International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2020, 10(5), 21-30.

Renewable Energy Projects on Isolated Islands in Europe: A Policy Review

Marula Tsagkari*, Jordi Roca Jusmet

Department of Economics, University of Barcelona, Diagonal 696, 08034, Barcelona, Spain. *Email: marou.tsagari@gmail.com

Received: 02 April 2020 **Accepted:** 20 June 2020 **DOI:** https://doi.org/10.32479/ijeep.9683

ABSTRACT

Island territories that are not connected to the mainland grid have some peculiarities derived from their high level of isolation. For this reason, they are the subject of specific regulation in various European countries under the EU, national and local regulation. In order to deal with the high cost of energy on their territories, the lack of grid stability and the lack of autonomy, many initiatives that promote the introduction of energy self-sufficiency in isolated insular locations have emerged. The present paper is a policy review regarding islands non-interconnected with the mainland grid. The focus is on the key policy issues for the promotion of renewable energy as well as the outcomes of these policies in Greece, Portugal, Spain and France. A discussion of the unified price system, the creation of local markets and the special regulation for energy storage and the demand side management systems are some of the policy proposals cocluded from the present review. In order to overcome all the discussed barriers an approach that reaches across different governance levels with a special focus on the peculiarities of the island systems is needed.

Keywords: Isolated Electricity Systems, Energy Policies, Regulatory Barriers, Islands, Southern Europe, Review
JEL Classifications: Q4, Q42, O13

1. INTRODUCTION

Island territories that are not connected to the mainland grid have some peculiarities derived from their high level of isolation like higher cost of energy, grid instability and high energy dependence. For these reasons, they are the subject of specific regulation under the EU, national and local legislation. A promising alternative to the costly and polluting fuels are the small scale decentralized hybrid energy systems which take advantage of renewable energy sources locally available in remote areas. This hybrid system normally consists of a micro-grid system that operates independently from the main grid, and provides energy produced from local sources, often renewable. The systems are complemented with energy storage solutions like batteries, hydrogen storage, and pumping. The importance of islands as laboratories of clean energy has been a crucial issue in the relevant literature due to the numerous economic, environmental, and social benefits (Jaramillo-Nieves and Del Río, 2010).

The high renewable energy potential, and the clearly defined boundaries make islands ideal test beds for sustainability and renewable energy. Acknowledging that, nowadays, many islands worldwide have turned to decentralized energy systems aiming to become "100% self-sufficient." Some examples include Samso (Jørgensen and Nielsen, 2015), Astypalaia (Hatziargyriou et al., 2017), Reunion Island (Selosse et al., 2018), and Yong Shu Island (Ye et al., 2017). Although there is some available research regarding the regulation for decentralized electrical systems of isolated islands in Spain, Greece, France, and Portugal (e.g., Katsoulakos, 2019; Uche-Soria and Rodríguez-Monroy, 2018) an overview and a comparative analysis is missing from the literature. Therefore, the aim of this paper is to review the present policies through an analysis of some insular renewable energy projects in the aforementioned countries. Additionally, we discuss the most important policy barriers and conclude with policy recommendations.

2. METHODOLOGY

The methodology of the paper is a comparative policy analysis based on systematic review. In order to identify the most important issues, a comprehensive selection of reports regarding the implementation of decentralized energy systems on islands in Southern Europe was analyzed. Four islands, each one from a different country in southern Mediterranean, were chosen as tool to illustrate how their regulatory frameworks have evolved and how this evolution has influenced the renewable energy penetration. The paper focuses on the Mediterranean countries as these countries, despite their high potential, lag behind on renewable energy projects often due to regulatory and bureaucratic barriers.

The key issues selected are those that are central to the transition towards electricity self-sufficiency, and represent a significant barrier or an area of untapped potential. From the barriers identified, we chose to focus only on the regulatory and legislative. Those issues have been identified through a review of the available case studies also presented in Table 1 and of primary documents from governments, grid operators and regulators. A number of interviews were conducted with experts on the projects for clarifications and in order to gain better understanding regarding the regulatory obstacles they faced during the implementation of the projects. The respondents were given the option to remain anonymous, but their role and affiliations are presented in Appendix1.

3. ISLAND SELECTION

3.1. Canary Islands-El Hierro

The non-peninsular systems in Spain include Mallorca–Menorca, Ibiza–Formentera, and the Canary Islands. The island of El Hierro is located in the Atlantic Ocean and is the smallest and southern of the Canary Islands. Prior to the implementation of a renewable energy system, the island was depended on nine diesel units located in the Llanos Blancos power station that produced 13.36 MW/year in order to cover the local demand. In 2014, the hydro plant started its operation. The project combines a wind farm and with a pumped-storage hydroelectric power station. It consists of an upper deposit and a lower deposit of a maximum capacity. The wind farm consists of 5 aero generators each with 2.3 MW of power (total 11.5 MW) and a pumping plant of two 1500 kW pump sets and six 500 kW pump sets with a total power of 6 MW. During the windy days the energy excess is used to store water from the lower deposit in the upper deposit as a storage solution (Frydrychowicz-Jastrzębska, 2018). However, the project is still underperforming, due to various technical difficulties like the small capacity of the upper reservoir and the lack of grid stability. A recent study (Garcia Latorre et al., 2019) concluded that Gorona del Viento has increased the real electricity cost 154% in 2016 and 115% in 2017 compared to conventional production until 2014.

3.2. Dodekanese Islands - Tilos

The Greek islands host 15 % of the Greek population and are responsible for 14 % of the total national annual electricity consumption. The Greek electricity network can be divided into the national power grid, found in the mainland, and a number of smaller local grids on the islands (Hatziargyriou et al., 2017; Katsoulakos, 2019): The island of Tilos is located in South-East Aegean, has a total area of 61.49 km², and a population of 780 people. The island belongs to the Dodekanese area and it is one of the islands of "Barren Line", meaning that it has limited connection with the mainland. Until now, the electricity demand on the island of Tilos was covered by the oil station of the close island of Kos. However, the connection was rather unstable with many regular and long term power blackouts. In order to deal with this issue, in 2015 it was decided the development and operation of an innovative renewable energy project. The system is a hybrid photovoltaic/wind/storage energy system that consists of $NaNiCl_2$ batteries with a capacity of 2MWh, an 800 kW wind turbine, 592 PV panels of a total capacity 160 kW, distributed heat storage that controls the domestic electrical water heaters and smart meters that monitor energy loads (Notton et al., 2017).

3.3. Azores *Islands* - Graciosa

The autonomous power systems in Portugal include Madeira and the Azores islands. The island of Graciosa is located in the northern part of the central group of the Azores and has a total population of 4777 people in an area of 60.65 km². Due to the rough topography of the seafloor, an underwater connection with a submarine cable is not possible and thus, the islands of Azores are isolated from the mainland and from each other. Before the installation of renewable energy in Graciosa, the total demand of 14 GWh annually was covered by six diesel generators. With the new system that consists of a 4,5 MW wind park a 1 MW PV system and a battery-based energy storage management system (BESS) with a capacity of 3.2MWh, 65% of the local demand can be covered from renewable energy (Colthorpe, 2018)

3.4. Corsica Island

The non-interconnected areas of the French territory (also called Zones Non Interconnectees- ZNI) include Corsica and the overseas departments regions and collectivities (Guadeloupe, Reunion, Mayotte, Martinique, French Guiana, Saint Pierre and Miquelon, Wallis, Futuna, Chausey). The island of Corsica is the smallest of the three big occidental Mediterranean islands and has the lowest GDP per capita in France. In 2012, a demonstration project called MYRTE (Renewable hYdrogen Mission for Electrical grid integration), located close to Ajaccio was designed. The project consists of photovoltaic panels with a potential of 560 KW, a fuel cells stacks, an electrolyzer and tanks (H_2, O_2 and H_2O) (Dubois et al., 2013). Since 2012, the project injects energy to the network and produces enough electricity for 200 households in the pilot phase, with potential of expanison (Universita di Corsica, 2019).

4. THE REGULATORY FRAMEWORK ON THE SELECTED ISLANDS

4.1. Regional Policies

Regional policies combined with national targets are considered important factors for the energy transition and are often seen as the intermediary step between the national and the European level (De Jong and Egenhofer, 2014). Currently, many of the peripheral areas of the European Union have their own regional energy plan tailored to their needs. In the Canary Islands, like the rest of the Spanish territory, the responsibility for the operation and transport of electricity falls under the jurisdiction of Red Eléctrica de España (REE). However, the Autonomous Community of Canary islands is responsible for the short and long term planning of production and the development and execution of the basic regulations on generation, transport, distribution and marketing (Law 11/1997). The Canary Islands Energy Plan (PECAN), revised in 2015, focuses on the transformation of the fossil fuel based system towards an increased use of renewable energy in order to reduce costs and to increase energy autonomy (Gobierno de Canarias, 2007). The EECan25 (Gobierno de Canarias, 2017) also recognizes the need for interconnections and energy storage. In 1997 and in 2006, the Council of the island independently published the "El Hierro Sustainability Plan" (PDS), aiming to make the island the first island completely powered by renewable energy sources, and at the same time to improve the quality of life of local people and to preserve the cultural and natural heritage (Cabildo inslular del el Hierro, 2006).

The Azores Regional Government had set the target of 60% of electricity from renewable sources by 2018. Later, the same year, the 2030 Azorean Energy Strategy, was adopted, with three main principles; decarbonization, efficiency, and sufficiency (Goberno dos Acores, 2018). In Greece, law 4414/2016 (Hellenic Republic, 2016), highlights the need for regional climate change adaptation plans that will design policies tailored to the climatic conditions of each region. However, there is still no clear framework that involves different levels of governance during the national planning process. The local government of the South Aegean Region defined the strategic priorities of sustainable energy development in the area for the period 2014-2020. Despite the fact that there is not concrete target for the area of Dodekanese, the islands want to contribute to the achievement of the national target of 20% production from RES in 2020 (South Aegean Periphery, 2015).

In France, the Energy Transition Law for Green Growth (LTECV) aimed to increase the involvement of the local authorities in the design and implementation of the energy policies of their territories, promoting this way decentralization and paving the way for innovative solutions. The French long term Energy Plan was adopted with the decree n 2015-992 (Law No. 2015-992 on the Energy Transition for Green Growth Act in France 2015) and focuses on energy transition. The PPE (Pluriannual Planning for Energy) for Corsica developed jointly by the local government and the state representative in the region and was published on 2015. The main objectives are to increase electrical production from renewable sources, energy security and efficiency. The specific targets are to continue the development (+38%) of electricity production from renewable energy sources and energy autonomy by 2030 (Ministere De L'écologie, 2015).

4.2. EU Policies

The strategic role of the European islands in the energy transition has been acknowledged already in 1992 in the Maastricht treaty and later, in 1997 in the Amsterdam treaty. Following the Amsterdam treaty, the European Commission composed the "Resolution on the problems of island regions in the European Union" (European Parliament, 2016). As a result, the EU allowed member states to adopt specific measures in these "small isolated networks territories," acknowledging the importance of these areas in order to tackle climate change. The EU policies have tried to reduce the main obstacles regarding renewable energy, especially the high initial investment and the high risk involved, to promote renewable energy communities and the autonomous renewable energy systems on islands. The Smart Islands project, inspired by the European Commission's Smart Cities and Communities, started in 2015, aiming to identify best practices among island communities and to propose similar or adapted solutions for other island communities in the EU. The most important step in the EU legislation regarding renewable energy on islands is the Clean Energy for European Islands Initiative that prioritized the clean energy transition on EU's 2700 islands and highlighted the need for new, modern and innovative energy systems (European Commission, 2017). The declaration was followed by the establishment of the Clean Energy for EU islands Secretariat and the design of a platform and a European Island Facility under the Horizon 2020 project. Additionally, the Azores, the Canary Islands, and the Greek non-interconnected islands have all been derogated from certain provisions of Directive 2009/72/EC (European Commission, 2014). According to this derogation these territories are not obligated to separate production, network management and transport activities from the supply.

4.3. National Policies

Greece has acknowledged that islands are a key element for the energy transition and the national economic growth. For this reason the 10-year Development Plan of Greece include special sections dealing with the problems on islands (Minstry of the Environment, 2010). The proposed solutions are the interconnection of the islands with the mainland, and when this is not feasible due to financial and technical restrictions, the development of self-sufficient renewable energy systems. According to the Greek Regulatory Authority for Energy (RAE) the islands which are not powered by the mainland power grid, termed as the Non-Interconnected Islands (NIIs), have an electricity market which consists of thirty-two autonomous systems and of islands complexes (RAE, 2014). In Spain, Article 10 of Law 24/2013 (Gobierno de España, 2013) also defines special regulations for the "Insular and Extra-peninsular Electricity Systems," while the remuneration scheme was updated with the though Royal Decree 413/2014 (Gobierno de España, 2014). The main pieces of legislation for the Portuguese electricity market is The National Energy Strategy 2020 (ENE, 2020) approved by the RCM no. 29/2010 of April 15, 2010 (Ministério da Economia e da Inovação, 2009) and the Energy Efficiency Fund (ESF), created by Decree-Law No. 50/2010 (Ministério da Economia, 2010). The renewable energy production on the NII islands is regulated with the Diário da República n. º227/2017 (Assembleia da República, 2017). In France, the regulation of the NIIs is part of the Energy Code and the past years has had a special reference in the Energy Policy Priorities (Legislative French Assembly, 2005) and more recently in the multiannual electricity planning presented in 2018 (Ministere De L'écologie, 2018).

5. RESULTS

This section discusses the main regulatory challenges the aforementioned projects face, as those were defined from the review and the interviews.

5.1. Remuneration Scheme

In Greece, the Feed-in-Tariff (FiT) scheme that was in place with small alterations since 1994 was replaced with a Feed-in-Premium (FiP) scheme in 2014, that adds a premium to price received by renewable generators in the wholesale electricity market. The FiP Contracts of renewable energy projects participate in the wholesale electricity market (either directly or through aggregators) and enter with zero price energy offers on an hourly basis. According to the code for NII, projects operating after 2016 will continue to benefit from a FiT scheme through power purchase agreements (PPAs), under the condition that the islands are not interconnected to the mainland grid or do not have a daily electricity market (RAE, 2014). The FiT is calculated as the difference between the reference price and the reference market prices. The reference price per category of renewable energy source (RES) is published or auctioned, and reflects the overall average remuneration which is required by RES generators. The difference between the electricity price in the wholesale market; and the RES tariff is mainly covered through the special fee for the reduction of greenhouse gases emissions – ETMEAR, charged to all final electrical energy consumers (Hellenic Republic, 2016). Regarding renewable energy from hybrid stations, like the one in Tilos, there is still not a clear remuneration mechanism, as a special tariff only of hybrid stations is currently under consideration. One of the respondents highlighted the pricing issue as a main barrier for the project as "the framework mainly refers to pumping systems rather than battery-powered hybrid stations" (I1).

In Spain, the National Decree RD 738/2015 introduced a new remuneration scheme for the NII (Ministerio de Industria Energia y Tourismo, 2015). This remuneration is an addition to the remuneration received from the sale of the energy valued at the price of the market, and aims to cover the difference between the extra costs and the income. For the calculation of this compensation the initial investment costs, the income from the sale of energy at the market price, and the operating costs for a company well managed and efficient are considered. Exceptionally, the specific remuneration scheme may also incorporate an extra incentive for the investment, when the installation helps to a significant reduction of the costs in the systems of non-peninsular territories. This incentive will be established based on the reduction of the costs generated and not so much of the characteristics of the type installation (Gobierno de España, 2014). This extra cost resulting from the incentives is covered 50% through a specific item of the General State Budgets, while the remaining 50% is paid by consumers through the fees charged for access to the electrical system. In January 2016, the Spanish Electricity sector launched the model of auctions for large scale projects in order to reduce the gap between the selling price and the generation cost.

The FiT scheme in Portugal was launched in 1998 and lasted until 2012, with various modifications like differentiations per technology, change in the guarantee period and in the value of the tariff (Proença and St. Aubyn 2013). Currently, in Portugal there are two remuneration options: a general remuneration scheme under which the producers sell electricity produced at a market price, and a guaranteed remuneration scheme in which producers sell the electricity produced at a guaranteed price in a given period, the price of which may be fixed or indexed to a benchmark. In Azores, the vast majority of renewable energy production is remunerated through a guaranteed purchase rate. The remuneration takes into account the difference between the average cost acquisition of this energy and the price of energy traded in the market (Decreto-Lei n.º 76/2019) (Presidência do Conselho de Ministro, 2019). These revenues are covered by a global tariff applicable to all consumers. In 2019 it was announced that Portugal, following the Spanish example will hold two auctions for solar projects. For the specific case of Azores, the Regional Legislative Decree No. 26/2006/A (Região Autónoma dos Açores, 2006), subsequently updated by Regional Legislative Decree No. 14/2019/A (Região Autónoma dos Açores, 2019), defines an additional remuneration mechanism known as PROENERGIA or "System of Incentives for the production of energy from renewable sources." For investment projects on the islands of Santa Maria, São Jorge, Graciosa, Flores and Corvo, the rate increases to 35% (Região Autónoma dos Açores - Assembleia Legislativa, 2010). The Graciolica project operates under a PPA between Electrcidade dos Azores (EDA) and the private firm Younicos and part of the costs is covered by the money saved from the fuels.

In France, renewable energy is also promoted through feed in laws and competitive tenders. More concretely, a combination of FiTs for installations below 500 kW and FiPs for installations above 500 kW is in place since 2015. The overseas departments, including Corsica, are subject to this special remuneration, which defines a guaranteed purchase price over a period of 15-20 years. This compensation is a premium resulting from the difference between the reference compensation and a reference market income, and although exposes producers to market price signals, also guarantees a reasonable remuneration (Code de l'énergie, 2019). In order to deal with the problems of energy security during load peaks in extreme weather events, the maximum share of intermittent generation is legally limited to 30% within the island's electricity grid (Notton et al., 2019).

5.2. Unified Price Electricity Systems

The aforementioned insular systems, due to the high levels of isolation have also higher investment and operating costs, which normally should have been reflected on the electricity prices the consumers pay monthly. In Spain, the Law 54/1997 (Jefatura del Estado, 1997) introduced a system of unified prices in the whole Spanish territory aiming to minimize the differences in the prices between the islands and the mainland that can lead to discrimination. More recently, the Article 10 of Law 24/2013 (Gobierno de España, 2013) provides the base for the regulation of the electricity market, which is different from the mainland. The electricity price depends on the moving average of the peninsular prices of the 12 months prior to delivery of the supply, corrected by a coefficient. This new reference index takes into account the variation of the generation costs of each hour in each independent insular system. Similarly in Greece, due to the system of unified prices the population on the mainland pays a special tariff in order to cover the elevated price of electricity on the islands. This amount is an annual estimation that is being paid to the Hellenic Electricity Market Operator (LAGIE). At the end of every year, the special accounts of LAGIE and the Hellenic Electricity Distribution Network Operator (HEDNO) are being balanced. However, in 2018, in an effort to incentivize the renewable energy projects the Greek government proposed a return of 3% on the municipalities who live in proximity with renewable energy projects. From this amount about 1% is being reduced from the monthly bills of the residents, and the rest is used by the municipality. "This new legislation is considered a step towards the correct direction" according to one of the interviewees (I2). Portugal did not have a unified price system for its territory until 2003, when was introduced the Decreto-Lei nº 182/95 (Ministério da Indústria e Energia, 1995), which acknowledged the need to subsidize the high cost of electricity production on islands. France also applies the principle of electricity price equalization at national level, and thus, the consumers in the NIIs pay the same electricity price to that of continental France. The additional costs are paid by the consumers in the mainland through the Contribution of the Public Service for Electricity controlled by the Energy Regulatory Commission (Legislative French Assembly 2004, 2000). According to one respondent "the approach is really old and not adequate for a succesfull renewable energy transition." (I8)

In all four cases the unified price system does not pose direct incentives for the improvement of the electricity production and the decrease of energy demand through better management. Thus, the main incentives are in the form of subsidies and are not reflected directly on the bills of the consumers. The unified price systems although aim to ensure fair prices and to avoid discrimination between the habitants of mainland and the islands does not allow for a pricing structure that reflects the cost of energy production and thus, promote the renewable energy (Owens, 2009). This creates various discussions in cases like the costly and underperforming hybrid station in Hierro, but also in cases of resistance from the local population which does not seem to have any direct economic benefit from the deployment of RES. Other issues include the rising costs for the governments that can lead to deficits, and economic disincentives for the electrical utilities which are forced to sell power on these islands at the same price that they sell power in mainland, when they offer have to wait more than a year for the remuneration. In Greece, although there is a small incentive for the residents through a reduction in the monthly bill, this does not solve the problem for the government expenses and the utility companies.

5.3. Energy Storage

Renewable energy is characterized by inherent volatility and randomness, while the island power grids should maintain the balance of supply and demand in a real-time mode. Energy storage techniques are effective approaches to cope with the stochastic and volatile behaviors of renewable energy generation. With these techniques, the redundant renewable energy can be transformed into mechanical, electromagnetic and chemical energy in various energy storage systems (ESSs). The stored energy can then be released when real time renewable energy generation is insufficient. An ESS can be stand alone or part of a hybrid system. The analysis of Neves and Silva (2015) concluded that storage is a challenging but essential part for a hybrid system. (Bayod-Rújula et al. (2017) also recognized the high potential of storage in off-grid islands. However, until the various barriers in storage technology are overcome it will be difficult to achieve 100% self-sufficiency.

In Greece, the regulation regarding energy storage in non-interconnected islands is rather unclear. Before the implementation of the Tilos project there was not a policy framework for battery storage, especially for cases in which the storage system will operate in both stand alone and in grid-connected system. The laws 3851/2010 (Minstry of the Environment, 2010) and 4414/2016 (Hellenic Republic, 2016) have detailed provisions dealing with the operation of hybrid stations in the NIIs and within the interconnected system. Greece was the first European country to adopt specific regulation regarding the installation of hybrid systems (Krajačić et al., 2011). According to this framework, there are two different tariffs, one for the electricity that is fed to the grid and one for the electricity that comes from storage units. Additionally, there is a limited amount of energy from the grid that can be used for storing, and can only be used when RES are not available. Again, one interviewee pointed out that Tilos project pushes for improvements in the legal framework for hybrid systems, especially in the regulation "dealing with battery technology" (I1).

In Portugal, although hydro storage exists for many years as a storage option, this is not directly regulated under the Decree-Law No. 29/2006 (Ministério da Economia e da Inovação, 2006). Similarly in France, there is lack of coherent regulation regarding storage. In the article L121-7 of the Codeco (Code de l'énergie, 2019), is highlighted that the cost of storage facilities in the NIIs is covered by the grid operator. In France, the law provides that centralized storage facilities managed by the network operator may be financed by the public energy service charges based on the additional costs of production they avoid. The French Energy Regulatory Authority - CRE has defined a methodology for analyzing the projects in order to calculate the avoided costs. In Spain, the Decree 900/2015 (Ministerio de Industria Energia y Tourismo, 2015) introduced a number of financial obligations for solar projects, including those of energy storage for self-consumption. The legislation changed in 2018 with the Real Decreto 244/2019 (Ministerio de Industria Energia y Tourismo, 2019), and the fees for storage were removed.

Grid fees can play an important role in the deployment of energy storage. France and Portugal are two EU Member States that charge grid fees for charging and discharging storage. This is because storage facilities can be seen as consumers, when drawing electricity and generators when they provide back the electricity to the network. The relevant EU regulation on the internal market for electricity, states that network operators should not apply charges to access the networks, however this deals only with the issue of double network charges and does not cover instances of double taxation. This double taxation is a significant economic burden that needs to be addressed.

In none of the four countries storage is supported by incentives. Experience from other technologies (e.g., wind and photovoltaic), and from other areas (e.g., incentives for storage in Hawaii) have shown that subsidies can decrease the investment risk and encourage the deployment of storage technologies. According to one study (Hoppmann et al., 2014), incentives for the promotion of storage systems although not necessary, can be valid for short term. In another case study on the island of Corvo the authors concluded that for a battery capacity up to 40 kWh the proposed remuneration scheme is a fixed tariff of €53.8/kWh multiplied by battery capacity (Krajačić et al., 2011).

5.4. Interconnections

In all four cases a diesel plant (Hierro, Graciosa) or an underwater cable (Tilos, Corsica), connection provides the backup system for the 100% RES electricity system (Table 1). These backup systems can be found in other islands around the world who also tend to be self-sufficient, like Reunion Island, Samoa, Cook Islands, and Hawaii. Although many have suggested alternative solutions, like island hydrogen production (Vivas et al., 2018), natural gas (Raghoo et al., 2017) and biomass (Sakaguchi and Tabata, 2015) there seems to be an agreement that a reliable and non-intermittent back-up system needs to be in place at least in the medium term. This is because even if these islands can achieve 100% production from local RES, their total installed capacity should be approximately 3 times the maximum annual demand, given the current capacity reserve margin. In this line, it is acknowledged that interconnected systems hold some advantages against a standalone system, even in the case of renewable energies. For example, Alves et al. (2019) concluded that for the islands of Pico and Faial in Azores, the interconnection with an underwater cable can increase RES penetration and decrease intermittency. Similarly, another research (Lobato et al., 2017), highlighted that interconnections among the Canary Islands can lead to more efficient use of the thermal units. The better exploitation of the power generated by RES with the use of underwater cable interconnections has also been observed for the case of Malta-Sicily-Italy (Ippolito et al., 2018) and among the Greek islands (Georgiou et al., 2011). The underwater cable interconnection with other islands can be very helpful in cases of overcapacity as in the case of Tilos, which can avoid this overload by sending the excess energy to Kos. Without this interconnection and given the priority dispatch, the problem of overcapacity can be a burden for Graciosa and Hierro. Thus, a potential interconnection with neighboring islands can allow for a better utilization of local RES to be used up and to a lower cost. The introduction of a better selling price of energy from RES in the NII compared to the continental system can provide additional incentives for interconnections among the islands.

5.5. Electricity Markets

Energy markets of the island territories examined are monopolies and controlled by national companies. This is often the case for small scale electricity markets around the world. There are many options to include competition on insular electricity markets like the single buyer model, bilateral contracts and wholesale markets (pools). According to an EU deliverable (STORIES Project, 2012) the single buyer and the bilateral contracts models are the most suitable. In the Canary Islands, Endesa is the local vertically integrated company responsible for the transmission, distribution and supply of the electricity, manager of the system and generator of most of the electricity. REE, as the system operator is responsible to ensure access to electricity to all the stakeholders. In Greece, PPC is the grid operator of all the NIIs and also the only sole generator, distributor and supplier on islands. Despite the market opening, there are still no liberalized electricity markets in small islands like Tilos. With the exception of RES, PPC holds all the generation licenses at the Greek islands. In Portugal, ERSE is the independent national regulatory authority, EDA RENOVÁVEIS S.A., is the main renewable power operator, and the single buyer is EDA, S.A. In the bigger island of Corsica, EDF Corse has the role of production, single buyer, transport, distribution, and marketing. In order to break these monopolies the EU and as a result, the national governments call for a competitive free market. This allows little space for adaptation to the specific island characteristics, where market structure cannot follow the continental trends. Even in cases in which the markets are open to competition, they are not still operational due to various administrative barriers, like the delay of payments from the regulated price system in the cases of Greece and Spain.

A potential interconnection with neighboring islands can help overcome the limitations in small electricity markets. In Greece, HEDNO is responsible to operate a platform suitable for energy trading between the members of a community, facilitating a ‘micro-market’ for energy transactions. In Spain, the new law 738/2015 paves the way for the creation of a new virtual market and is expected to increase the security of the investors, as each year 50% of the electricity price in the NIIs will be known and based on the prices of the past year (Uche-Soria and Rodríguez-Monroy, 2018). According to Sumper (2019), a micro-market can develop stronger social relationships among the actors and thus, lower levels of competitiveness and self-interest. In the case of islands, not interconnected to the mainland but with interconnections among them, the prices will reflect the local demand and labor.

5.6. Demand Side Management and Reduction

Due to the limited available resources, it is of extreme importance for the NIIs to regulate and limit demand. This is in contrast with the current trends as demand has been increasing in all four cases examined (Table 2). This increase in energy demand can be explained with the increase of population, tourism and the use of electric appliances and air conditions. Due to this increase in

Table 1: Description of the islands of the present study

Islands	Gross Population	Area (km^2)	Interconnection with mainland	Location
Corsica	327,374 (2017)	8680	Partial (with the SACOI; Sardinia–Corsica–Italy)	Mediterranean Sea
El Hierro	10,798 (2018)	268,71	No	Mediterranean Sea
Graciosa (Azores)	4391 (2011)	60,65	No	Atlantic
Tilos	780 (2011)	61,48	Interconnection with Kos	Mediterranean Sea

energy demand, if islands want to achieve energy self-sufficiency they will have to invest in demand side management (DSM) and flexibility, which can help to regulate the demand according to the available generated power. Various studies (e.g., Mengelkamp et al., 2018) have sown that DSM can increase self-sufficiency, decrease power peaks and reduce the energy demand. Despite these recognitions, most EU countries, like Portugal, still lack a regulatory framework for demand side measures and no incentive mechanism in place. In Spain, Law 24/2013 of the Electricity Sector (Gobierno de España, 2013) and the Royal Decree 216/2014 (Ministerio de Industria Energia y Tourismo, 2014) aim to facilitate and promote Demand Response policies through specific provisions. One interviewee concluded that "The discussion on demand response management needs to advance in Spain if we want to see more projects like Gorona del Viento operate efficiently" (I7).

France is a pioneer in the area of demand response policy and has prioritized in the political agenda the opening of the market for DSM. Law No. 2013-312 (Legislative French Assembly, 2019) enabled any consumer in mainland France to use its electricity demand reductions on the energy markets, either directly or indirectly through an independent aggregator. In Greece, there is still no specific provision for DSM systems for small consumers. However, the new Target Model (expected by the end of 2019) will have specific provisions for demand flexibility and smart meter installation. Due to the importance of DSMs for the non-interconnected islands it is necessary to design a business model that will ensure incentives for both customers and providers.

Table 3 summarizes the most important regulatory approaches of the issues discussed in the four case studies. Our analysis suggests that there are very few differences regarding the regulation for the promotion of RES, on the island territories, in the countries examined. In all four cases, there are similar policies regarding the financial support for the renewable energies on these isolated territories, with the only difference being the type of support. With these incentives the national governments want to promote the further penetration of RES on the non-interconnected islands. Additionally, all islands examined, show a clear interest and commitment to take advantage of their renewable potential and to gain self-sufficiency. This is highlighted in the development of local plans with specific RES targets and in the national commitment.

Graciosa has achieved the higher penetration of renewable energy, mainly due to the presence of geothermal energy. Similarly, Corsica for being a single island with interconnection has been able to achieve the higher levels of renewable sources penetration compared to the other islands, without having to deal with issues of overcapacity and grid instability, that constitute important barriers for the Hierro and Tilos. The latest two cases still face a number of administrative barriers that delay them from reaching their full potential including bureaucracy, complicated administrative process, and rapidly changing regulation. In order to further promote decentralized renewable energy on the islands that are not interconnected to the mainland grid, we suggest it is important to review the unified pricing system, in order to reflect the cost of energy production on islands and motivate alternative solutions. Some of the possible solutions include more subsidies for renewable energy projects, tariffs based on the avoided cost method and replacement of geographic prices with a system that subsidizes households based on their socioeconomic status.

A common element in all four cases is the lack of specific and clear legislation regarding storage, despite the fact that the need for storage devices in these systems has been highlighted in various studies. Additionally, only France seems to have a well-developed plan regarding DSM, while Greece and Spain are foreseeing to develop a regulatory framework. Currently, in Greece and Spain there is a plan of interconnection among the Dodecanese islands and among some of the Canary Islands. No such plan exists for

Table 2: Energy demand on the selected islands

Island	2008 (MWh)	2017 (MWh)	Increase (%)
Hierro	38024	41489	9,11
Graciosa	13858	14264	2,92
Corsica	2018000	2279000	12,93
Kos-Kalymnos-Tilos[a]	340436	382075	12,23

Sources: ISTAC 2019; SREA 2019; EDF, 2019 and HEDNO 2019. [a]Data available only for the whole system (~100 MW system)

Table 3: Comparative analysis

Islands	Production from RES (%)	Target	Local regulation	National regulation	Support	Tenders	Unified price system	Interconnection	Single buyer
Corsica	26% (2017)	100%	Programmation pluriannuelle de l'énergie (PPE)	Integrated National Plan Energy-Climate (2019)	FiT-FiP	Yes	Yes	Existing	Yes
Hierro	45,9% (2017)	100%	Estrategia energética de canarias 2015-2025 (EECan25)	Draft of the integrated national energy and climate 2021-2030 (2019)	Special remuneration	Yes	Yes	Planned	Yes
Graciosa	65%	100%	Estratégia Açoriana para la Energia 2030	Integrated National Energy and Climate Plan 2021-2030 (2018)	Special remuneration	Yes	Yes	Not planned	Yes
Tilos	16%	100%	N/A	National Energy and Climate plan (2019)	FiT	Yes	Yes	Planned	Yes

Source: Authors own elaboration

Azores. Under a potential interconnection the full operation of a local energy market will become possible.

6. CONCLUSIONS

Islands are often seen as 'test laboratories' for renewable sources. The high cost of energy in these territories, the lack of grid reliability, and the often privileged conditions for renewable energy make them ideal test beds. However, in order to take advantage of the full potential of the islands it is necessary to create tailor made solutions, including energy storage systems, an adequate price system, interconnections and a fully operational market.

Our analyses shows that despite the efforts, there is still lack of an appropriate dynamic regulatory framework regarding insular systems in all four countries examined. Thus, it is urgent to create a more adequate and flexible regulatory framework, that will allow each island to use its specific renewable energy potential. Various barriers need to be removed and collaboration among the countries with similar characteristics like the ones examined here can help islands progress towards 100% electricity self-sufficiency.

REFERENCES

Alves, M., Segurado, R., Costa, M. (2019), Increasing the penetration of renewable energy sources in isolated islands through the interconnection of their power systems. The case of Pico and Faial Islands, Azores. Energy, 182, 502-510.

Assembleia da República (2017), Diário da República n.º 227/2017, Série I de 2017-11-24. Lei n.º 109/2017. Portugal. from: https://www.//dre.pt/application/conteudo/114248651 [Last accessed on 2020 May 30].

Bayod-Rújula, A.A., Burgio, A., Leonowicz, Z., Menniti, D., Pinnarelli, A., Sorrentino, N. (2017), Recent developments of photovoltaics integrated with battery storage systems and related feed-in tariff policies: A review. International Journal of Photoenergy, 2017, 12.

Cabildo Insular del el Hierro. (2006), Prevision del Plan de Desarollo Sostenible. Spain: Cabildo Insular del el Hierro.

Code de l'énergie. (2019), France. Available from: https://www.legifrance.gouv.fr/affichCode.do?cidTexte=LEGITEXT000023983208. [Last accessed on 2019 Aug 12].

Colthorpe, A. (2018), Hybrid Power Plant' Enabled for 65% Renewable Energy Island Graciosa. Available from: https://www.energy-storage.news/news/hybrid-power-plant-enabled-for-65-renewable-energy-island-graciosa.

De Jong, J., Egenhofer, C. (2014), Exploring a Regional Approach to EU Energy Policies. Brussels: CEPS Special Report.

Dubois, J., Hû, G., Poggi, P., Montignac, F., Serre-Combe, P., Muselli, M., Hoguet, J.C., Vesy, B., Verbecke, F. (2013), Safety cost of a large scale hydrogen system for photovoltaic energy regulation. International Journal of Hydrogen Energy, 38(19), 8108-8116.

EDF. (2019), Open Data EDF, Corse. Available from: https://www.opendata-corse.edf.fr. [Last accessed on 2019 Aug 24].

European Commission. (2014), Commission Decision of 14 August 2014 Granting the Hellenic Republic a Derogation from Certain Provisions of Directive 2009/72/EC of the European Parliament and of the Council. Avaialble from: http://www.legislation.gov.uk/eudn/2014/536/contents. [Last accessed on 2020 Feb 12].

European Commission. (2017), Political Declaration on Clean Energy for EU Islands. Brussels, Belgium: European Commission.

European Parliament. (2016), Resolution on the Special Situation of Islands 2015/3014(RSP). Brussels, Belgium: European Parliament.

Frydrychowicz-Jastrzębska, G. (2018), El Hierro renewable energy hybrid system: A tough compromise. Energies, 11(10), 2812.

Garcia Latorre, F.J., Quintana, J.J., de la Nuez, I. (2019), Technical and economic evaluation of the integration of a wind-hydro system in El Hierro Island. Renewable Energy, 134, 186-193.

Georgiou, P.N., Mavrotas, G., Diakoulaki, D. (2011), The effect of islands' interconnection to the mainland system on the development of renewable energy sources in the Greek power sector. Renewable and Sustainable Energy Reviews, 15(6), 2607-2620.

Goberno dos Acores. (2018), Estratégia Açoriana Para a Energia 2030. Ponta Delgada. Available from: http://www.azores.gov.pt/Gra/sreatdre/conteudos/destaques/2018/Outubro/EAE2030.htm. [Last accessed on 2019 Aug 12].

Gobierno de Canarias. (2007), PECAN. Las Palmas de Gran Canaria. Available from: http://www.gobiernodecanarias.org/ceic/energia/doc/planificacion/pecan/pecan2007.pdf. [Last accessed on 2019 Aug 12].

Gobierno de Canarias. (2017), EECan 25. Available from: http://www.gobiernodecanarias.org/ceic/energia/temas/planificacion/EECan25_DocumentoPreliminar_junio2017.pdf. [Last accessed on 2019 Aug 12].

Gobierno de España. (2013), Electricity Sector Regulation Electricity Law 24/2013. German, Spanish: IEA/IRENA.

Gobierno de España. (2014), Royal Decree 413/2014 on Electricity Generation by Means of Renewable, Cogeneration and Waste Facilities. German, Spanish: IEA/IRENA.

Hatziargyriou, N., Margaris, I., Stavropoulou, I., Papathanassiou, S., Dimeas, A. (2017), Noninterconnected Island systems: The Greek case. IEEE Electrification Magazine, 5(2), 17-27.

HEDNO. (2019), Statistics Reports and Monthly Reports on Non-interconnected Islands Released. Available from: https://www.deddie.gr/en/themata-tou-diaxeiristi-mi-diasundedemenwn-nisiwn/agora-mdn/stoixeia-ekkathariseon-kai-minaion-deltion-mdn. [Last accessed on 2019 Aug 24].

Hellenic Republic. (2016), Law No. 4414/2016-new Support Scheme of Renewable Energy and CHP Plants-provisions Concerning the Legal and Administrative Unbundling of Natural Gas Supply and Distribution and Miscellaneous Provisions. Greece: Hellenic Republic.

Hoppmann, J., Volland, J., Schmidt, T.S., Hoffmann, V.H. (2014), The economic viability of battery storage for residential solar photovoltaic systems-a review and a simulation model. Renewable and Sustainable Energy Reviews, 39, 1101-1118.

Ippolito, M., Favuzza, S., Massaro, F., Mineo, L., Cassaro, C. (2018), New high voltage interconnections with islands in the mediterranean sea: Malta and sicily. Analysis of the effects on renewable energy sources integration and benefits for the electricity market. Energies, 11(4), 838.

ISTAC. (2019), Estadística de Energía Eléctrica/Series mensuales. Islas de Canarias. 1991-2019. Available from: http://www.gobiernodecanarias.org/istac/temas_estadisticos/sectorsecundario/industria/energia. [Last accessed on 2019 Aug 24].

Jaramillo-Nieves, L., Del Río, P. (2010), Contribution of renewable energy sources to the sustainable development of Islands: An overview of the literature and a research agenda. Sustainability, 2(3), 783-811.

Jefatura del Estado. (1997), Ley 54/1997, de 27 de Noviembre, Del Sector Eléctrico. Spain: Legislación Consolidada.

Jørgensen, S.E., Nielsen, S.N. (2015), A carbon cycling model developed for the renewable energy Danish Island, Samsø. Ecological Modelling, 306, 106-120.

Katsoulakos, N.M. (2019), An overview of the Greek Islands' autonomous electrical systems: Proposals for a sustainable energy future. Smart Grid and Renewable Energy, 10(04), 55-82.

Krajačić, G., Duić, N., Zmijarević, Z., Mathiesen, B.V., Vučinić, A.A., da Graça Carvalho, M. (2011), Planning for a 100% independent energy system based on smart energy storage for integration of renewables and CO_2 emissions reduction. Applied Thermal Engineering, 31(13), 2073-2083.

Law No. 2015-992 on the Energy Transition for Green Growth Act in France. (2015), Available from: https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000031044385 and categorieLien=id. [Last accessed on 2019 Aug 12].

Legislative French Assembly. (2000), Loi n° 2000-108 Du 10 Février 2000 Relative à La Modernisation et Au Développement Du Service Public de l'électricité. France: Legislative French Assembly.

Legislative French Assembly. (2004), Loi n° 2004-803 Relative Au Service Public de l'électricité et Du Gaz et Aux Entreprises Électriques et Gazières. France: Legislative French Assembly. Available from: https://www.legifrance.gouv.fr/eli/loi/2004/8/9/ECOX0300221L/jo/texte. [Last accessed on 2019 Aug 12].

Legislative French Assembly. (2005), Energy Program Act POPE n° 2005-781, Establishing France's Energy Policy Prioritie. French: Legislative French Assembly.

Legislative French Assembly. (2019), LOI n° 2013-312 du 15 avril 2013 Visant à Préparer la Transition Vers un Système Énergétique Sobre et Portant Diverses Dispositions sur la Tarification de l'eau et sur les Éoliennes. French: Legislative French Assembly.

Lobato, E., Sigrist, L., Rouco, L. (2017), Value of electric interconnection links in remote island power systems: The Spanish Canary and Balearic archipelago cases. International Journal of Electrical Power and Energy Systems, 91, 192-200.

Mengelkamp, E., Bose, S., Kremers, E., Eberbach, J., Hoffmann, B., Weinhardt, C. (2018), Increasing the efficiency of local energy markets through residential demand response. Energy Informatics, 1(1), 11.

Ministere De L'écologie. (2015), Révision de La Programmation Pluriannuelle de l'Energie Pour La Corse (2019-2023/2024-2028). Available from: http://www.corse.developpement-durable.gouv.fr/IMG/pdf/joe_20151220_0295_0008-1.pdf. [Last accessed on 2019 Aug 12].

Ministere De L'écologie. (2018), Multi-Annual Energy Plan (MAEP). French Strategy for Energy and Climate Paris, France: Ministere De L'écologie.

Ministério da Economia e da Inovação. (2006), Decreto-Lei n°. 29/2006 de 15 de Fevereiro. Available from: https://www.dre.pt/pesquisa/-/se. [Last accessed on 2020 Jan 25].

Ministério da Economia e da Inovação. (2009), National Energy Strategy 2020 (ENE 2020). Portugal. Available from: https://www.dre.pt/application/file/483321. [Last accessed on 2019 Aug 12].

Ministério da Economia. (2010), Decree-Law No. 50/2010 on the Fund for Energetic Efficiency. Brazil: Ministério da Economia, da Inovação e do Desenvolvimento.

Ministério da Indústria e Energia. (1995), Decreto-Lei n°. 182/95. Portugal: Ministério da Indústria e Energia. Available from: https://www.data.dre.pt/eli/dec-lei/182/1995/07/27/p/dre/pt/html. [Last accessed 2019 Aug 27].

Ministerio de Industria Energia y Tourismo. (2014), Royal Decree 216/2014, por el que se Establece la Metodología de Cálculo de los Precios Voluntarios Para el Pequeño Consumidor de Energía Eléctrica y su Régimen Jurídico de Contratación. Available from: https://www.boe.es/diario_boe/txt.php?id=BOE-A-2014-3376. [Last accessed on 2020 Mar 03].

Ministerio de Industria Energia y Tourismo. (2015), Real Decreto 738/2015 Por El Que Se Regula La Actividad de Producción de Energía Eléctrica y El Procedimiento de Despacho En Los Sistemas Eléctricos de Los Territorios No Peninsulares. Spain: Ministerio de Industria Energia y Tourismo. Avaialble from: https://www.boe.es/boe/dias/2015/08/01/pdfs/BOE-A-2015-8646.pdf. [Last accessed on 2019 Aug 12].

Ministerio de Industria Energia y Tourismo. (2019), Real Decreto 244/2019, de 5 de Abril, Por El Que Se Regulan Las Condiciones Administrativas, Técnicas y Económicas Del Autoconsumo de Energía Eléctrica. Available from: https://www.boe.es/diario_boe/txt.php?id=BOE-A-2019-5089. [Last accessed on 2019 Aug 12].

Minstry of the Environment. (2010), National Renewable Energy Action Plan in the Scope of the Directive 2009/28/EC. Energy and Climate Change. Available from: http://www.ypeka.gr/LinkClick.aspx?fileticket=CEYdUkQ719k%3D and tabid=37. [Last accessed on 2019 Aug 27].

Neves, D., Silva, C.A. (2015), Optimal electricity dispatch on isolated mini-grids using a demand response strategy for thermal storage backup with genetic algorithms. Energy, 82, 436-445.

Notton, G., Duchaud, J.L., Nivet, M.L., Voyant, C., Chalvatzis, K., Fouilloy, A. (2019), The electrical energy situation of French Islands and focus on the Corsican situation. Renewable Energy, 135, 1157-1165.

Notton, G., Nivet, M.L., Zafirakis, D., Motte, F., Voyant, C., Fouilloy, A. (2017), Tilos, the First Autonomous Renewable Green Island in Mediterranean: A Horizon 2020 Project. Switzerland: 15th International Conference on Electrical Machines, Drives and Power Systems (ELMA). p102-105.

Owens, A.D. (2009), Energy Policy. EOLSS Publications. Available from: https://www.books.google.nl/books?id=inGWCwAAQBAJ. [Last accessed on 2019 Oct 31].

Partnership, Smart Islands. (2019), Smart Islands. Available from: https://www.smartislands.org. [Last accessed 2019 Jul 03].

Presidência do Conselho de Ministro. (2019), Decreto-Lei n°. 76/2019. Available from: https://www.dre.pt/pesquisa/-/search/122476954/details/maximized. [Last accessed on 2019 Aug 12].

Proença, S., St Aubyn, M. (2013), Hybrid modeling to support energy-climate policy: Effects of feed-in tariffs to promote renewable energy in Portugal. Energy Economics, 38, 176-185.

RAE. (2014), Electrical System Operation Code for Non-interconnected Islands (NII Code). Athens: RAE.

Raghoo, P., Surroop, D., Wolf, F. (2017), Natural gas to improve energy security in small Island developing states: A techno-economic analysis. Development Engineering, 2, 92-98.

Região Autónoma dos Açores. (2006), Decreto Legislativo Regional n.° 26/2006/A. Ponta Delgada: Região Autónoma dos Açores.

Região Autónoma dos Açores. (2010), Decreto Legislativo Regional n.° 5/2010/A. Ponta Delgada: Região Autónoma dos Açores.

Região Autónoma dos Açores. (2019), Decreto Legislativo Regional n.° 14/2019/A. Ponta Delgada: Região Autónoma dos Açores.

Sakaguchi, T., Tabata, T. (2015), 100% Electric power potential of PV, wind power, and biomass energy in Awaji Island Japan. Renewable and Sustainable Energy Reviews, 51, 1156-1165.

Selosse, S., Ricci, O., Garabedian, S., Maïzi, N. (2018), Exploring sustainable energy future in Reunion Island. Utilities Policy, 55, 158-166.

South Aegean Periphery. (2015), Guidelines for Formulating Strategic Priorities and Projects for the Sustainable Energy Development of the Region South Aegean. Available from: http://www.pnai.gov.gr/ckfinder/userfiles/files/Κατευθύνσεις για τη διαμόρφωση Στρατηγικών ΒΕΑ.pdf. [Last accessed on 2019 Aug 27].

SREA. (2019), Energia, Água e Combustíveis. Available from: https://www.srea.azores.gov.pt/Conteudos/Relatorios/lista_relatorios.aspx?idc=6194 and idsc=6713 and lang_id=1. [Last accessed on

2019 Aug 12].
STORIES Project. (2012), Scheme for Market Organization of Autonomous Electricity Systems. Available from: https://www.ec.europa.eu/energy/intelligent/projects/sites/iee. [Last accessed on 2019 Aug 27].
Sumper, A. (2019), Micro and Local Power Markets. United States: John Wiley and Sons Ltd.
Uche-Soria, M., Rodríguez-Monroy, C. (2018), Special regulation of isolated power systems: The canary Islands, Spain. Sustainability, 10(7), 2572.
Universita di Corsica. (2019), MYRTE Research Platform in Energetics. Available from: https://www.universita.corsica/en/research/myrte. [Last accessed on 2019 Oct 28].
Vivas, F.J., De las Heras, A., Segura, F., Andújar, J.M. (2018), A review of energy management strategies for renewable hybrid energy systems with hydrogen backup. Renewable and Sustainable Energy Reviews, 82, 126-155.
Ye, B., Zhang, K., Jiang, J., Miao, L., Li, J. (2017), Towards a 90% renewable energy future: A case study of an island in the South China Sea. Energy Conversion and Management, 142, 28-41.

APPENDIX 1

Interviewee	Case	Affiliation
I1	Tilos	University
I2	Tilos	University
I3	Tilos	Euinice
I4	Graciosa	Graciolica
I5	Graciosa	Graciolica
I6	Hierro	Endesa
I7	Hierro	Gorona del Viento
I8	Corsica	University