, Food Sovereignty and Forestry (ex MiPAAF)</i> - <i>ARERA- Italian Regulatory Authority for Electricity gas and water system</i> - <i>ENEA - Italian National Agency for New Technologies, Energy and Sustainable Economic Development.</i> - <i>GSE - Manager of energy services in Italy</i> - <i>ISPRA (Istituto Superiore per la Protezione e la Ricerca Ambientale)</i> - <i>AGRIS (Agenzia per ricerca in agricoltura)</i> - <i>ISTAT (National Institute of Statistic)</i>



- *CONSIP S.p.a.*
- B. Regional agencies:**
 - *AREA - Azienda Regionale per l'Edilizia Abitativa*
 - *AREUS - Azienda Regionale Emergenza Urgenza Sardegna Argea Sardegna*
 - *ARPA-Regional Environmental Protection Agency. Area Tecnico Scientifica-Servizio Controlli, monitoraggi e valutazione.*
 - *ARPA-Regional Environmental Protection Agency: departments of each district (Province)*
 - *ARST S.p.A. (Azienda Regionale Sarda Trasporti S.p.A.)*
 - *A.S.P.O. S.p.A. (Azienda Servizi Pubblici Olbia S.p.A.) Abbanoa S.p.a.*
 - *ARST S.p.A. (Azienda Regionale Sarda Trasporti S.p.A.)*
- C. Sardinia Region offices:**
 - *Presidenza della Regione - Direzione generale - Servizio statistica regionale ed elettorale*
 - *Assessorato degli Enti Locali, Finanze e Urbanistica*
 - *Assessorato dei Trasporti*
 - *Assessorato della Difesa dell'Ambiente*
 - *Assessorato della Programmazione - Centro Regionale di Programmazione*
 - *Assessorato della pubblica istruzione, beni culturali, informazione, spettacolo e sport*
 - *Assessorato dell'Agricoltura e Riforma Pastorale*
 - *Assessorato dell'Industria - Servizio attività estrattive e recupero ambientale*
 - *Assessorato dell'Industria - Servizio semplificazione amministrativa per le imprese, coordinamento sportelli unici, affari generali*
- D. Regional public authorities/bodies:**
 - *Provincia Del Sud Sardegna - Area dei Servizi Ambientali*
 - *Provincia di Nuoro -Settore Urbanistica Trasporti Energia*
 - *Provincia di Oristano -Settore Ambiente e Suolo*
 - *Provincia di Sassari - Settore Ambiente*
 - *Città Metropolitana di Cagliari - Settore Ecologia*
 - *Consorzio BIM Taloro*
 - *Consorzio del Bacino Imbrifero Montano del Flumendosa Consorzio di Bonifica del Basso Sulcis*
 - *Corpo Forestale e di Vigilanza Ambientale*
 - *Corpo Nazionale dei Vigili del Fuoco Direzione Regionale Sardegna*
 - *CRENOS (Centro Ricerche Economiche Nord Sud)*
 - *Direzione Marittima di Olbia*
 - *ENAS (Ente Acque della Sardegna)*
 - *LAORE (Agenzia per l'attuazione dei programmi regionali in campo agricolo e per lo sviluppo rurale)*
 - *Parco Naturale Regionale di Porto Conte*
 - *Parco Geominerario Storico e Ambientale della Sardegna*
 - *Parco nazionale dell'Arcipelago di La Maddalena*

	<ul style="list-style-type: none"> - <i>Parco Nazionale dell'Asinara</i> - <i>Parco naturale regionale di Tepilora, Sant'Anna e Rio Posada</i> - <i>Parco naturale regionale Molentargius – Saline</i> <p>E. Regional Academic bodies:</p> <ul style="list-style-type: none"> - <i>ISFORT - Istituto Superiore di Formazione e Ricerca per i Trasporti</i> - <i>ISRE- Istituto Superiore Regionale Etnografico</i> - <i>JRC- Joint Research Centre</i> - <i>Università degli Studi di Cagliari</i> - <i>Università degli Studi di Sassari</i>
Dimension 2	<p>Power Generation Companies</p> <p><i>In Sardinia there are the following energy (electricity and gas) distributors (companies operating in all provinces):</i></p> <ul style="list-style-type: none"> - <i>electricity E-Distribution S.p.A. for all the provinces.</i> - <i>ALPERIA SMART SERVICES SRL Via Dodiciville 8 - Bolzano/Bozen (Bolzano/Bozen); authority@alperia.eu</i> - <i>AXPO ITALIA S.P.A. Vi; IV Novembre 149 - Roma (Roma) http://www.axpo.com</i> - <i>A2A ENERGIA S.P.A. Via corso di Porta Vittoria 4 - Milano (Milano) segreteria.ad.aen@a2a.eu</i> - <i>IREN MERCATO SPA Via S. Giacomo e Filippo 7 - Genova (Genova); gianluca.bufo@irenmercato.it</i> - <i>EDISON ENERGIA S.P.A. Foro Buonaparte 31 - Milano (Milano); edisonenergia@pec.edison.it</i> - <i>ERG POWER GENERATION S.P.A. Via DE MARINI 1 - Genova (Genova); autoritaenergia@erg.eu</i>
Dimension 3	<p>Energy service companies</p> <ul style="list-style-type: none"> - <i>EDISON ENERGIA S.P.A., Foro Buonaparte 31 - Milano (Milano) edisonenergia@pec.edison.it</i> - <i>E.JA Via Zara 11 - Cagliari (Cagliari); amministrazione@ejaenergia.it</i> - <i>ENEL ENERGIA S.P.A. Viale Regina Margherita 125 - Roma (Roma) http://www.enelenergia.it</i> - <i>ENERG.IT S.P.A. Via Edward Jenner 19/21 - Cagliari (Cagliari) amministrazione@energ.it</i> - <i>ENI PLENITUDE S.P.A. SOCIETÀ BENEFIT Centro Direzionale PIAZZA EZIO VANONI 1 - San Donato Milanese (Milano); eniplenitude@pec.eniplenitude.com</i> - <i>E.ON ENERGIA S.P.A. Via Dell'Unione 1 - Milano (Milano); eonenergia@legalmail.it</i> - <i>HERA COMM S.P.A. Via Molino Rosso 8 - Imola (Bologna), http://www.gruppohera.it/</i> - <i>ILLUMIA SPA Via De' Carracci 69/2 - Bologna (Bologna) alex.giozzi@illumia.it</i>

	<ul style="list-style-type: none"> - <i>SHERDEN ENERGIA SRL Via Renzo Frau 10 - Cagliari (Cagliari); info@sherdenenergia.it</i>
Dimension 4	<p>Citizen's typologies</p> <ul style="list-style-type: none"> - <i>residents</i> - <i>seasonals (1-3 months residence)</i> - <i>tourists (less than 1 week permanence)</i>
Dimension 5	<p>Active organizations or entities</p> <p>A. National companies:</p> <ul style="list-style-type: none"> - <i>TERNA S.p.A</i> - <i>Trenitalia S.p.A.</i> <p>B. Regional companies:</p> <ul style="list-style-type: none"> - <i>GEASAR S.p.A. (Società di Gestione ed all'Aeroporto di Olbia Costa Smeralda S.p.A.)</i> - <i>Porto Conte Ricerche S.r.l.</i> - <i>CTM S.p.A. (Consorzio Trasporti e Mobilità S.p.A.)</i> <p>C. Consortia active at regional level:</p> <ul style="list-style-type: none"> - <i>Consorzio BIM Taloro</i> - <i>Consorzio del Bacino Imbrifero Montano del Flumendosa Consorzio di Bonifica del Basso Sulcis</i> - <i>Consorzio di Bonifica del Cixerri</i> - <i>Consorzio Di Bonifica Del Nord Sardegna</i> - <i>Consorzio di Bonifica della Gallura</i> - <i>Consorzio di Bonifica della Nurra – Sassari</i> - <i>Consorzio di Bonifica della Sardegna Centrale</i> - <i>Consorzio di Bonifica della Sardegna Meridionale Consorzio di Bonifica dell'Oristanese</i> - <i>Consorzio di Bonifica d'Ogliastra</i> - <i>Consorzio Zona Industriale di Interesse regionale di Chilivani Consorzio Industriale Provinciale Carbonia Iglesias</i> - <i>Consorzio Industriale Provinciale di Cagliari</i> - <i>Consorzio Industriale Provinciale Nord Est Gallura</i> - <i>Consorzio Provinciale Industriale di Nuoro Consorzio Provinciale Industriale di Oristano Consorzio Provinciale Industriale di Sassari</i> - <i>Consorzio ZIR Macomer</i> - <i>Consorzio Provinciale Industriale Villacidro- Villaservice</i>

Table 16. Stakeholder identification for the ET of the island of Sardinia

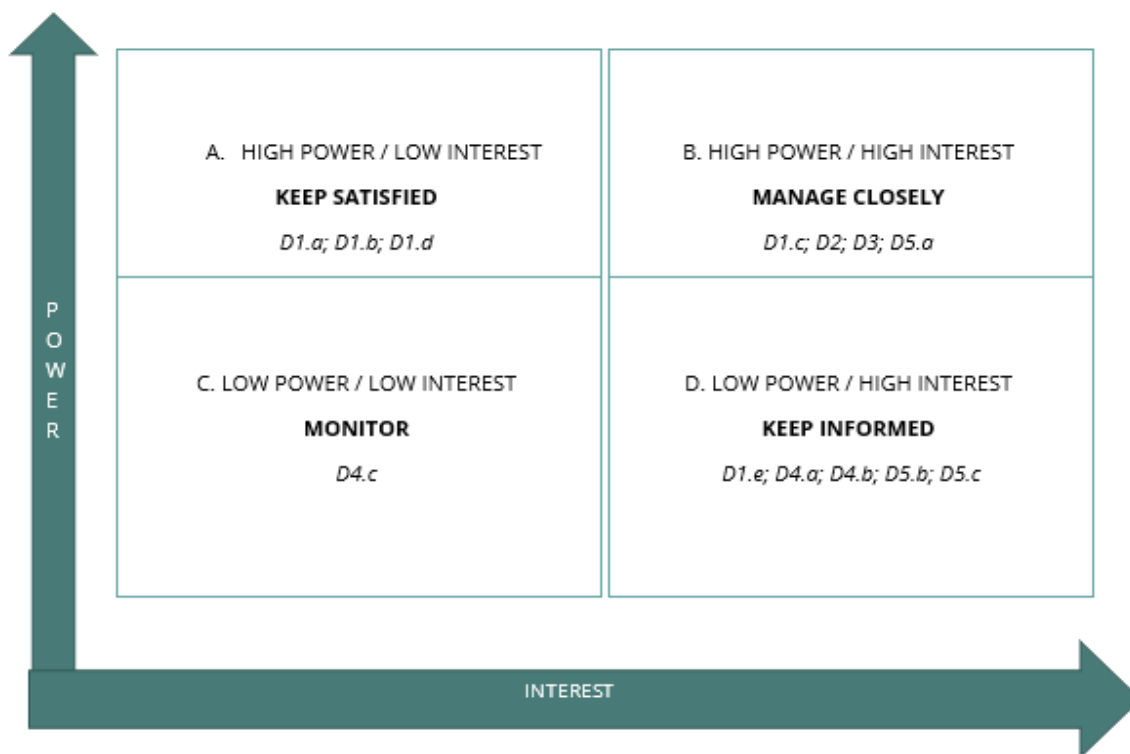


Figure 5. Power-interest matrix for Sardinia stakeholders

➤ **Best Practices**

BEST PRACTICES IMPLEMENTED IN SARDINIA
<p>ELECTRICITY</p> <p>As far as run-of-river hydroelectric power plants in Sardinia are concerned, in the GSE table we find Dorgali and its dam on the Cedrino river at Pedra 'e Othoni. Its installed capacity is 3.8 MW and its flow rate is 9 cubic metres per second.³ Dec. 2021</p> <p>Currently, the region has 38,903 residential photovoltaic plants with a total capacity of 230 MW.⁵ (5 May 2023)</p>
<p>TRANSPORT</p> <p>According to the DESTI-SMART project, the following actions were implemented:</p> <p>Charging stations for electric vehicles. Agreement of the Memorandum of Understanding between the Region of Sardinia, the municipalities in whose territories the charging stations will be built and the private operator that will implement the regional recharging infrastructure. Implementation of 32 fast charging stations along the main regional roads.</p> <p>Implementation of the Regional Cycling Mobility Plan. The first cycle path implemented was the section Alghero-Porto Torres-Sassar, and the second started from Cagliari and arrives to Barumini (South Sardinia).</p>

Table 17. Best practices implemented in Sardinia

4.3 Study of the Greek islands: South Aegean Region

4.3.1 National Policies and Regulatory Framework

Greece is located in south-eastern Europe, at the confluence of three continents: Asia, Africa and Europe. It has more than 2,000 islands, of which about 170 are inhabited; some of the easternmost Aegean islands lie within a few miles of the Turkish coast, and a coastline some 15,021 km long; mountains and sea are the dominant features of Greek space. All this means that Greece's Mediterranean climate is subject to a number of regional and local variations based on the country's physical diversity.

In terms of available resources, fossil fuels are scarce, although at the beginning of the 21st century Greece's electricity needs were practically covered by fossil fuels (mainly lignite-fired power plants) and a small part by hydropower. Later advances have been made with solar and wind power.

Greece's first National Sustainable Development Strategy was adopted in 2002, and a second version was prepared in 2007 in line with the European Renewed Strategy for Sustainable Development. After overcoming the deep economic crisis during the last decade, the adoption of the SDGs in 2015 and the implementation of the 2030 Agenda for Sustainable Development provide an ambitious and transformative framework for just and sustainable development. The main objective is to ensure a balance between economic growth, social cohesion and justice, as well as the protection of the environment and the country's unique ecological wealth [65]. Later, in May 2018, Greece adopted a National Growth Strategy, which has been updated in May 2019 as "National Strategy for Sustainable and Fair Growth 2030" fully aligned with Strategy 2030.

The National Recovery and Resilience Plan (NRRP) "Greece 2.0" [66] fully meets the EU objectives for an accelerated ecological transition and the digital transformation of the economy. Its main pillars include achieving a green transition through the interconnection of the Greek islands with the land to enhance the potential of renewable energy sources, grid distribution in urban and rural areas, creating an action plan to tackle energy poverty or creating infrastructures for electric vehicles among others.

In addition, the National Energy and Climate Plan (PNEC), adopted in 2019, is the main document setting energy and climate policy through 2030 and includes targets and supporting measures to put the country on a path to net-zero emissions. In this regard, the National Climate Law adopted in May 2022, set targets to reduce total GHG emissions by 55% by 2030, 80% by 2040 and reach net zero emissions by 2050 [67].

Below is part of the regulatory framework in the different aspects of Greece:

REGULATORY FRAMEWORK IN GREECE	
NAME OR REFERENCE	DESCRIPTION
Renewable energy support (RES)	<p>One of the most crucial distinctions with regard to RES in Greece is between mainland grid and interconnected islands and non-interconnected islands. This differentiation is crucial as it affects the type and level of support, for which RES plants are eligible.</p> <p>Generally available support schemes, whose details are provided in the Regulatory inventory, are:</p> <ul style="list-style-type: none"> • Subsidies are offered to small hydro power plants, CHP plants, hybrid plants and other RES only for autonomous production (RES E) as well as for geothermal, aerothermal heat pumps and biomass (pellets), solar thermal technologies, solar water heaters and solar heating (RES H&C). • Tax relief is offered to small hydro power plants, CHP plants, hybrid plants and other RES only for autonomous production. • Feed-in tariff - RES plants below 400 kW on interconnected islands and all RES on non-interconnected islands are eligible for a Feed-In Tariff. • Premium tariff (Feed-In Premium) - RES and CHP plants on interconnected islands participate in the electricity market and may be awarded with a sliding feed-in premium. • “Virtual net-metering” is available for city/regional councils, schools, universities, farmers, farming associations and Energy Communities. • Subsidy for purchase of EVs (GO ELECTRIC) by different categories (natural persons, enterprises, taxi owners) and subsidy for installation of EV chargers for natural persons. • The production of biofuels is eligible for subsidy or tax relief. A biofuel quota scheme is in place. However, it is not applicable to islands (both interconnected and non-interconnected).
Grid-related policies	<ul style="list-style-type: none"> • RES are prioritised in the electricity network, while there are curtailment provisions for interconnected wind power plants. • ADMIE (TSO) and HEDNO (DSO) are primarily the responsible authorities for the grid procedure. There is one distribution system operator (HEDNO). • The country has a smart meter penetration rate of 2.6%. • The electricity supplier switching rates for household customers in 2018 was 4.5%.
Energy efficiency policies (EE)	<ul style="list-style-type: none"> • Energy efficiency measures are promoted/supported for refurbishment of buildings for citizens, for replacement of public lighting for public authorities and for improvement of energy efficiency in industry.
Community energy policies	<p>Greece introduced the concept of energy communities into its legislation in 2018. Energy communities can benefit from special provisions such as participating in the EU projects, owning RES plants and operating virtual net-metering. The legislation has been undergoing revision since 2021.</p> <ul style="list-style-type: none"> • To this date, the concept of prosumer is not legally defined. However, the concept of autonomous producer bears many similarities with the

	<p>notion of prosumer. The net-metering scheme can be used by the autonomous producers that use following technologies: PV, small wind turbines, biogas, biomass/bioliquids, CHP, and small hydroelectric stations. Moreover, all RES technologies used by autonomous producers for self-consumption can receive subsidies.</p>
Other clean energy supporting policies	<ul style="list-style-type: none"> • Greece established Private Vocational Training Centers, which can offer specific seminars for the accreditation of RES installers. Apart from that, universities offer within their curriculum specific training courses on RES. Public sector authorities are supported by an “Electra Fund” in implementing energy efficiency measures.
Relevant energy sector authorities	<ul style="list-style-type: none"> • Ministry for environment and energy • Ministry for shipping and island policy • Regulatory Authority for Energy (RAE) • Hellenic Energy Exchange S.A. (HEEx) • Administrator of Renewable Energy Sources and Guarantees of Origin (DAPEEP S.A.) • Hellenic Electricity Distribution Network Operator S.A. (HEDNO) • Independent Electricity Transmission Operator S.A.(ADMIE)

Table 18. Regulatory Framework In Greece

4.3.2 National Barriers toward an energy transition approach

Based on the Clean Energy Transition initiative which studied the current regulatory framework and as a result of a consultative process (surveys, interviews and joint meetings), the most important regulatory barriers to a clean ET on Greek islands were identified [68], and are ranked by order of priority in the following table:

REGULATORY BARRIERS - Case: GREECE	
Barrier 1	Lack of clear strategy for energy transition on the islands, lack of coordination and monitoring of implementation
Barrier 2	Lack of island specific energy planning and integration with spatial planning
Barrier 3	Complex and long permitting procedures for RES projects
Barrier 4	Lack of clarity regarding short and mid-term actions to allow clean energy transition and ensure security of supply on the islands
Barrier 5	Bureaucracy and administrative burden for the community energy initiatives
Barrier 6	Clean energy project subsidies equalise interconnected islands and mainland
Barrier 7	The regulated price for electricity generation in non-interconnected islands hinders clean energy transition

Table 19. Regulatory Barriers in Greece

4.3.3 Regional ET case study: South Aegean Region

In the case of Greece, the study is carried out in the South Aegean region since the pilots in Greece will be led by the Development Agency of South Aegean Region, which hosts a population of more than 300,000 people. The South Aegean Region (EL42) is one of the thirteen Regions of Greece (NUTS II) and an EU Transition Region. It is divided in 13 Regional Units comprising a total of 33 Municipalities, essentially encompassing the territory that had in the past consisted of the Prefectural Departments of the Cyclades and the Dodecanese.

The historical, cultural and natural environment as well as the insular landscape of the Aegean led to the formation of its distinct place identity, either as a global touristic destination (Santorini, Mykonos and Rhodes are some of the widely popular islands), or the wild insular beauty of the Aegean (micro insular space of the Cyclades), or/and the Greek maritime borders to the East (Kos-Rhodes).

➤ Current status

The Region consists of island municipalities which exhibit very diverse geographical, economic and social characteristics, ranging from urban centres, like the city of Rhodes (with 100,000 inhabitants), to small islands consisting primarily of rural populations. Most islands in the region are very touristic thus making ET a big challenge; therefore, a 2-step “status” analysis is needed when selecting the three case studies that will be included in the pilot area of the insular and cross border South Aegean Region.

A. The reference to the 1st step is the “energy transition status”: there are 2- speed islands on board of ET, the first are the islands that there is any measure on ET and the others are the islands where initiatives such as measures towards energy sustainability, waste management and other climate change relevant interventions have been attempted, albeit in a sporadic manner (for example the energy- autonomous island of Nisyros, the renewable energy generation farms in Tilos, providing the excess of the produced energy to neighbouring islands, in Chalki and Astypalea).

B. The reference to the 2nd step is the analysis of the “island ecosystem “status” on geographical, economic and social characteristics defining the difference between urban population in big island cities and rural population in micro insular space of small island groups.

➤ Current plans for ET

Due to its particularities, the South Aegean Region and its associated development agencies have managed a number of projects and are highly involved in different initiatives. Many of these projects belong to the Interreg Europe program, for example Sustainable Tourism in Fragile Territories – SHIFT (MED) or Sustainable Construction in Rural and fragile areas for Energy efficiency –SCORE (MED) among others.

Regarding the plans developed for the islands, this region is strongly involved in the Clean Energy for EU islands initiative, and several islands have developed their CETAs such as the islands of Andros, Chalki, Kassos, Kos, Sifnos, Symi, Syros or Tilos among others.

Focusing on the development of local plans, different municipalities belonging to islands in the South Aegean region are involved in the Covenant of Mayors. This means that this region is strongly committed to ET and decarbonization. Some of the plans analyzed are those of the municipalities of Nisyros, Oia, Poseidonia, Milos, Korthi, Kéa, Iraklia, Ios, Halki, Leros, Lipsi or Tilos. The main actions proposed in this region are classified as short or long term. In the short term, those related to the energy consumption of buildings, installation of panels, use of bicycles and electric vehicles are considered. In the long term, other measures are considered that mobilize a major budget, such as local energy generation, promotion of smart grids with the use of smart meters, electric charging points, development of energy control centres, etc. Other actions of interest include:

- A special case is the island of Kassos, whose energy situation is complicated due to lack of efficiency, high dependence and frequent blackouts. First of all the inhabitants themselves are committed to a change of behaviour, and stakeholders together with the support of European funding are providing technical support for the improvement of the island's technologies and buildings.
- The case of Halki is of special interest for the project, being one of the smallest inhabited islands in the Dodecanese. This municipality started electrifying transport and building photovoltaic plants for the use of its inhabitants.
- Finally, another case of interest is that of Sifnos, a highly touristic island with large variations in population. Its high dependence on fossil fuels and the difficulty to transport it created the need to install technologies to make use of renewable energies and try to become a 100% renewable self-sufficient municipality. In this case, the cooperative on the island of Sifnos had a great influence.

➤ Stakeholder mapping

SOUTH AEGEAN REGION STAKEHOLDER MAPPING	
Dimension 1	<p>Local councils and public bodies</p> <ul style="list-style-type: none"> - MUNICIPALITY OF HALKIS - FODSA - South Aegean Region - South Aegean Region – Technical Departments of Dodecanese and Cyclades - MUNICIPALITY OF ASTYPALAIIA - MUNICIPALITY OF TILOS - MUNICIPALITY OF KARPATHOU

Dimension 2	<p>Power Generation Companies</p> <ul style="list-style-type: none"> - PPC Renewables S.A <ol style="list-style-type: none"> 1. PPC Renewable-C.ROKAS S.A.I.C. - 52.7% of C.ROKAS is now owned by Iberdrola (see below). 2. PPC Renewable-TERNA Energy S.A. - In cooperation with TERNA S.A. (GEK Group) (see below). 3. PPC Renewable-DIEKAT Energy S.A. 4. PPC Renewable-MEK Energy S.A. - PPC RHODES S.A. (ex KOZEN HELLAS S.A.) - PPC CRETE S.A
Dimension 3	<p>Energy service companies</p> <ul style="list-style-type: none"> - PPC Renewables S.A <ol style="list-style-type: none"> 1. PPC Renewable-C.ROKAS S.A.I.C. - 52.7% of C.ROKAS is now owned by Iberdrola (see below). 2. PPC Renewable-TERNA Energy S.A. - In cooperation with TERNA S.A. (GEK Group) (see below). 3. PPC Renewable-DIEKAT Energy S.A. 4. PPC Renewable-MEK Energy S.A. - PPC RHODES S.A. (ex KOZEN HELLAS S.A.) - PPC CRETE S.A
Dimension 4	<p>Citizens typologies</p> <ul style="list-style-type: none"> - <i>Permanent Citizens: Residents, community Organizations, Neighbourhood Associations</i> - <i>Stationary citizens</i> - <i>Seasonal Citizens</i> <i>Tourists</i>
Dimension 5	<p>Active organizations or entities</p> <ol style="list-style-type: none"> 1.Sustainable Islands Network – DAPHNI” 2. “Ilektron” Our energy community aims to wean the energy of the South Aegean islands from the burning of hydrocarbons. Production required energy from renewable sources and to export the excess energy outside our region. We intend to make this activity profitable for society and investors because both forces are needed to make our vision possible. https://ilektron.gr

Table 20. Stakeholder identification for the ET of the island of South Aegean Region

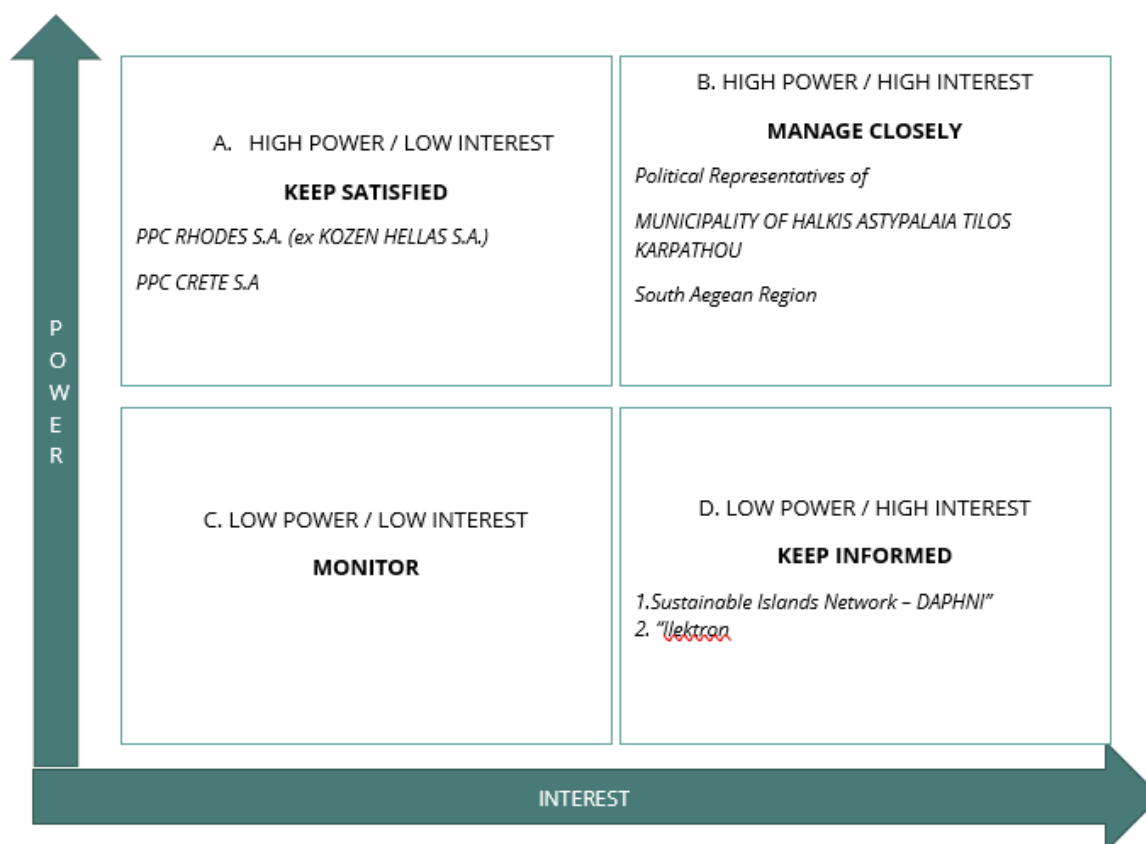


Figure 6. Power-interest matrix for South Aegean Region stakeholders

➤ Best Practices

BEST PRACTICES IMPLEMENTED IN SOUTH AEGEAN REGION	
ENERGY EFFICIENCY	
Enhancing the energy efficiency of public buildings", for the submission of proposals for inclusion and funding, from the Priority Axis "Sustainable development and resource management", of the Operational Program "South Aegean", which is co-financed by the European Regional Development Fund. This initiative implemented horizontal in all islands of the South Aegean Region.	
ELECTRICITY	
<ul style="list-style-type: none"> – 1 MWp photovoltaic system that will fully cover the needs of the residents who will participate through the recently established ChalkiON. https://clean-energy-islands.ec.europa.eu/countries/greece/chalki – "Supply of new generation benches for the Ports of Rhodes" upgrade the equipment of the electronic services from solar energy and the aesthetic improvement of the spaces in the centre of Rhodes. 	



<p>https://www.rodiki.gr/article/420863/topotheththhkan-ta-prwta-exypna-pagkakiasth-rodoto-apo-to-dhmotiko-limeniko-tameio</p> <ul style="list-style-type: none"> - Energy efficiency in public lighting and public buildings ELENA Project Factsheet Improving Energy Efficiency in the Region of South Aegean. https://www.eib.org/attachments/documents/project-factsheet-improving-energy-efficiency-in-the-region-of-south-aegean.pdf
TRANSPORT
<ul style="list-style-type: none"> - Public transport with electric vehicles in Astypalaia (https://e-astypalea.gov.gr) - Public transport with electric vehicles in Chalki. - Electric ferries and boats, hydrogen (maritime and road transport). - Public transport with electric vehicles in medieval town of Rhodes.
SMART GRIDS
Smart (digital) meters, Energy Management System, Demand-Side Management, Cybersecurity.
STORAGE
Electric Vehicle Charging Stations, Rhodes Municipality.

Table 21. Best practices implemented in South Aegean Region

4.4 Comparative study

Different studies have been carried out by means of questionnaires to different target groups: **citizens** and **public authorities**.

The structured questionnaire is one of the main instruments for gathering survey data and will be used to establish a structured, organized, and well-documented way of collecting evidence based on personal opinions and views on the energy transition on touristic islands. The questionnaires were created by UPV and were structured in a clear and simple manner to encourage participation and facilitate communication with target groups. The original English version of the questionnaires is attached as Annex I

The objective of the comparative study is to obtain the state of ET in the different regions that make up the consortium. For this purpose, the information collected from the surveys of public authorities and citizens will be analysed. In addition, through the research study carried out in the rest of the document, an integrative view of the regulatory framework, actors involved in ET, existing plans and initiatives and barriers in each of the regions will be obtained, all of this backed up by the surveys and interviews.

4.4.1 Citizen's questionnaire results

This section presents the data collected via the online questionnaire and summarizes the outcomes of the field research data collected in different islands of Italy, Greece, and Spain. The data has been analysed collectively in order to obtain aggregate results presented in graphical format, while taking into consideration all available contributions.

The aim of the citizens questionnaire is to analyse the knowledge and awareness about energy transition of citizens, whether they are residents or tourists of Mediterranean tourist islands. A total of **175 responses** were obtained from different countries (Italy, Greece, and Spain):

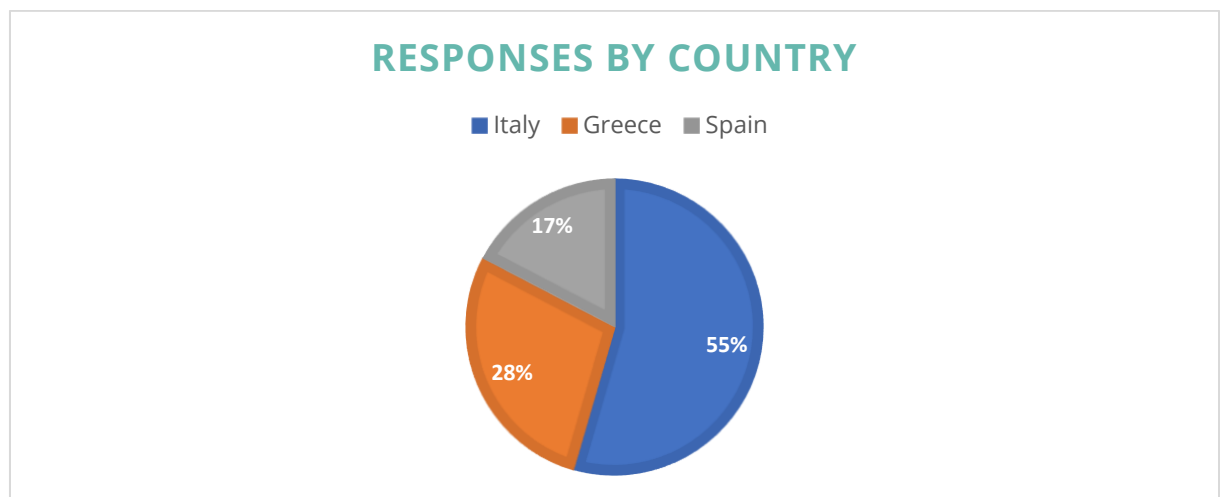


Figure 7. Citizen survey: participation by consortium countries (%)

As can be seen in the graph, the country with the highest participation was Italy (55%), followed by Greece (28%) and finally Spain (17%).

Of the aforementioned countries, these were the islands with the highest participation in the surveys:

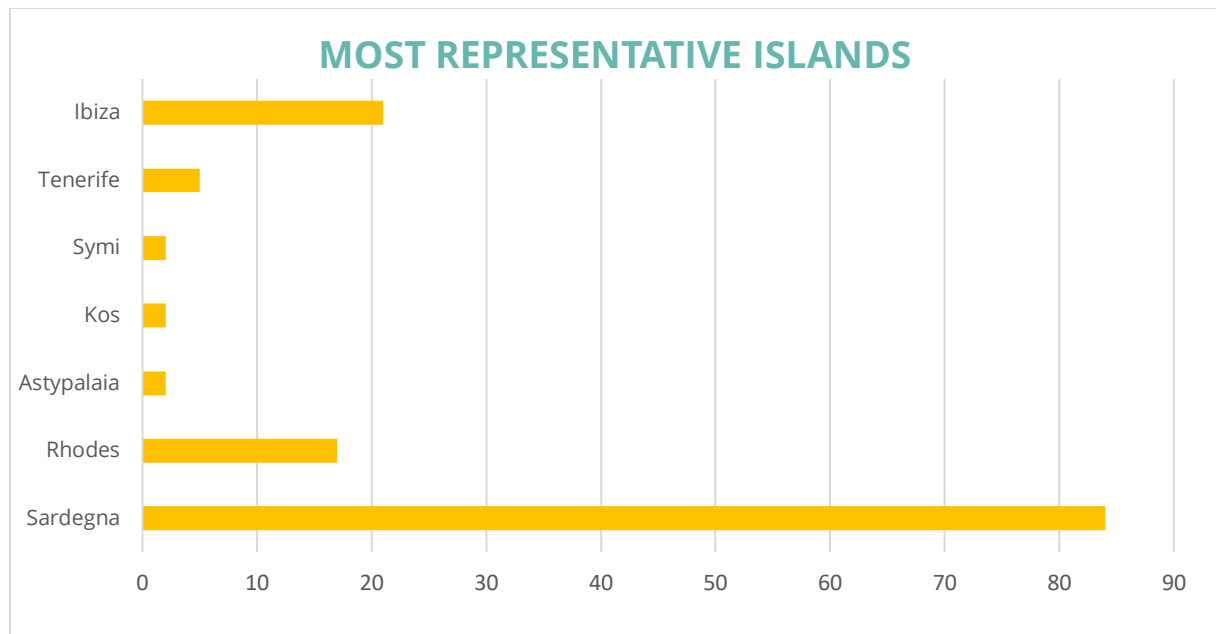


Figure 8. Citizen survey: most representative islands in the survey

As the figure above shows, Sardinia (Italy) had the highest representation of citizens, followed by Ibiza (Spain), Rhodes (Greece) and Tenerife (Spain). The great difference between Sardinia and the rest is since the first Seminar of the project was held on this island, which increased the participation in the survey.

➤ RESPONDENT'S PROFILE

In order to determine the respondent's profile, it was required to determine the type of citizen:

- **Tourist:** they only visit the island occasionally.
- **Seasonal:** they are frequent visitors to the island.
- **Permanent:** they are inhabitant of the island.

The most represented group were **permanent** with a total of 75% of respondents followed by **tourists** with a 17% of participation and **seasonal** with 8% of respondents.

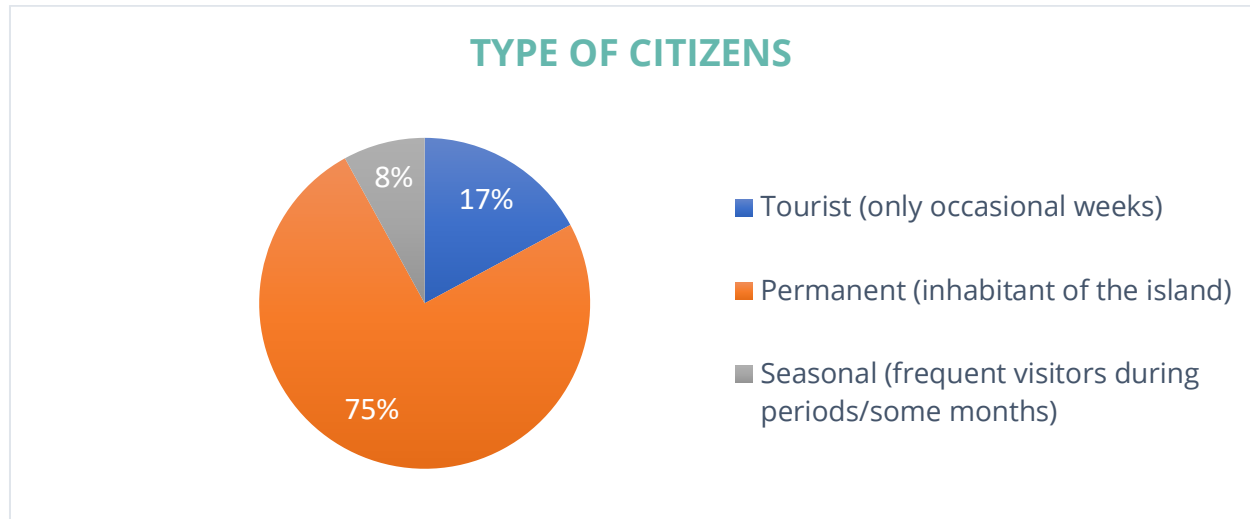


Figure 9. Citizen survey: type of citizens who participated in the survey (%)

In relation to the age of citizens, the most representative group is the 35-45 age group, followed by the 45-55 age group and the 25-35 age group. This implies that the surveys will have a bias characteristic of this age range.

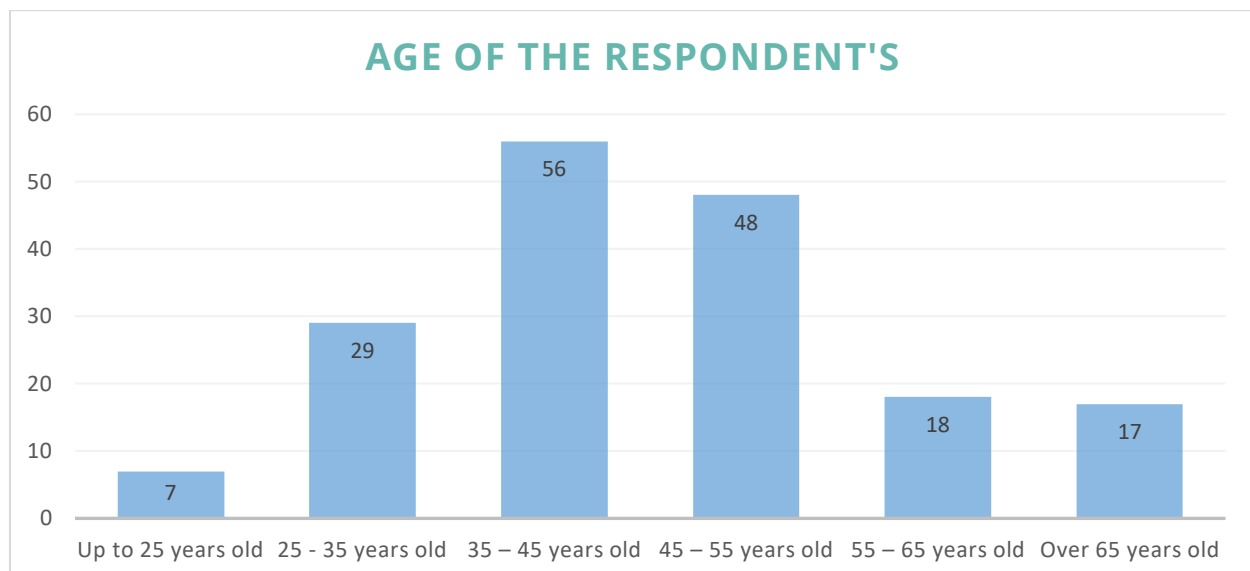


Figure 10. Citizen survey: distribution of survey participants by age

Finally, the level of education of the respondents was also considered, being:

- **Primary education:** population having completed at least 5 years of schooling, usually starting at age 5 or 6 and completed at age 11 or 12, not completing a higher level.
- **Secondary education:** secondary school graduate, school graduate, elementary high school graduate.
- **Upper secondary education:** technical diploma (intermediate vocational training), and equivalent qualifications.

- **Higher education:** bachelor's degree, higher technician (higher level training cycles), specialist technician (FPII) and equivalent or similar qualifications.
- **Post-graduate studies:** Master's or postgraduate degree, PhD studies (third cycle studies)

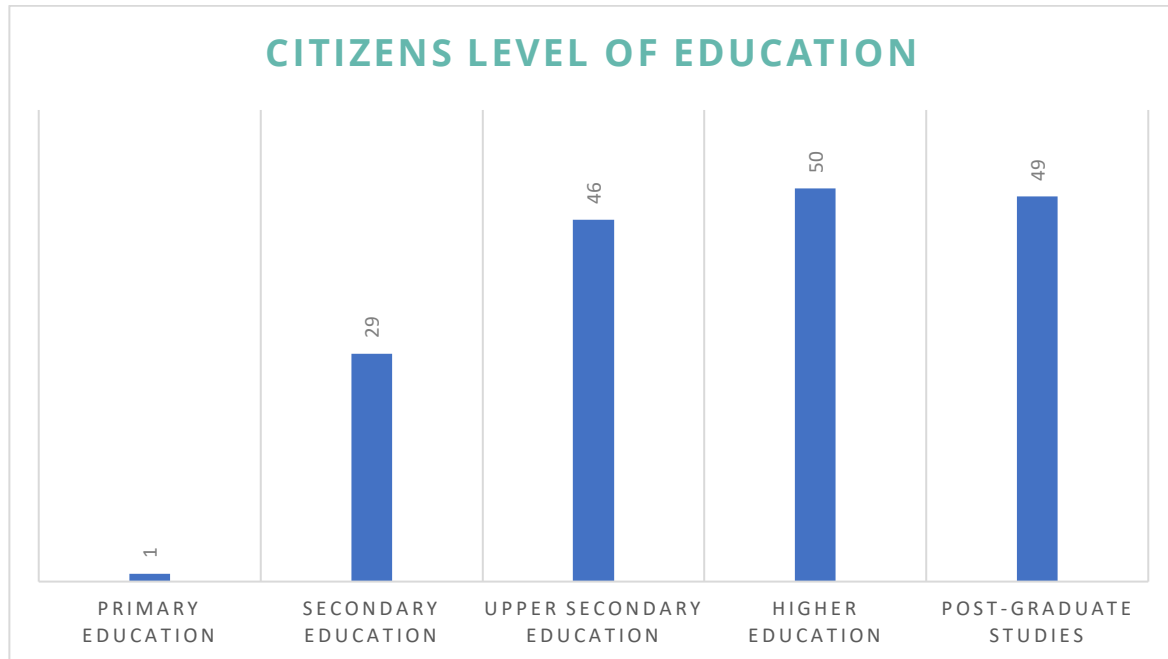


Figure 11. Citizen survey: distribution of participants according to defined levels of education

Hence, most of the citizens who participated have upper secondary education, higher education and postgraduate studies. This characteristic will also mark the answers obtained in the surveys.

➤ LEVEL OF AWARENESS

In this section of the questionnaire, respondents were asked to assess knowledge of the ET at a general level. The main objective of this section was to define the current knowledge available to citizens to cope with the ET, taking into account the characteristic bias marked in the section on the profile of the respondents. Seven key questions were asked to determine this level of citizens' knowledge:

1- Have you taken any courses related to energy transition, e.g., recycling, environmental, awareness raising, informative etc.?

This question covers, on the one hand, whether courses are currently being held to address ET at citizenship level and whether they are adequately disseminated. On the other hand, it shows whether society's sensitivity in this respect has been marked by official courses or not.

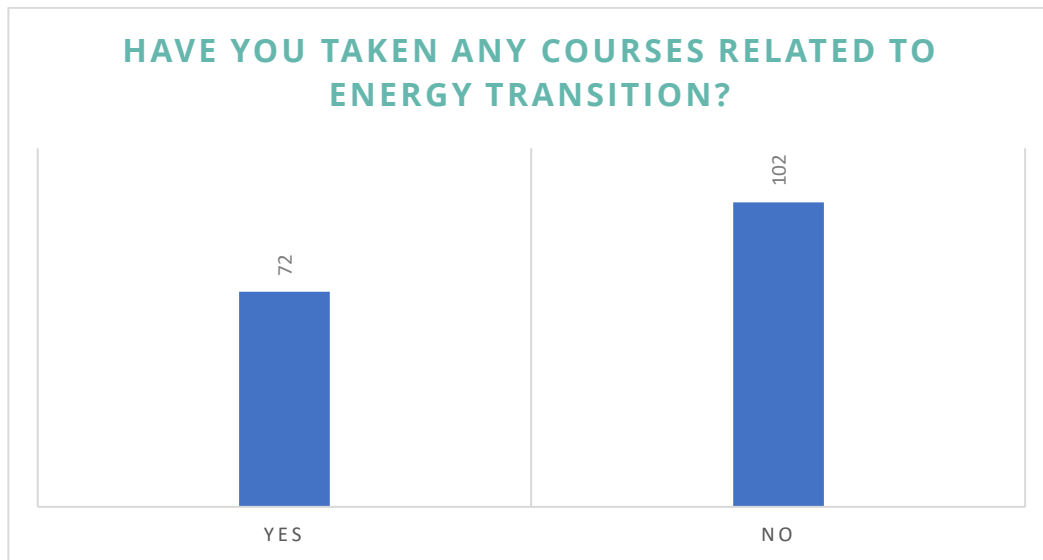


Figure 12. Citizen survey: Number of citizens who have received ET courses

As shown in the previous figure, most respondents **have not taken courses** related to the **ET**.

2- Do you think that living on an island is a risk factor for climate change?

This is a key issue for the GENERA project because, as discussed in previous sections of the document, islands have some particularities that make them more vulnerable to climate change and their level of adaptation and management.

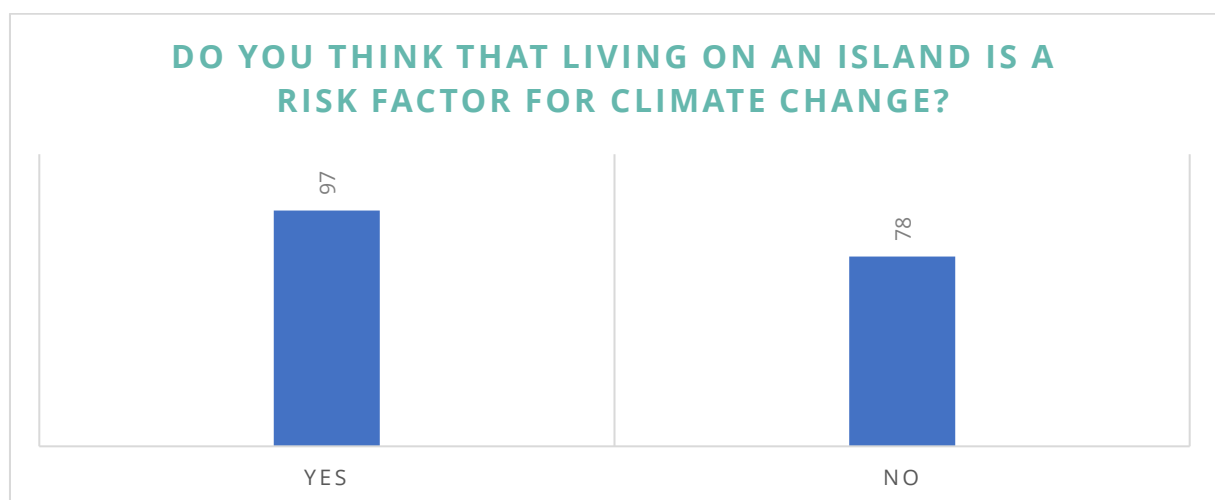


Figure 13. Citizen survey: Number of citizens who consider living on an island to be a risk factor for climate change

Most of the respondents think that living on an island **is a risk factor** for climate change. Over 45% consider islands to be equally vulnerable to climate change. This response may be influenced by a lack of information on climate change or ET, as well as other issues related to the level of development of the island or the opinion of individual citizens on the impact of climate change.

From this question it can be deduced that training to provide more information to citizens is necessary, either to further explain what it means to be a risk factor (energy implications of the island, impact on the marine environment and its economy etc.) or to raise awareness of climate change to a greater degree.

3- Do you know if the area where you live (or you are visiting as tourist) is energetically vulnerable to climate hazards?

The next question was whether citizens were aware of the vulnerability of the island they live on/visit to climate hazards.

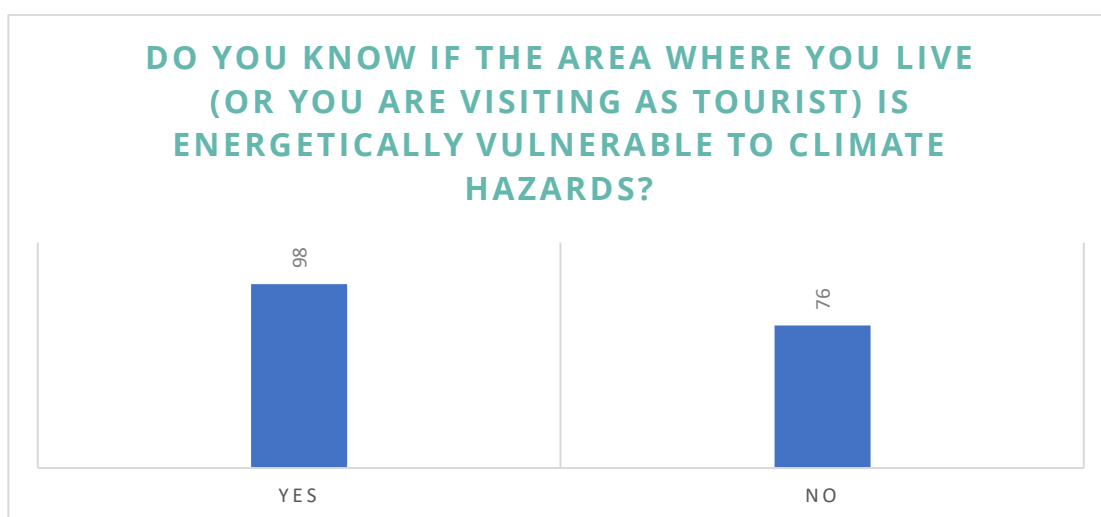


Figure 14. Citizen survey: Number of citizens aware of the island's energy vulnerability

Most of them **are aware** that the area where they live or visit as tourists is energetically vulnerable to climate hazards. This may be mainly due to the fact that the energy dependence of the islands is something very evident, that almost everyone knows about and is aware of some of the measures that are taken, since they involve a significant economic investment. However, about 44% of those surveyed are unaware of this, so there is still a great deal of work to be done to mitigate this.

4- Are you aware that there are EU initiatives at the municipal level to support municipalities in tackling climate change?

This question is raised with the aim of finding out how different initiatives, such as the Covenant of Mayors, are disseminated at the municipal level. Knowing what is being promoted and what support is provided gives an insight into the current needs and the degree of importance that municipalities have.

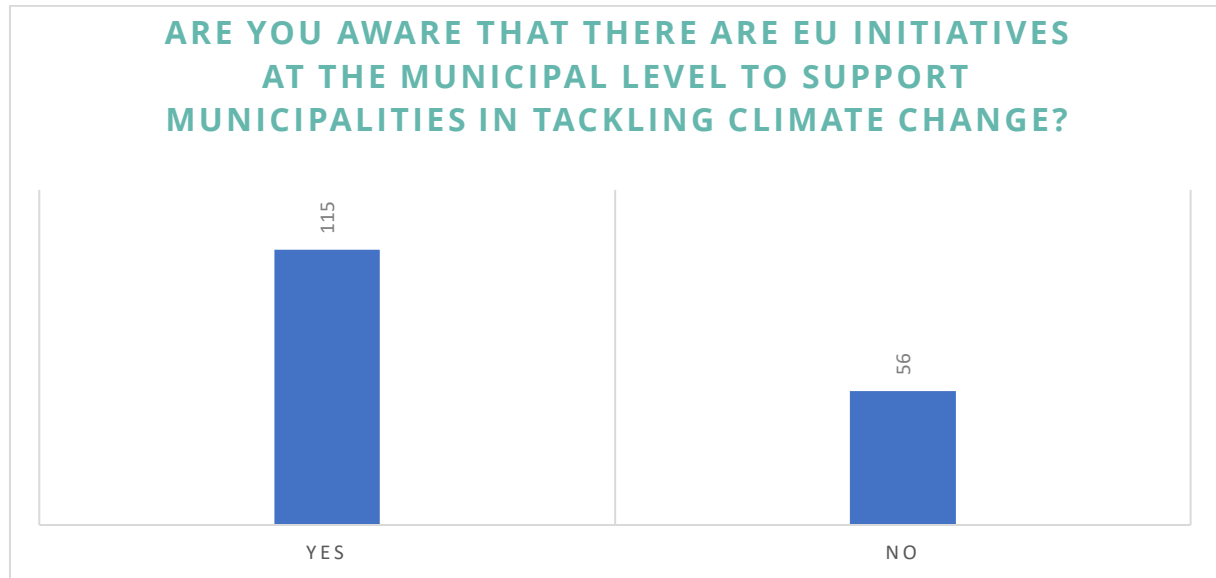


Figure 15. Citizen survey: Number of citizens aware of municipal initiatives to address climate change

Quite a few people **are aware** that there are initiatives at the municipal level to support municipalities in tackling climate change. This is a positive response, as there has been a good dissemination of these initiatives.

5- Do you know if your municipality/region where you live (or you are visiting as tourist) has an energy transition roadmap?

Developing an ET roadmap makes it possible to know what measures will be implemented now, or in the near future, and which sectors will be affected. This issue is also related to the previous question, as some initiatives such as the Covenant of Mayors or Clean Energy for EU islands involve the development of an action plan or CETA.

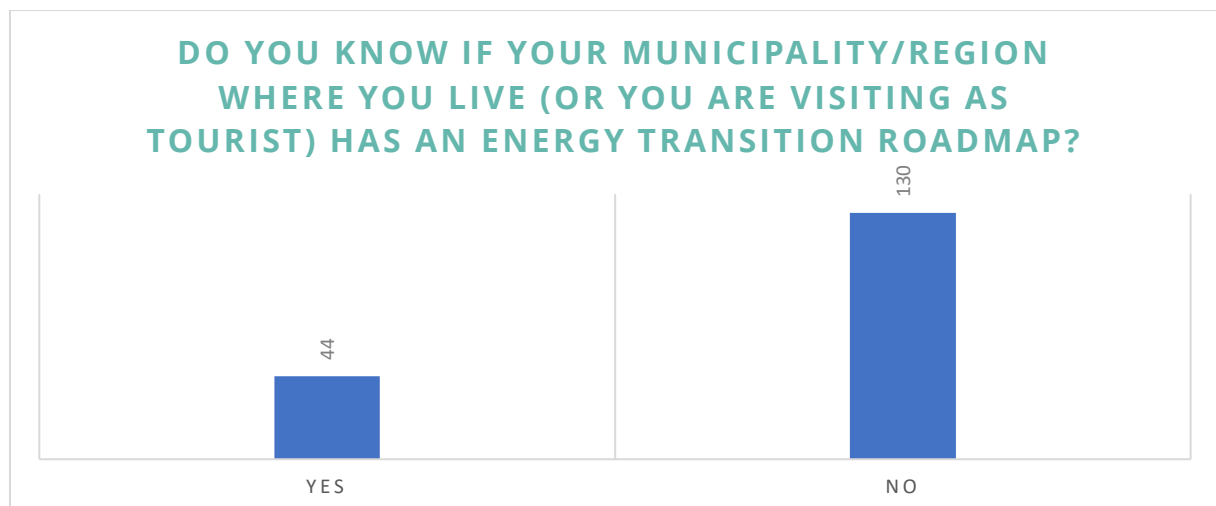


Figure 16. Citizen survey: Number of citizens who know whether the municipality in which they reside/visit has developed a roadmap for ET

The vast majority **are not aware** of whether the municipality/region has an energy transition roadmap. This answer contrasts with the previous answer, since most of respondents know that there are initiatives aimed at supporting municipalities, but in this question, it is evident that citizens are not aware of those that promote the creation of a roadmap. Furthermore, if the municipality is developing the roadmap itself, it is not communicated to the rest of the population, so it would be helpful to disseminate it more widely.

6- Do you think that measures that reduce CO₂ emissions increase your quality of life?

This question is rather complicated, as it does not specify which measures, but the main idea was to find out whether individual citizens believe that taking measures to reduce air pollution would improve their quality of life.

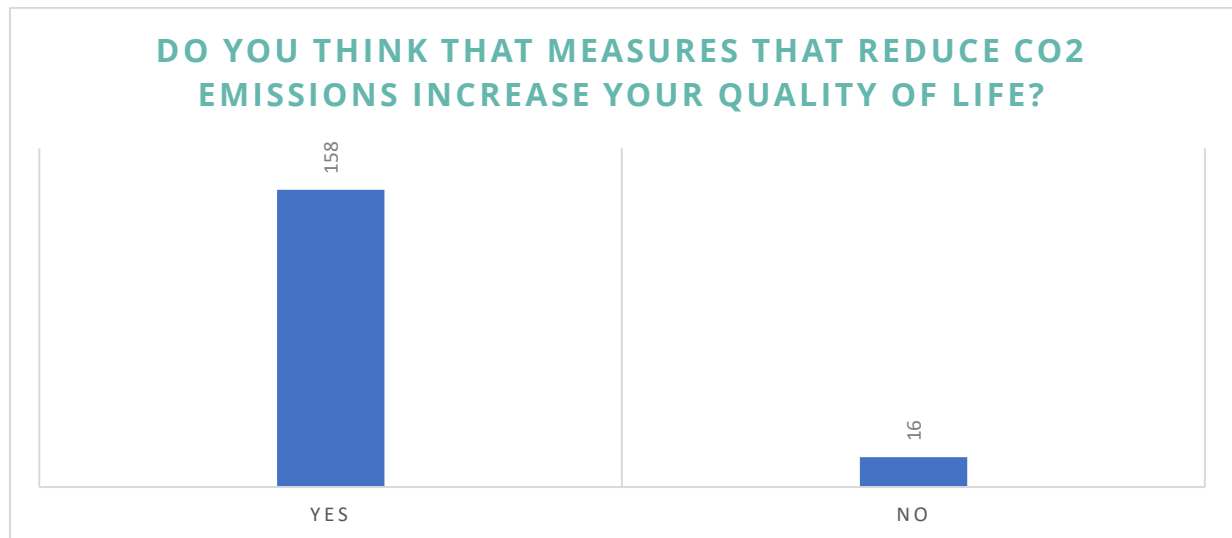


Figure 17. Citizen survey: Number of citizens who think that measures to reduce CO₂ emissions improve their quality of life

As shown in the figure, the vast majority **are aware** that measures that reduce CO₂ emissions increase their quality of life. This is a positive response, as it is a welcome response to different actions, both for the improvement of the environment and for the quality of life of citizens.

7- Are you willing to do actions in your daily life or when you travel (tourist) to reduce CO₂ emissions and tackle climate change?

Finally, the last question was addressed to citizens to find out their willingness to make changes in their daily lives to address climate change. The actions were not specified, so any action can be assumed (change of habits to use renewable energies, reduction of energy consumption, change of lighting, use of public transport, etc.).

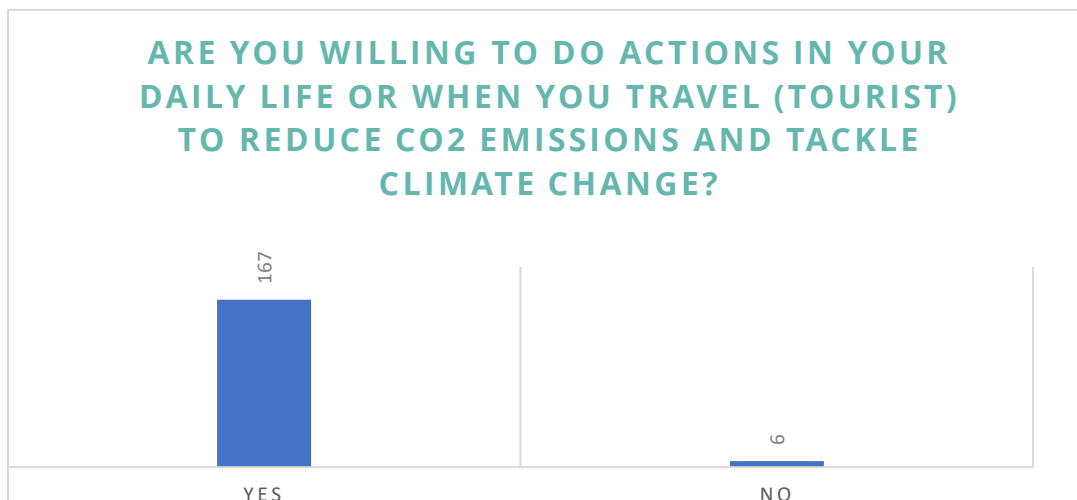


Figure 18. Citizen survey: Number of citizens predisposed to change habits to address climate change

Except for 6 respondents, **the rest all perform actions** to reduce CO₂ emissions and tackle climate change. This gives rise to a good opportunity for GENERA seminars and/or trainings on what kind of measures to carry out from the citizens' perspective in order to promote ET.

4.4.2 Public Authorities results

This section presents the data collected through surveys conducted with public authorities, mainly in municipalities located on touristic islands. To facilitate the collection of information, the questions were implemented in the form of a survey. This section summarizes the results obtained with the objective of providing an overview of the current state of ET in the different municipalities and to identify new opportunities.

A total of **30 responses** were obtained from different municipalities located in Spain, Greece and Italy. The country that is most represented in the results obtained from the surveys is Italy, mainly the municipality of Sardinia. Spain is also well represented and the municipalities are mainly located in Tenerife (Canary Islands) and Ibiza (Balearic Islands). Finally, responses have also been obtained from Greek island municipalities, as Kos.

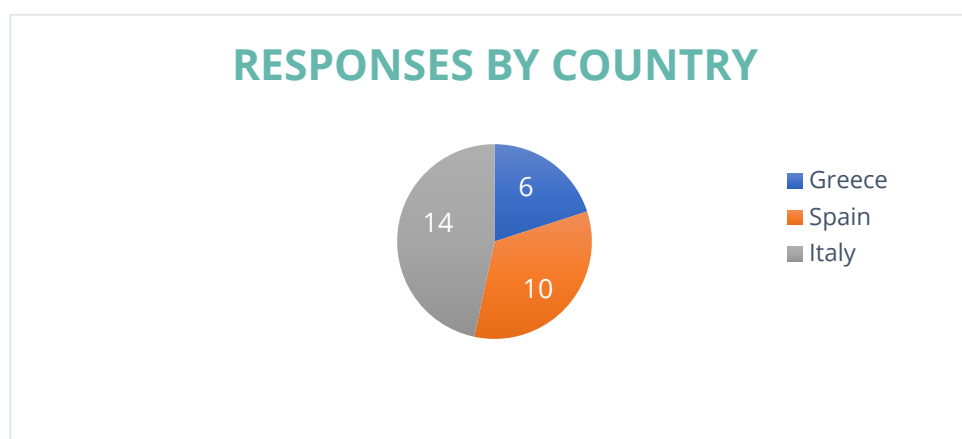


Figure 19. Public authorities' interviews: number of responses per country

The municipalities indicate through the survey that since they are touristic islands, the number of inhabitants increases considerably in the high season months. Hence, most municipalities see an increase in the number of inhabitants in the months of June, July and August and September.

The following are the results that respond to main **challenges** to be addressed to address ET at the municipal level, main **priorities** to address the above challenges, current and future **opportunities** and, finally, **barriers** that hinder progress towards sustainability.

➤ MAIN CHALLENGES

In relation to the challenges facing the municipality in addressing the ET, these are the ones that stand out the most:

MAIN CHALLENGES	
1	Limited financial resources and funding for the implementation of renewable energy projects and infrastructure
2	Lack of technical expertise and human resources in the field of renewable energy
3	Regulatory barriers and legal frameworks that may hinder the development of renewable energy projects
4	Dependence on fossil fuel-based energy sources, which may be deeply ingrained in the existing energy infrastructure and difficult to replace
5	Ensuring that the energy transition is socially inclusive and that vulnerable groups are not left behind in the process

Table 22. Main challenges to be addressed at the municipal level defined

➤ MAIN PRIORITIES

After reviewing the challenges faced by the municipalities, some priorities were proposed to address the aforementioned challenges, and these were the main ones selected:

MAIN PRIORITIES	
1	Developing and implementing comprehensive energy transition strategy, which includes clear targets, timelines, and measurable indicators of success
2	Reduce administrative work for the installation of photovoltaic energy in homes
3	Increasing investment in renewable energy projects, including the development of local renewable energy sources and the integration of inter-island renewable energy grids
4	Strengthening the capacity of local governments and institutions to plan, manage, and implement the energy transition effectively

Table 23. Main priorities to address current challenges.

➤ OPPORTUNITIES

Regarding the current/future opportunities that can be leveraged to address the energy transition in each municipality, these were the ones most frequently mentioned:

MAIN OPPORTUNITIES	
1	Abundant renewable energy sources such as solar, wind, and wave power, which can be harnessed to reduce dependence on imported fossil fuels
2	Introduce supportive policy frameworks and regulations, such as tax incentives, subsidies, and feed-in tariffs, which can help to spur the development of renewable energy projects
3	Establishing entities such as energy communities to collectively produce, consume, store, share and sell renewable energy

Table 24. Main opportunities to address ET.

➤ BARRIERS

Finally, the identified barriers that most municipalities find in order to implement measures regarding energy transition:

MAIN BARRIERS	
1	National Plans that lack concreteness, implementation and follow-up due to the lack of attention to this issue at the national level. Local energy needs, challenges and priorities should be identified and made visible to regional and national level in a national strategy/plan for the islands.
2	Lack of community involvement in energy projects. Lack of capacity, information and supporting frameworks for energy sharing
3	Lack of support mechanisms tailored to islands needs and characteristics

Table 25. Main barriers hindering progress towards sustainability

➤ MUNICIPAL ENERGY TRANSITION MANAGEMENT

This section analysed the state of the art of the energy transition from the point of view of the municipalities located on touristic islands, identifying their objectives and whether or not they were aware of the existing support. The questions and answers are discussed below.

1- Is your municipality concerned about the energy transition?

The vast majority, 28 municipalities out of 30, the 93,3%, indicated that they are concerned about ET.



2- Has the municipality received support or assistance from other organizations in managing the energy transition?

A large number of municipalities also report having received support/assistance from other organizations to manage ET, specifically 20 organizations out of 30 (66,6%)

3- The Municipality has knowledge of Financing Mechanisms (national or EU level) regarding energy transition?

18 municipalities out of 30, the 60%, indicated that they are aware of financial mechanisms regarding energy transition. Some of those they mentioned were: national and regional calls for PRTR recovery funds, grants for the promotion of self-sufficiency of Public Administrations, IDAE, NEXT GENERATION, ...

4- Has the Municipality received any funding for energy transition from national/EU budget?

In this regard, 16 out of 30, the 53,3 % municipalities have confirmed that they have already received national/ EU budget to implement measures related to ET. This implies that more than half of the municipalities surveyed obtained financing and have begun their process towards sustainability.

➤ EUROPEAN INITIATIVES TO PROMOTE THE ENERGY TRANSITION IN MUNICIPALITIES

In this section, the municipalities were asked if they have participated in any European initiative such as the Covenant of Mayors and the vast majority (22 municipalities out of 30 that represents the 73,3%) answered **yes**.

The remaining 8 municipalities, the 26,6%, that answered that they had not participated in European initiatives were asked if they would like to participate in the future, and the majority said yes.

➤ DEVELOPMENT OF SUSTAINABLE ACTION PLANS AT THE MUNICIPAL LEVEL

Finally, the last question was related to the development of action plans to address ET at the municipal level. Specifically, the municipalities were asked about a Sustainable Climate and Energy Action Plan (SECAP). The response was that 17, the 56,6 %, of the municipalities answered in the affirmative. However, 13 of the municipalities that represent 43,3% indicated that they do not have a developed SECAP.

Therefore, the responses obtained indicate that most of the municipalities that completed the questionnaire were aware of the current trends and progress towards ET.

5. Conclusions

The extensive bibliography consulted, as well as sources from municipalities located on islands (citizens and public authorities), make this document a source of information on the state of ET at the municipal level, mainly on islands. However, by increasing the number of people surveyed, a broader view of the current state can be obtained and a more exhaustive comparative analysis of the different islands that make up the consortium can be carried out. For this reason, we hope to gather more information and expand this document by providing more concrete data that specifically define each island.

The main findings to date are as follows:

- The regulatory framework puts municipalities in the spotlight to promote ET and although there is a diversity of initiatives (very different depending on the island), there are still barriers that slow down and hinder the implementation of measures.
- The islands have different initiatives that support the development of roadmaps and favour the implementation of measures, but it is very important to have entities that provide support and assistance to the municipalities (some islands already have these entities).
- The use of support tools to help develop action plans and provide assistance to municipalities would be very useful, but to date no such tools are directly accessible by public authorities.
- Municipalities located on tourist islands, in general, seem to be informed about the impact of climate change and the importance of actions at the municipal level. However, it is necessary to continue to increase awareness and support for the creation of roadmaps that set the progress to become more sustainable.
- The action plans developed to date focus on the implementation of measures to favour the use of renewable energies in public buildings, implementation of grids for electric vehicles, replacement of lighting fixtures with more efficient ones, promotion of public transportation, etc. Promoting long-term measures requires more comprehensive financial and technical support.
- It is necessary to carry out training for public authorities and citizens to raise their awareness and sensitize them.

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ANNEX I

➤ CITIZENS' SURVEY

The aim of this questionnaire is to analyse the knowledge and awareness about energy transition of citizens, whether they are residents or tourists of Mediterranean tourist islands. This analysis will be part of the Work Package 2 of the GENERA project - Revitalizing Energy Transition in Touristic Islands, funded by the European Union in the LIFE21-CET-LOCAL-GENERA programme No. 101077073. This questionnaire does not contain private information and will not take more than 5 minutes of your time.

Thank you very much for your time and cooperation.

1. Select the type of citizen according to your residence status on the island:

- Tourist (only occasional weeks).
- Seasonal (frequent visitors during periods/some months)
- Permanent (inhabitant of the island).

2. Age (please select age range)

- Up to 25 years old
- 25 - 35 years old
- 35 – 45 years old
- 45 – 55 years old
- 55 – 65 years old
- Over 65 years old

3. Level of education (select the one that best suits your case).

- **Primary education:** Population having completed at least 5 years of schooling, usually starting at age 5 or 6 and completed at age 11 or 12, not completing a higher level.
- **Secondary education:** Secondary school graduate, school graduate, elementary high school graduate.
- **Upper secondary education:** technical diploma (intermediate vocational training), and equivalent qualifications.
- **Higher education:** Bachelor's degree, higher technician (higher level training cycles), specialist technician (FPII) and equivalent or similar qualifications.
- **Post-graduate studies:** PhD studies (third cycle studies)

4. Level of awareness

Tackling climate change with all that it entails and committing to a decarbonised economy towards the energy transition requires greater awareness and a greater willingness of action on the part of all actors in society.

Have you taken any courses related to energy transition, e.g., recycling, environmental, awareness raising, informative etc.?

Yes	No
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Do you think that living on an island is a risk factor for climate change?

Yes	No
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Do you know if your area is energetically vulnerable to climate hazards?

Yes	No
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Are you aware that there are EU initiatives at the municipal level to support municipalities in tackling climate change?

Yes	No
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Are you aware of whether your municipality/region has an energy transition roadmap?

Yes	No
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Do you think that measures that reduce CO2 emissions increase your quality of life?

Yes	No
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Are you willing to do something in your daily life to reduce CO2 emissions and tackle climate change?

Yes	No
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Are there any initiatives in your region to address climate change and promote sustainability? Please select if you are aware of any of the following:

- 1. Installation of photovoltaic solar energy / and or solar thermal energy in the residential sector
- 2. Installation of solar photovoltaic or other renewable energies in municipal buildings
- 3. Preparation of a manual of good practice to face climate change in rural tourism establishments
- 4. Creation of a Municipal Plan for Sustainable Tourism
- 5. Campaigns to promote energy saving, sustainable mobility, renewable energies, etc. or courses for citizens on best practices for energy saving
- 6. Membership of energy communities
- 7. Municipal environmental protection by-laws
- 8. Promoting the circular economy in waste generation (e.g. discriminatory charges on the amount of waste generated by each household). economic incentives for the return of packaging, etc.)
- 9. Switching from fossil-fuelled public transport service to electric/hybrid vehicles.
- 10. Participation in sustainable mobility projects or introduction of electric chargers

How do you think climate change may affect your city/municipality?

1 - Not at all; 2- Very little; 3 - In specific aspects; 4 - Quite a lot; 5 - Completely

1	2	3	4	5
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Please explain how your municipality could be improved to cope with the energy transition?

➤ **INTERVIEWS**

Public authorities' interviews

CHARACTERISATION	
Name of the municipality	
Island size (m²)	
Inhabitants of the municipality (number of persons)	
Average age of inhabitants	
Approximate number of holidaymakers	
High season months	

1. Is there any good practice in your municipality/region on the following topics?

BEST PRACTICES	
ENERGY EFFICIENCY	<i>Construction and renovation of buildings, measures to achieve the new targets for the public sector, industries or transport</i>
ELECTRICITY	<i>wind energy, solar photovoltaic, geothermal, marine energy, combined heat and power, Use and promotion of renewable energies</i>
COMMUNITY ENERGY ACTIONS	<i>Prosumers, Energy Sharing, Community Energy Initiatives</i>
HEATING AND COOLING	<i>Biomass, heat pumps, district heating and cooling, solar thermal</i>
TRANSPORT	<i>Sustainable and intelligent mobility: electric vehicles, electric ferries and boats, hydrogen (maritime and road transport)</i>
STORAGE	<i>Battery energy storage systems, pumped hydro</i>
SMART GRIDS	<i>Smart (digital) meters, Energy Management System, Demand-Side Management, Cybersecurity</i>
RENATURALISATION AND DECARBONISATION	<i>Introduction of vegetation walls, Water management in parks</i>
AWARENESS	<i>Raising public and/or business awareness for the energy transition</i>



2. Given the nature of your municipality (number of inhabitants, island municipality, tourism pattern, etc.):
- *What do you consider to be the **main challenges** facing the municipality in dealing with the energy transition? Tick as many as you need.*
- Limited financial resources and funding for the implementation of renewable energy projects and infrastructure
 - Lack of technical expertise and human resources in the field of renewable energy.
 - Difficulties in coordinating and collaborating with other municipalities, regional governments, and private stakeholders.
 - Regulatory barriers and legal frameworks that may hinder the development of renewable energy projects.
 - Resistance from the public or local communities to renewable energy projects due to lack of awareness or concerns about their impact on the environment.
 - Dependence on fossil fuel-based energy sources, which may be deeply ingrained in the existing energy infrastructure and difficult to replace.
 - Integration of renewable energy sources into the existing energy grid and ensuring a stable supply of energy.
 - Managing the transition of energy consumption patterns among citizens and industries.
 - Ensuring that the energy transition is socially inclusive and that vulnerable groups are not left behind in the process
 - Adapting to the changing energy market dynamics and ensuring a fair and competitive market for renewable energy.
- Is there another challenge that has not been mentioned but should be included?***
- *What would be **the main priorities** to address the above-mentioned challenges?*
- Developing and implementing comprehensive energy transition strategy, which includes clear targets, timelines, and measurable indicators of success.
 - Encouraging public awareness and participation through education and outreach campaigns that emphasize the benefits of renewable energy and the importance of domestic energy saving.
 - Reduce administrative work for the installation of photovoltaic energy in homes.
 - Increasing investment in renewable energy projects, including the development of local renewable energy sources and the integration of inter-island renewable energy grids.
 - Make simple user guides (to help them surf through bureaucracy) for those citizens who want to install PV panels.
 - Strengthening the capacity of local governments and institutions to plan, manage, and implement the energy transition effectively.
- *What do you think are the **current/future opportunities** that can be used to address the energy transition in your municipality?*



- Abundant renewable energy sources such as solar, wind, and wave power, which can be harnessed to reduce dependence on imported fossil fuels.
- Potential energy interconnection and cooperation between islands, which can help to optimize the use of renewable energy sources and reduce costs
- Technological advancements in energy storage and management, which can help to address the intermittent nature of renewable energy sources and ensure a stable supply of energy.
- Introduce supportive policy frameworks and regulations, such as tax incentives, subsidies, and feed-in tariffs, which can help to spur the development of renewable energy projects.
- Public awareness and education campaigns about the benefits of renewable energy and the importance of energy conservation, which can help to increase public support for the energy transition
- Better choice of materials and designs for energy-efficient buildings, which can help to optimize energy consumption and reduce waste (public buildings/schools/ etc).
- Establishing entities such as energy communities to collectively produce, consume, store, share and sell renewable energy.

- *What do you think are the **barriers** to energy transition in your municipality? Please select some from the list or include more if applicable.*

- **National Plans that lack concreteness, implementation and follow-up due to the lack of attention to this issue at the national level.** Local energy needs, challenges and priorities should be identified and made visible to regional and national level in a national strategy/plan for the islands.
- **Grid constrains and security of supply.** Grid connection procedures and grid modernization methodologies are not always suitable for renewable energy projects with island characteristics.
- **Spatial planning and stringent constrains.** Spatial planning legislation not adjusted to island's characteristics.
- **Lack of community involvement in energy projects.** Lack of capacity, information and supporting frameworks for energy sharing.
- **Lack of support mechanisms tailored to islands needs and characteristics.**

3. Finally, please answer the following questions about your municipality:



MUNICIPAL ENERGY TRANSITION MANAGEMENT

Is your municipality concerned about the energy transition?

Yes	No
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Has the municipality received support or assistance from other organizations in managing the energy transition?

Yes	No
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The Municipality has knowledge of Financing Mechanisms (national or EU level) regarding energy transition?

Yes	No
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If yes, which ones?

Has the Municipality received any funding for energy transition from national/EU budget?

Yes	No
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EUROPEAN INITIATIVES TO PROMOTE THE ENERGY TRANSITION IN MUNICIPALITIES

Does your municipality participate in a European initiative such as the Covenant of Mayors?

Yes	No
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If not, would you like to participate?

Yes	No
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DEVELOPMENT OF SUSTAINABLE ACTION PLANS AT THE MUNICIPAL LEVEL

Has your municipality developed a "Sustainable Energy and Climate Action Plan (SECAP)"?

Yes	No
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What stage is it in?

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Could you please indicate how much budget has been involved?

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