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Energy profiling of the follower islands' case studies and replicability scenarios construction

Deliverable 10.1

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

Deliverable D10.1
Energy profiling of the follower islands' case studies and replicability scenarios construction

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DELIVERABLE 10.1 – VERSION 2
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R	Document, report (excluding the periodic and final reports)	X
DEC	Demonstrator, pilot, prototype, plan designs	
DEM	Websites, patents filing, press & media actions, videos, etc.	
O	Software, technical diagram, etc.	

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

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

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EXECUTIVE SUMMARY

This report constitutes Deliverable 10.1 of the EU-funded Horizon 2020 project MAESHA presenting the detailed energy databases for six (6) follower islands (Gran Canaria, Favignana, Gozo, Saint Barthélemy, La Reunion, Madeira), the islands' factsheets giving a comprehensive overview of their economy-energy systems, as well as the scenario outline of the long-term assessments of their energy systems.

Section 1 contains a brief overview of the follower islands, their diverse socio-economic and climate features as well as the justification behind their selection for replication. Section 2 provides information on the steps followed in the data collection process, the requested data categories, the data sources, and the respective data gaps and limitations by island. Section 3 provides an overview of the database structure of each island. Section 4 discusses the data gaps and limitations identified for EU islands in several studies related to energy modelling tools and energy system planning for non-interconnected islands. Based on the data collection in the MAESHA follower islands and these studies, this section describes the basic features of a generalised Excel-based data tool-template open for use by island stakeholders and other interested parties. Section 5 presents the process for the development of the factsheets of the follower islands as well as their structure. Section 6 summarises the elements of the scenario outline as well as specific goals or milestones for the energy transition for each island.

The complete energy databases (in Excel format) and the islands' factsheets (in pdf format) are included as annexes to this report.

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NOTATIONS, ABBREVIATIONS AND ACRONYMS

Acronyms	
DSO	Distribution System Operator
E3-ISL	Energy-Economy-Environment island-scale model
EU	European Union
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GVA	Gross Value Added
kWh	kilowatt-hour or 10^3 watt-hours
MWh	megawatt-hour or 10^6 watt-hours
GWh	Gigawatt-hour or 10^9 watt-hours
GHG	Greenhouse Gases
GVA	Gross Value Added
Gp-km	Giga passenger-kilometre, or 10^9 passenger-kilometre (A passenger-kilometre is the unit of measurement representing the transport of one passenger by a defined mode of transport (road, rail, air, sea, inland waterways, etc.) over one kilometre.)
Gt-km	Giga tonne-kilometre, or 10^9 tonne-kilometre (A tonne-kilometre is a unit of measure of freight transport which represents the transport of one tonne of goods (including packaging and tare weights of intermodal transport units) by a given transport mode (road, rail, air, sea, inland waterways, pipeline etc.) over a distance of one kilometre.)
Gv-km	Giga vehicle-kilometre, or 10^9 tonne-kilometre (A vehicle-kilometre is a unit of measurement representing the movement of a vehicle over one kilometre.)
MAESHA	DeMonstration of smArt and flExible solutions for a decarboniSed energy future in Mayotte and otHer European islAnds
MS	Member State
NACE	Nomenclature statistique des Activités économiques dans la Communauté Européenne (Statistical classification of economic activities in the European Community)
NSO	National Statistics Office of Malta
NUTS	Nomenclature des Unités Territoriales Statistiques (statistical breakdown of the European Union to harmonize data production at different scales)
OCT	Overseas Countries and Territories
OR	Outermost Region (most remote regions of the European Union)
PP	Power Plant
PPE	Programmation Pluriannuelle de l'Energie - Multiannual Energy Program
PV	Solar Photovoltaics
RE	Renewable Energy
RES	Renewable Energy Sources
toe	tonne of oil equivalent, or 107 kilocalories, or 41.86 GJ (Gigajoule)
ktoe	thousand toe
UNESCO	United Nations Educational, Scientific and Cultural Organization

1. INTRODUCTION

The work of Task 1.3 and WP2 was focused on the detailed energy profiling and on the comprehensive long-term assessment of energy system configurations of the demonstration island of Mayotte, including the solutions promoted in MAESHA, such as the flexibility solutions, the energy community concepts, etc. After the demonstration, MAESHA aspires to capitalise the activities on the island of Mayotte, assess the replicability of the solutions themselves as well as apply the decision-making tools in follower islands and beyond. The replication of the tools and data templates for the development of transition strategies for the follower islands will lead to the generalisation of a toolkit to be integrated to a user manual, for wide application in other EU islands. In this respect, the project shall not only benefit the six territories plus Mayotte that it directly reaches, but as many insular territories as possible in EU, as in the EU there are approximately 2,400 inhabited islands with a total population of more than 20 million inhabitants.

As in the case of Mayotte, detailed data and information are required to inform the replicability studies as well as the modelling activities for the follower islands in WP10. Task 10.1 aims at a developing detailed energy profiling of the follower islands and provides an initial screening of their energy and economy situation.

This work focuses on a selection of follower islands, including Saint Barthélémy (Caribbean, France), Réunion (Indian Ocean, France), Gran Canaria (Atlantic Ocean, Canary Islands, Spain), Gozo (Mediterranean Sea, Malta), Favignana (Mediterranean Sea, Sicily, Italy), and Madeira (Atlantic Ocean, Portugal). These islands are characterised by diverse geographical locations, energy system scale, and socioeconomic characteristics, offering a broad replicability spectrum.

1.1. RATIONALE BEHIND THE SELECTION OF THE FOLLOWER ISLANDS

The replicability of the solutions proposed in MAESHA will be studied and validated for six follower islands in WP10. Having six follower islands with very different features regarding location and climate, energy system, socio-economic opportunities, RES potential etc. is assumed to be beneficial for the replicability assessment.

In general, the island typology is applied at the level of NUTS regions. Island regions are defined as NUTS level 3 regions (which count between 150 000 and 800 000 inhabitants) within the European Union that are entirely composed of one or more islands. In this context, islands are defined as territories having:

- a minimum surface of 1 km²,
- a minimum distance between the island and the mainland of 1 km,
- a resident population of more than 50 inhabitants,
- no fixed link (for example, a bridge, a tunnel, or a dyke) between the island(s) and the mainland[1].

There are almost 2,400 inhabited islands in the EU with a total population of over 20 million inhabitants, with diverse characteristics depending on the classification, for instance:

- geographical position – close to or remote from the mainland/continental Europe,

[1] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Territorial_typologies_manual_-_island_regions#Published_indicators

- interconnected to the continental power grid or not,
- climatic conditions, which are related closely to the energy needs and services (heating, cooling, etc.),
- surface area and availability of resources,
- demographic and economic conditions – there are densely or diffusely populated islands, etc.

In this context, the follower islands were selected so that they represent a significant share of European citizens (more than 2 million inhabitants), they are spread both in geographical Europe and overseas territories – two islands are located in geographical Europe (Gozo and Favignana), three islands are outermost regions (Réunion, Madeira, Gran Canaria as part of the Canary islands) and an overseas territory (Saint Barthélémy) – and they show different features regarding location and climate, energy system, socio-economic opportunities, RES potential etc. They bring in various contexts and energy system features that will enrich the solutions of MAESHA and ensure its application in different environments to fully exploit the decarbonization potential. Nevertheless, there are also common challenges encountered in insular systems associated with the security of energy supply and the clean energy transition, such as the heavy reliance on imported fossil fuels and the limited local resources. The diverse profiles of the follower islands will prove that MAESHA solutions can be replicable and adaptable to a large spectrum of islands.

Table 1 Comparative overview of key features of the follower islands.

Follower island	Status	Population (inh.)	Interconnection	Climate	Area (km^2)
Gran Canaria	OR	865,756	NO	subtropical	1,560
Gozo	Part of insular MS	39,287[2]	YES	mediterranean	67
Saint-Barthélémy	OCT	9,961	NO	tropical	25
Favignana	commune	3,407	NO[3]	mediterranean	37
Madeira	OR	251,060	NO	humid subtropical	801
Réunion	OR	859,959	NO	tropical	2,512

1.2. BRIEF OVERVIEW OF THE FOLLOWER ISLANDS

This section summarises the basic features of the six (6) follower islands in terms of geographical location, socioeconomic and political status and climate.

[2] Including Comino

[3] There are current discussions and plans for the interconnection of Favignana to the national power grid via Sicily (https://www.isolesostenibili.it/en/2021/07/12/piano-di-sviluppo-terna-due-nuovi-cavi-sottomarini-per-lisola-del-giglio-e-favignana/)

Figure 1: Location of the follower islands in the world map.

1.2.1. Saint-Barthélémy (Caribbean, France)[4]

Saint-Barthélémy, officially “Collectivité territoriale de Saint-Barthélémy” is an overseas collectivity of France (collectivité d'outre-mer) in the Caribbean. The collectivity is one of four territories among the Leeward Islands in the northeastern Caribbean that form the French Antilles, along with Saint-Martin, Guadeloupe, and Martinique.

Saint-Barthélémy is at the Greater and Lesser Antilles junction, 230 km northwest of Guadeloupe and 25 km southeast of Saint-Martin. Its surface area is 21 km^2 (25 km^2 including islets), and its population is 10,464 inhabitants (2021 census).

The Gross Domestic Product reaches 367 million € (2014), and the GDP per capita is €38,994 (2014). The economy of Saint-Barthélémy is based on high-end tourism and duty-free luxury commerce, serving visitors primarily from North America. The construction and public sectors also enjoy significant investment in support of tourism. With limited freshwater resources, all food must be imported, along with energy resources and most manufactured goods and products. The tourism sector creates a strong employment demand and significant revenues.

The climate of Saint-Barthélémy is maritime tropical. There are two seasons: a dry season called “Lent” from December to May and a rainy season called “Winter” from July to October. Temperatures vary from 27° in winter to 30° in summer. Although sunshine remains essential throughout the year, rainfall remains a variable aspect of the climate. However, there is more rain during the cyclone season in the winter.

Saint-Barthélémy's blueprint for its energy transition is encapsulated in its Multiannual Energy Program (Programmation Pluriannuelle de l’Energie (PPE) de Saint-Barthélémy). According to the PPE, the island anticipates limiting the maximum annual growth of electricity consumption by +5% in 2023-2028 and by +3% in 2029-2033. The PPE also sets ambitious targets for the deployment of renewable energy sources by 2033, coupled with battery storage. The overarching objective is to achieve 50% and 100% penetration of renewable energy in the power sector in 2028 and in 2033 respectively.

[4] https://www.overseas-association.eu/oct/saint-barthelemy/

1.2.2. Gran Canaria (Canary Islands, Spain)

Gran Canaria is the fourth largest (1,560 km^2) and third most populated island in Spain, located in the Atlantic Ocean in a region known as Macaronesia about 150 km off the northwestern coast of Africa and about 1,350 km from Europe and is part of Spain. As of 2023, the island had a population of 862,893 inhabitants, constituting approximately 40% of the archipelago's population. Las Palmas is the capital of Gran Canaria.

Gran Canaria is considered a desert climate due to its severe lack of precipitation. Gran Canaria has consistent warm temperatures in spring, summer and autumn, and mild winters. Gran Canaria is noted for its rich variety of microclimates. The average daytime high ranges from 20 °C in winter to 26 °C in summer. Some cool nights occur in winter, but lows below 10 °C are unknown near the coast. Inland, the climate is still mild, but mountainous areas see the occasional frost or snow. Different climates and a variety of landscapes characterize this island. One-third of the island is protected as a Biosphere Reserve by UNESCO.

Most of the Canarian economy focuses on tourism, accounting for up to 36% of the gross income of the island. The Canary Islands attracts millions of tourists every year. Besides that, locals rely on the agrifood industry, related to sugarcane, tropical fruits, vegetables, and rum.

Apart from the Integrated National Energy and Climate Plan of Spain (PNIEC 2021-2030), the Canary Islands have a separate concrete and ambitious policy agenda for clean energy development – Canary Islands Energy Transition Plan (PTECan) – aiming at the decarbonization of the Canarian economy by 2040, including road, domestic maritime and air transport. The Government of the island (Cabildo of Gran Canaria) promotes Local Energy Communities and Industrial Energy Communities. Currently, five (5) Local Energy Communities (4.2 MW) and four (4) Industrial Energy Communities (8.6 MW) are located in the island.

1.2.3. Gozo (Malta)

Gozo island is part of the Republic of Malta, and along with the island of Malta and Comino form the Maltese archipelago. The surface area is 67 km² and lies approximately 6 km northwest of the nearest point of Malta. The island of Gozo is approximately in the centre of the Mediterranean Sea between the island of Sicily in Italy and North Africa.

As of 2021, the island has a population of 39,287 inhabitants, of whom 7,242 live in its capital city Victoria. Since the 2011 census, the population increased by 25%. Currently, the island is reachable by ferry and seaplane. Passenger and car ferries cross regularly between the port of Mġarr on Gozo and Ċirkewwa on Malta. The Gozitan economy rests upon small and medium enterprises and tourism[5]. Furthermore, Gozo's agriculture and fishing sector is much larger than that of the Maltese Islands as a whole.

In line with Malta's Low Carbon Development Strategy, the Government of Malta has declared its intention to make the island of Gozo carbon neutral. In particular, the Gozo Regional Development Strategy as published by GDRA consists of various measures which promote sustainable development on the island. Moreover, the Gozo Regional Development Strategy declares the intention of Gozo to support the energy transition at the regional level as part of the 100 Climate-Neutral and Smart Cities initiative under the EU Horizon Programme [GRDA, 2023].

1.2.4. Favignana (Italy)

[5] https://gozobusinesschamber.org/gozo/

The Egadi Islands archipelago consists of three main islands: Favignana, Marettimo and Levanzo; its geographical location is about 17 km from the north-western coast of Sicily, administratively belonging to the Trapani province. Favignana is the largest of the three Egadi Islands, with a land area of 19.8 km^2.

The Egadi Islands are of a Mediterranean climate, characterized by hot, dry summers and mild winters with moderate rainfall concentrated in the autumn-winter periods. To date, no thermo-pluviometric stations are installed in the islands' territory, so it is only possible to estimate rainfalls based on the conditions measured by the stations in the Trapani area.

As of 2024, the population of the Egadi islands amounted to 4,513 inhabitants, mainly concentrated on the island of Favignana, the administrative centre of the archipelago, accounting for 75-80% of the total Aegadean population. Given the reliance of the archipelago on tourism, the resident population fluctuates between the summer and winter, peaking at around 60,000 people. The island of Favignana is famous for its tuna fisheries and is now a popular tourist destination with frequent hydrofoil connections to the mainland[6].

Apart from the national energy and climate plan and strategies that affect the transition of Favignana, the PEARS 2030 (Energy and Environmental Plan of the Sicilian Region) has outlined specific goals for the Minor Islands Programme, per the Ministerial Decree 14/02/2017. The PEARS 2030 plan is aligned with the broader objectives of the Clean Energy for EU Islands initiative[7].

1.2.5. La Réunion (Indian Ocean, France)

La Réunion, officially the Department of Réunion, is an island in the Indian Ocean, 9000 km away from Paris[8], and an overseas department and region of France (Département et Région d'Outre-Mer), and, consequently, one of the outermost regions of the European Union, under which the laws and regulations are applicable as of right, as in metropolitan France. The island is part of the Mascarene Islands; it is located approximately 679 km east of the island of Madagascar. The estimated population as of January 2024 is 885,700 inhabitants[9]. Its capital and largest city is Saint-Denis.

The island covers 2,503 km^2. It is characterised by a humid tropical climate tempered by the oceanic influence of the trade winds blowing from east to west. The environment of La Réunion is characterised by numerous microclimates. In La Réunion, there are two distinct seasons, defined by the rainfall regime: a rainy season from January to March, during which most of the year's rain falls, and a dry season from May to November. April and December are transition months; sometimes, there are heavy rainfalls but also very dry periods. Temperatures in La Réunion are characterised by their great mildness throughout the year (November to April: temperature ranges between 21°C and 31°C on the coast, while from May to October, temperatures at sea level vary from 17°C to 28°C).

Along with the French overseas department of Mayotte, the island is one of the two eurozone areas in the Southern Hemisphere. The GDP of La Réunion was 18,693 million Euros (constant prices – base year 2019) and the GDP per capita was 21,658 euros in 2020. Tourism is an integral part of La Réunion's economy, ahead of sugarcane production and processing. Fisheries and agriculture are essential

[6] https://clean-energy-islands.ec.europa.eu/system/files/2023-01/CETA%20Favignan%20Jan%202023.pdf
[7] This project is a European Union initiative that seeks to transform islands into self-sufficient, clean energy hubs. One of the islands under this project is Favignana. (https://clean-energy-islands.ec.europa.eu/)
[8] https://ec.europa.eu/regional_policy/sources/policy/themes/outermost-regions/rup_2020/2020_reunion_factsheet_en.pdf
https://ec.europa.eu/regional_policy/sources/policy/themes/outermost-regions/rup_2020/2020_reunion_factsheet_en.pdf
[9] https://www.insee.fr/fr/information/2018985

activities in the island's economy: the agricultural territory covering 20% of the island's surface area employs 10% of the active population, generates 2% of the gross regional value-added and provides the island's main export.

The island of La Réunion, as part of France, follows all national energy and climate laws. The energy transition goals in France are defined by the Pluriannual Energy Programming (PPE) which targets self-sufficiency for the Overseas Territories, including La Réunion, by 2030. The latest revised PPEs for the period of the MAESHA project are those for 2019/2023 and 2023/2028.

1.2.6. Madeira (Portugal)

Madeira, officially the Autonomous Region of Madeira, is one of two autonomous regions of Portugal, the other being the Azores. It is an archipelago in the North Atlantic Ocean, in a region known as Macaronesia, just under 400 km north of the Canary Islands and 520 km west of Morocco. It has an area of 801 km^2. Its population was 256.6 thousand inhabitants in 2023. The capital of Madeira is Funchal, located on the south coast of the main island. Roughly half of the region's population lives in Funchal. Madeira generally has a mild and moderate subtropical climate with Mediterranean summer droughts and winter rain.

Madeira is also an Outermost Region of the European Union. Due to its geographical situation, it is entitled to derogation from some EU policies despite being part of the European Union. The region's gross domestic product (GDP) was 5,026 million euros in 2021 (current prices), accounting for 2.4% of Portugal's economic output. Data from 2021 recorded GDP per capita of 19,889 Euros, approximately half of the Euro area average. Trade and tourism contribute 27% to the region's economy.

Madeira is an example of an island frontrunner in the energy transition who has developed and implemented action plans with concrete objectives on multiple fronts. Madeira set the priorities of its clean energy transition back in 2012 with the Sustainable Energy Action Plan (SEAP-RAM, 2012), which was updated in 2022 with the Sustainable Energy and Climate Action Plan (SECAP-RAM, 2022). It is committed to reducing its energy intensity and carbon footprint, improving the security of energy supply, and reducing dependence on fossil fuel imports. Another key strategic document, the Sustainable Urban Mobility Action Plan (PAMUS RAM, 2019), aims to provide sustainable, high-quality mobility and transport in the Portuguese region. It was released in 2019.

2. Data Collection

2.1. Collection process and templates

In general, the data collection in Task 10.1 was a collaborative process in which various MAESHA partners were involved in identifying, collecting, reviewing, and categorising the different data categories for the follower islands in a structured way. The data collection process for the follower islands followed roughly the same steps as the data collection for Mayotte in Task 1.3, taking stock and leveraging the data templates, questionnaires and data mapping tools developed in Task 1.3.

The first sub-task of the Task 10.1 was the identification of the data requirements for the modelling work and replicability studies in WP10. For this subtask, the list with all the data categories of WP2 was used. The WP10 Task Leaders completed this list with additional items, such as social statistics and metrics related to energy communities since the work of WP10 has a broader spectrum, compared to WP2.

Based on this list, the data templates developed in Task 1.3 were further adjusted for the follower islands by E3Modelling:

- An Excel file (WP10_Data mapping template) containing the list of all the categories, the requested level of detail, the task/deliverable associated with it, comments, and data sources.
- An Excel file (ESTDataTemplate_1) regarding socio-economic factors (including GDP, sectoral production, and labour market data) and demand-side energy data for buildings, industries, and transport sectors.
- An Excel file (ESTDataTemplate_2) includes all necessary supply-side data (focusing on power generation mix and electricity-producing technologies) and fuel prices.
- A Word file (Additional instructions) was a technical guide for filling in the Excel templates. It included a questionnaire on possible new energy projects and existing energy, transport, and climate policies.

These data templates were shared with the partners from the follower islands and several bilateral and multilateral meetings were organised to provide the necessary clarifications to the partners regarding the data categories requested. The partners initially indicated which data categories are applicable and which data are available as well as possible data sources, using the data mapping tool. Most of data were requested for the long-term energy assessments.

The key categories considered are: energy balances, electricity balances, existing power capacities by plant type, renewables' potential, population, GDP, sectoral GVA, social statistics, vehicle stock and transport activity, electricity and imported fuel prices, etc.

After receiving all the databases, E3M prepared a compiled Excel database for each island, including the data gathered by the partners and additional data based on desktop research. A single data mapping file was also created, compiling the availability of data categories and data gaps by island and the relevant data sources according to the "WP10_Data mapping template" categories (Annex II).

2.2. Data Sources and Limitations

2.2.1. Saint-Barthélémy

The following table summarises the key data categories for which data are available.

Table 2 Main data categories and sources for Saint Barthélémy database.

Data	Sources
- Power system data – consumption & supply (2015-2022)	- EDF - Electricity of France.
- Consumption of oil products	- Collectivite de Saint Barthelemy
- Existing power capacities, RES potential	- EDF - Electricity of France.

- Population, GDP	- CEROM - Comptes Économiques Rapides pour l'Outre-mer. - INSEE - French National Institute of Statistics and Economic Studies.
- Vehicle stock	- LOGICARTES - Directorate of Road Traffic and Transport - Saint-Barthélemy.
- Power system scenarios till 2040	- Multiannual Energy Program (PPE), 2022
- Electricity prices	- CRE, the French Energy Regulatory Commission.

As an overseas country and territory (OCT), Saint-Barthélémy depends on France with which it maintains special links. The OCTs have wide-ranging autonomy, covering areas such as economic affairs, employment market, public health, home affairs and customs, while defence and foreign affairs usually remain within the remit of the Member States[10]. The most recent GDP data available for Saint-Barthélémy is still for 2014 from the IEDOM - Overseas Emission Institute – there are no data on economic accounts for the last 10 years. No relevant data are available from National Institute of Statistics and Economic Studies of France (INSEE). Instead, other economic indicators, such as company activity (as of 2017), could be used as a proxy for the economy. Saint-Barthélémy does not impose VAT (Value Added Tax), income, wealth, or inheritance taxes[11]. Nevertheless, INSEE provides population data from 2014-2023. In the last three years, data on transportation by type have been available from the regional authority of vehicle stock (LOGICARTES).

Regarding energy system related data, energy balances or data on final energy demand by sector are not available. EDF Energy is the primary electricity supplier, the owner of the main power plant and the DSO on the island. Thus, they provide data on the total power generation, the fuel consumption in the power plant and electricity prices. To date, there are off-grid rooftop solar PV installations, used only for self-consumption in Saint-Barthélémy. Nevertheless, individual meters are not in place, thus the PV generation (and consumption) is not known. No commercial or utility solar PV plants connected to the public grid are installed on the island as of 2022.

Valuable energy consumption data could be obtained from the Multiannual Energy Program (PPE) of Saint-Barthélémy, that contains the most current and planned energy scenarios, including power capacities and projected penetration of Renewable Energy Sources (RES). The island does not produce primary fuel.

2.2.2. Gran Canaria

Gran Canaria provides comprehensive data through the ISTAC (Canarian Institute of Statistics), including GDP and GVA per sector. The granularity of some data, such as sectoral value added in manufacturing or the split of fuel consumption by sector of activity, may be low. Information on the electricity balance (power demand and supply) is available in detail, but full energy balances are missing.

[10] https://www.eeas.europa.eu/node/410670_fr

[11] https://www.globalexpansion.com/hubfs/Countrypedia%20PDFs/In%20use/Saint%20Barthelemy%20-%20Global%20Expansion%20Guide.pdf

ISTAC also provides detailed data on socio-economic factors, transport activity and stock by mode, and information on the power sector. The inventory of power plants is documented, including details on the vintage, the input fuel and technology, commissioning year, and capital and O&M costs.

The Canary Islands Energy Transition Plan (PTECan) is a significant document for the transition, that the WP10 partners could use for the development of the long-term energy transition pathways, although information specifically for Gran Canaria in the context of the Energy Transition plan is limited. Information on energy communities is also available.

Table 3 Main data categories and sources for Gran Canaria database.

Data	Sources
- Power system data – consumption & supply - Energy demand	- CIEGC – Gran Canaria Island Energy Council - ISTAC – Canarian Institute of Statistics.
- Existing power capacities, RES potential	- PTECan - MITECO – Ministry of Environment – Spain. - DGE – Directorate-general for Energy (Dirección General de Energía) – Canary Islands - CIEGC – Gran Canaria Island Energy Council.
- Population, GDP, GVA - Vehicle stock and transport data	- ISTAC – Canarian Institute of Statistics.
- Power system scenarios till 2040	- PTECan - MITECO – Ministry of Environment – Spain.
- Electricity prices - Fuel prices	- REE – Transmission System Operator – Red Eléctrica de España. - Anuario Energético de Canarias 2022

2.2.3. Gozo

Gozo is an integral part of the Republic of Malta. All relevant publicly available datasets, mostly included in the National Statistics Office of Malta (NSO) and EUROSTAT-NUTS3 statistical tables, treat Gozo and Comino as a single region, and thus data refer to both. The Gozo-specific datasets are restricted to data regarding:

- Population, gross domestic product and sectoral distribution of GVA
- Stock of road vehicles by type
- Local annual solar PV capacity and PV production

Enemalta, Malta's DSO, provides data on hourly power supply for Gozo upon request. The local MAESHA partner obtained the hourly load and hourly PV production values for 2018. These data for Gozo are not publicly available. However, other key data categories, such as complete energy balances, transport passenger and freight activity are not available for Gozo in particular, but only for the entire archipelago.

There are concrete plans for the clean transition of Gozo, included in the Gozo Regional Development Strategy and the National Energy and Climate Plan of Malta.

Table 4 Main data categories and sources for Gozo database.

Data	Sources
- Hourly power supply data	- Enemalta
- Existing power capacities, RES potential	- REWS - Regulator for Energy and Water Services. - MRA - Malta Resources Authority. - NSO - National Statistics Office - Malta.
- Population, GDP, GVA - Vehicle stock by type	- NSO - National Statistics Office - Malta.
- Power system scenarios till 2050[12]	- Ministry for the Environment, Climate Change and Planning
- Electricity prices	- REWS - Regulator for Energy and Water Services.

2.2.4. Favignana

In terms of data limitations, Favignana is similar to the Gozo case, as this small island is part of Egadi Islands and an integral part of Italy. The National Institute of Statistics of Italy provides Favignana-specific information only on the population time-series data from 2020 to 2024. Specific data and information on Favignana are obtained from the Sustainable Islands' Observatory[13] as well as the GIFT (Geographical Islands Flexibility) and ESCAPE (Clean Energy for EU islands)[14] project reports.

The Sustainable Islands' Observatory has most of the data for the Egadi Islands regarding infrastructure, e.g., desalination systems, water network, waste sorting, transport, installed capacity, and RE penetration. The EU project GIFT[15] presents data on the energy profiling of Favignana, including climate data, and a summary of short-term energy developments. The ESCAPE[16] report provides information on the energy system of the Egadi Islands – Favignana, Levanzo, Marettimo – such as final energy consumption by fuel, transport stock, power plant capacities, emission data and an analysis of the solar PV and wind potential on the island.

Table 5 Main data categories and sources for Favignana.

Data	Sources
- Power system data	- Sustainable Islands Observatory on smaller Italian islands.

[12] For the Republic of Malta.

[13] The Sustainable Islands Observatory promoted by Legambiente and the National Research Council (CNR-IIA) aims to contribute to telling what is happening in the smaller Italian islands in the energy, water, waste and mobility sectors, and to stimulate with reports, workshops, news and exchanges of experiences an acceleration in the push for a sustainable transition.

[14] The ESCAPE project concerns the development of a Clean Energy Transition Agenda (CETA) for the Egadi Archipelago, including the islands of Favignana, Levanzo and Marettimo.

[15] Link: https://www.gift-h2020.eu/

[16] The ESCAPE project concerns the development of a Clean Energy Transition Agenda (CETA) for the Egadi Archipelago, including the islands of Favignana, Levanzo and Marettimo. The island team applied for the technical assistance of the Clean energy for EU islands secretariat during the first call in May 2021, in order to get support for the CETA development.

- Vehicle stock and transport data	- ESCAPE project report (2023)
- Existing power capacities, RES potential	- GIFT European project. - ESCAPE project report (2023) - PEARS (Energy and Environmental Plan of the Sicilian Region) 2030
- Population, GDP, GVA	- Clean Energy for EU Islands Secretariat. - ISTAT

2.2.5. La Réunion

La Réunion counts on the National Institute of Statistics and Economic Studies of France (INSEE) as the leading official with a full report on the economic and social panorama: population and population distribution by age/sex/education/unemployment/language, GDP, sectoral GVA, income per capita, average household size, household income.

Energy- and climate-related data is mainly provided by the island's Energy Observatory, which includes the complete energy balance, emission inventories, and the power plant inventories. EDF's local department on the island also provides gross electricity production and electricity use per sector for its installations.

Transport road stock data by type and vintage are publicly available from the DGITM—Direction Générale des Infrastructures, des Transports et des Mobilités.

Table 6 Main data categories and sources for Réunion.

Data	Sources
- Power system data – consumption & supply (2015-2022)	- IEDOM - Overseas Emission Institute (Saint-Barthélemy Agency). - IGEDD – General Inspectorate for the Environment and Sustainable Development. - OCTA - Association of the Overseas Countries and Territories of the European Union.
- Energy balances	- OER - Energy Observatory – Reunion.
- Existing power capacities, RES potential	- EDF - Electricity of France.
- Population, GDP	- CEROM - Comptes Économiques Rapides pour l'Outre-mer. - INSEE - French National Institute of Statistics and Economic Studies.
- Vehicle stock	- DGITM – General Directorate of Infrastructure, transport, and mobility.
- Power system scenarios till 2040	- Pluriannual Energy Programming (PPE 2019 -2028).

- Electricity & fuel prices	- EDF Reunion. - Press communication of the local government

Most of the requested data were available and in adequate resolution.

2.2.6. Madeira

DREM, the Regional Directorate of Statistics of Madeira is the main data repository and data provider for Madeira. The DREM provides data and information on population, population distribution by age/sex/education/unemployment/language, GDP, GVA, income per capita, average household size, household income, industrial production, and household equipment. INE (Statistics Portugal) includes also figures relevant to Madeira. The following table includes the main data categories gathered for Madeira.

Table 7 Main data categories and sources for Madeira.

Data	Sources
– Energy balances until 2022	– DGEG, General Directorate of Energy and Geology.
– Existing power capacities, RES potential	– EEM, Electricity Company of Madeira.
– Population, GDP, GVA	– INE – Statistics Portugal. – DREM - Regional Directorate of Statistics of Madeira.
– Vehicle stock and transport data	– INE – Statistics Portugal. – DREM - Regional Directorate of Statistics of Madeira.
– Power system scenarios till 2050	– SECAP, AREAM
– Electricity and fuel prices	– DREM - Regional Directorate of Statistics of Madeira. – ERSE - Energy Services Regulatory Authority – DRETT - Regional Directorate of Economy and Land Transport

Most of the requested data were available and in adequate resolution.

3. Structure of the Databases

Annex 1 includes the list of the Excel databases. The first sheet of the databases of the follower islands describes briefly the data included in each sheet and allows the user navigation across the sheets. The following sub-sections present an overview of the available data and the sheet "Contents" for each island.

3.1. Saint Barthélémy

The provided data are summarized in *Figure 2*. The database includes time-series data on population (2014 - 2023), GDP (2010 - 2014), and the employment rate for 2019. There are also proxy indicators that could be used for the structure of the economy, such as company activity for 2015 and 2017 and the employment breakdown. Transport stock data is provided for road vehicles, including private cars, trucks, buses, and two-wheelers.

The data set includes data for the energy consumption and the prices of oil products, electricity end-user prices per type of consumer and local taxes. Information is provided on the diesel plant owned by EDF that supplies the island, as well as data on the planned expansion of the power capacities (wind, solar power, and biomass).

The data set also includes the link to a study presenting the public perception of climate change and willingness for social participation in the climate change combat.

#	Sheet Name	Description
1	Socio-economic data	Population data from 2014-2023, GDP for 2014. Proxy indicators for economy such as, company activity 2015 and 2017.
2	Energy	Time series data on final energy consumption, consumption of oil products and electricity production by plant type.
3	Transport	Transport stock data for road vehicles - private cars, trucks, buses, and two-wheelers.
4	Fuel Prices	Prices of oil products and electricity by consumer category, including fuel taxes.
5	Power plants	Information on the diesel motors from EDF.
6	Social statistics	Studies presenting the public perception on climate change and willingness to have solar panels.
7	NACE	Mapping of sectors used in the sheet "Socio-economic Data" according to NACE Rev.1 and NACE Rev.2 classifications.
8	Notes	Notes on the units & abbreviations.

Contents | Socio-economic data | Energy | Transport | Fuel Prices | Power plants | ...

Figure 2: Sheet Contents of the Saint Barthélémy database.

3.2. Gran Canaria

The provided data, summarized in *Figure 3*, include demographic information such as population, labour force, number of households, and economic data like GDP and GVA, as well as information on the penetration of appliances in households. Data related to the stock of vehicles per transport mode and input fuel, including road, maritime, and air as well as the energy consumption in transportation, are available.

Electricity balances are accommodated in the dataset. It also contains an inventory of Gran Canaria's power plants including the industrial plants by industrial sector and by technology type, containing the installed capacity, year of commissioning, investment and maintenance costs, net and gross capacity, units, heat rates, and maximum operating hours. Hourly load data for 2022, including capacity factors for wind and solar PV, as well as end-user electricity prices are included.

#	Sheet Name	Description
1	Socio-economic Data	Demographic data such as population, labor force and number of households as well as economic data like Gross Domestic Product, Gross Value Added, sectoral value added, etc. Measurement of industrial production (unavailable).
2	Transport stock	Data related to the stock of vehicles and traffic in terms of passengers and freight per transport mode (road, maritime)
3	Transport vintages	Detailed information on road stock and vintages for four different age segments. Navigation stock not available.
4	Transport energy	Transport energy consumption by liquid fuels and LPG (ktoe). Inland navigation in liquid fuels (ktoe).
5	Transport traffic	Maritime and aviation data on passengers and freight transported.
6	Electricity Prices	End-user electricity prices in April, 2024 and cost of electricity production for Gran Canaria.
7	Other Fuel Prices	After-tax/End-user price in EUR/MWh fuel and electricity. Pre-tax price(*) in EUR/MWh fuel, Excise taxes in EUR/MWh fuel and Value Added Tax (VAT) in % for: Diesel, Gasoline and LPG (Industry),
8	Electricity consumption	Breakdown of final energy consumption by end-use sector, data for electricity.Final Electricity Consumption (MWh) for sector and sub-sectors with EUROSTAT code identification.
9	Electricity supply	Electricity supply of Gran Canaria by plant type for 2020-2022.
10	Hourly load data	Hourly load data (MW) for 2022 including Capacity Factors for Wind and Solar.
11	Power plant inventory	Power plant inventory of Gran Canaria power system and relevant details, technology type, installed capacity, year of commissioning, investment and maintenance costs, net&gross capacity, units, heat rates and maximum operating hours.
12	Industrial plant inventory	Industrial plants with energy production (e.g cement, glass, steam and industrial gases). Details on type of fuel, comissioning year, economic and technical lifetime.
13	Additional power data	Additional data for losses in medium-low voltage transmission grid (% final demand).
14	Primary Production	Primary/Indigenous production of fuel not present in Gran Canaria.
15	GHG	Annual GHG emissions per energy sector in Ktn CO2-eq.
16	NACE	Mapping of sectors used in the sheet "Socio-economic Data" according to NACE Rev.1 and NACE Rev.2 classifications.
17	Notes	Notes on the units & abbreviations.

Contents | Socio-economic Data | Transport stock | Transport vintages

Figure 3: Sheet Contents of the Gran Canaria database.

3.3. Gozo

The list of data for Gozo is shown in *Figure 4*. Indications are added on whether the data are referring only to Gozo (inc. Comino) or the Republic of Malta in general.

The data specifically for Gozo are limited and concern mainly the demographic and economic data, the road transport fleet by type of vehicle as well as the installed solar PV capacities as well as the electricity consumption.

#	Sheet Name	Description
1	Socio-economic data	Demographic data such as population, labor force and number of households as well as economic data like Gross Domestic Product, Gross Value Added, sectoral value added, etc.
2	Industrial Production	Measurement of industrial production, data solely for Nonmetallic Minerals (e.g. Stone Clay, Cement Sector)
3	Transport stock	Data related to the stock of vehicles and traffic in terms of passengers and freight per transport mode (road, maritime, air).
4	Fuel Prices	After-tax/End-user price of electricity. Pre-tax price(*) in EUR/MWh fuel, Exercise taxes in EUR/MWh fuel and Value Added Tax (VAT) in % for: Coal, Natural Gas, Electricity, Heat/Steam and Diesel.
5	Power demand & supply	Data on the capacity of the grid-connected PVs, estimated total GWh produced and electricity consumption by sector.
6	Hourly load data	Hourly load data (MW) for 2018 including imports from Malta and capacity factors for solar.
7	NACE	Mapping of sectors used in the sheet "Socio-economic Data" according to NACE Rev.1 and NACE Rev.2 classifications.
8	Notes	Notes on the units & abbreviations.

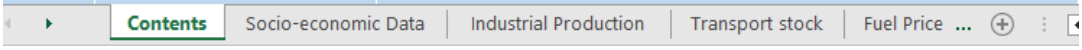

Figure 4: Sheet Contents of the Gozo database.

3.4. Favignana

A summary of the data collected for Favignana is presented in the sheet “Contents” as depicted in *Figure 5*.

The public databases and statistical information usually treat all three Aegadian islands as a single entity. Most of the data acquired for Favignana specifically derive from the ESCAPE project of the Clean Energy for EU Islands Secretariat and concern the population, the power plant information as well as the electricity consumption and the stock of vehicles on the island.

#	Sheet Name	Description
1	Socio-economic Data	Information of population for Favignana island from 2020-2024.
2	Energy	Final energy demand per sector for 2019-2020 Additional information on installed capacity & RES potential for Favignana and the other Aegadian Islands.
3	Transport	Information on vehicles for the Aegadian Islands.
4	Emissions	Data on energy-related emissions for the Aegadian Islands.
5	Fuel prices	Information on the fuel price of oil products for the Aegadian Islands.
6	NACE	NACE classification codes used in the "Socio-economic Data" sheet.
7	Notes	Notes on the units & abbreviations.

Contents | Socio-economic data | Energy | Transport | ...

Figure 5: Sheet Contents of the Favignana database.

3.5. La Réunion

The data gathered for La Réunion is presented in *Figure 6*. Energy balances from 2015 to 2022, the complete power plant inventory, including relevant details such as location, technology type, installed capacity, and year of commissioning as well as key macroeconomic figures are among the data included in the database.

#	Sheet Name	Description
1	Socio-economic Data	Demographic data such as population, labor force and number of households as well as economic data like Gross Domestic Product, Gross Value Added, sectoral value added, etc.
2	Transport stock	Data related to the stock of vehicles and traffic in terms of passengers and freight per transport mode (road, maritime, air)
3	Transport stock_vintages	Road stock segregated by type and vintage.
4	Energy Balances 2015-2022	Energy Balances from 2015 to 2022. Data of primary, secondary energy production. Energy distribution and Final Energy Consumption (French).
5	Power plant inventory	Power plant inventory of La Reunion power system and relevant details, such as location, technology type, installed capacity, year of commissioning.
6	Electricity prices	Pre-tax electricity prices by type of consumer for 2024.
7	Primary Production	No local primary production of those specific primary fuel.
8	GHG	Green Hous Gas emissions for the following sectors, waste treatment, services, agriculture, transport and supply: power generation and others.
9	Social statistics	Social statistics including age distribution, migration, religions, languages, education Unemployment rate.
10	NACE	Mapping of sectors used in the sheet "Socio-economic Data" according to NACE Rev.1 and NACE Rev.2 classifications.
11	Notes	Notes on the units & abbreviations.

Contents | Socio-economic Data | Transport stock | Transport stock_vintages | Energy Balances 2015 ...

Figure 6: Sheet Contents of the Réunion database.

3.6. MADEIRA

Figure 7 depicts the complete list of demographic, economic, energy and market-related data gathered for Madeira. Details on energy projects planned by the government for the 2021-2030/2050 horizon in sustainability projects and the Recovery and Resilience Plan (RRP) are included. Additionally, it contains the key socio-economic challenges, a list of plans and studies on energy cooperatives and energy communities.

#	Sheet Name	Description
1	Socio-economic Data	Demographic data such as population, labor force and number of households as well as economic data like Gross Domestic Product, Gross Value Added, sectoral value added, etc. International Trade in Goods: Exports by Product Group.
2	Households Data	Demographic and structural indicators as well as penetration of appliances in households.
3	Transport	Data related to the stock of vehicles and traffic in terms of passengers and freight per transport mode (road, maritime, air)
4	Fuel prices	Formulation of electricity tariffs by type of purchase contract and customer type (subsciption by year and month, pre-tax tariffs in peak and off-peak hours, taxes) and RES tariffs. Prices of the main fuels (EUR/MWh).
5	Energy balances 2019-2022	The latest energy balances of Madeira (2019-2022).
6	Electricity consumption	Electricity consumption by activity sector and type in the autonomous region of madeira (KWh). Number of registered UPACs, installed power and estimated production.
7	Demand projections	Final energy demand in 2019 in MWh per sector and type of fuel. Includes the Final Energy Demand of the Action Plan Scenario of 2030 and 2050.
8	Power plant inventory	Power plant inventory of Madeira power system, name, technology type, fuel and installed capacity.Planned power plant projects in Madeira, technology type, installed capacity, expected year of commissioning.
9	Electricity Balance	Electricity balance, Transformation Input/Output [Gross], Losses, Final consumption and Self-Consumption of Electricity in the Autonomous Region of Madeira.
10	Hourly Load Data	Voltage and Frequency data of Madeira power system with 15-minute resolution. Data from 2019 but also available for 2018.
11	Other Power sector data	Maximum resources Power and Production, Power Reserves info not applicable.
12	Primary Production	Primary/Indigenous production of fuel not present in the Autonomous Region of Madeira.
13	GHG emissions	Annual GHG emissions per energy sector in tn CO_2-eq.
14	Social Statistics	Resident population, according to age group and gender. Distribution per language, religion, and education. Employment status, conditions of accomodation. Access to water.
15	Social studies	Detailed data under the categories: Climate change/renewable energy sources: awareness, knowledge and initiatives; Social cohesion/trust in community/willingness to participate in social/environmental projects; Current key socio-economic challenges; List of Plans and studies; Energy cooperatives and Energy Communities.
16	NACE	Mapping of sectors used in the sheet "Socio-economic Data" according to NACE Rev.1 and NACE Rev.2 classifications.
17	Notes	Notes on the units & abbreviations.

Contents | Socio-economic Data | Households data | Transport | Fuel P

Figure 7: Sheet Contents of the Madeira database.

4. DEVELOPMENT OF THE GENERALIZED DATA TOOL

Energy profiling and data analysis is the initial milestone for the development, quantification, and assessment of the energy transition pathways for a specific region. Following the demonstration case of Mayotte, a user-friendly data processing routine has been applied for the data screening of six follower islands. Data analysis and energy profiling has been extended to the follower islands. Based on the application on seven EU islands, this tool has been generalized to ensure wide use from island actors and stakeholders in other islands.

This generalized data tool will be distributed to other islands beyond MAESHA via the communication channels of the partners (e.g., CPRM, GTI). This tool will enable the analysis of island solutions' potential, aiding internal debates on their applicability in island energy systems.

Research studies in the field further substantiate the necessity and the potential broad applicability of this tool. Liu et al. (2018) reviewed eleven bottom-up models and relevant energy system studies in isolated areas, including islands:

- EnergyPLAN, a deterministic model that optimizes a given energy system's operation, has been applied in Ireland.
- LEAP, an integrated, scenario-based modelling tool, has been used on the island of Crete for long-term national energy planning.
- TRNSYS evaluated system performance on the island of Utsira in Norway.

As highlighted in the paper, isolated areas have unique features that could challenge the energy demand forecasting accuracy, such as the unavailability of past data. To surpass the data scarcity, these studies used certain assumptions, based on cases with similar energy systems and economic profile or supported by other methods developed and applied to address such uncertainties and gaps such as stochastic mathematical programming (SMP), etc. For instance, Voyant et al. (2009) used ANN (Artificial Neural Networks) to predict the performance of a PV power grid on the island of Corsica, where the meteorological data was poor. Despite the development and application of various energy models, there is yet to be an existing generic energy model that could fully address the energy planning issues for the isolated areas. This is due to challenges like data collection, the involvement of distinctive characteristics, the intrinsic intermittence of RE, and the practical needs for different isolated areas.

4.1. DATA GAPS IN EU ISLANDS

Data gaps in insular energy studies are discussed in the work of Blechinger et al. (2016), which provides a global overview of the small island landscape and identifies an important issue: the need for a comprehensive global database with crucial information such as the location, size, population, and economic activity of all islands worldwide. Blechinger et al. (2016) point out the specific difficulty regarding the most decisive – and most challenging – parameters when modelling the electric system of an island, which is quantifying the electricity demand.

Isolated areas like islands exhibit unique characteristics that pose challenges to demand forecasting. These include the unavailability of past data and the fluctuation of the local demand, according to Liu et al. (2018). Furthermore, maritime transport, a significant aspect of island economies, has been overlooked in a study conducted on 38 different islands by Prina et al. (2021). Data on maritime transport are scarce, based on our study for seven islands in MAESHA.

Data collection in these areas faces numerous obstacles, including the involvement of distinctive characteristics, the intrinsic intermittency of renewable energy (RE), and the practical needs of different isolated regions. According to Liu et al. (2018), meteorological data, vital for RE forecasting, is often unavailable for these isolated areas. In a study performed by Michalena et al. (2018) considering islands in the South Pacific, limited data on electricity sales and RE potential was obtained, while no reliable data on sectoral energy demand was available.

These findings underscore the need for more comprehensive data collection and the development of models that consider the unique characteristics and needs of isolated areas. Overcoming these challenges is crucial for accurate energy modelling and planning in these regions.

Regarding the MAESHA case and the data collection for the follower islands, *Table 8* depicts the key data gaps observed in these islands. The data collection process was generally efficient and comprehensive, and the collected data were largely sufficient. However, in some cases, the collected data may lack detail, the time series may be limited (e.g., energy balances, transport activity for some of the follower islands, etc.) and the granularity may be low (e.g., in power system data – consumption and supply, or terms of split fuel consumption by sector of activity, etc.).

Table 8 Main data limitations for each follower island.

Island	Data limitations
Saint Barthélémy	GDP and GVA Details for transport Energy Balances Hourly load data
Gran Canaria	Energy Balances
Gozo	Energy balance Transport activity
Favignana	GDP and GVA Energy balance Transport data Hourly load data
Réunion	Hourly load data
Madeira	-

4.2. Development process and Structure of general tool

The data tool is included as Annex IV in this deliverable and follows mostly the structure of the data templates used in Task 1.3 and Task 10.1.

5. DEVELOPMENT OF FACTSHEETS FOR THE FOLLOWER ISLANDS

The creation of the fact sheets resulted from an in-depth analysis of data provided by each partner, which was subsequently organised into five (5) distinct topics:

- General information: geographical location, administrative status, climate and population of the island.
- Economy: gross domestic product, GDP growth in recent years and structure of the economy.
- Energy: energy demand by sector and energy carrier, power system data and key recent energy developments.
- Transport: motorization rate, vehicle fleet, access transport modes and transport infrastructure.
- Clean Transition Strategies: key plans and strategies that reflect, chart and influence the vision for climate ambition and energy transition of the island.

The key information was presented for each topic, depending on the data availability. The structure of the factsheets has been presented to project partners during consortium meetings and the kick-off meeting of the Work Package 10, resulting in useful feedback and ideas on the content.

Each draft fact sheet was forwarded to the relevant partner for review, comments and feedback. After the exchanges with the partners from the follower islands, comments, feedback and adjustments were integrated into the document and handed to the partner Euroquality for final graphical editing and visual presentation.

5.1. STRUCTURE

The fact sheets are organised in a 4-page leaflet format divided into five primary sections to present visually the data available for each island. The content is distributed across different pages visually to enhance readability and facilitate comprehension.

The first category encompasses general information about the island, including its location, climate, and administrative conditions. The second category presents economic information regarding the island's gross added value. The third category represents the energy sector, characterised by the island's final energy demand and power mix. The fourth category outlines the transport sector, featuring the motorization rate, vehicle stock, and critical infrastructure elements such as airports. The fifth category discusses the ongoing clean energy transition strategies on the island. It briefly describes these strategies and identifies the entities responsible for their implementation. The final category includes the name and the contact details of the relevant local partner.

5.2. DISSEMINATION CHANNELS - METRICS

This work will be disseminated via the networks of the partners such as the Conference of Peripheral Maritime Regions of Europe (CPMR), which brings together more than 150 regions from 24 states in the European Union and beyond, and the Greening the Islands (GTI) Observatory, which gathers partnerships with 26 islands, 12 islands associations and 35 market and research actors, including international solutions providers, industry associations and island companies.

This work will be also included in the discussions in current workshops such as the Sustainable Places: European Islands Clean Energy Transition, where MAESHA is one of the targeted projects. Through

their vast networks and active participation in other islands' decarbonisation projects, partners will ensure that the results will be widely advertised, and that more than policy makers and energy actors in 20 islands will use the data functionality service.

Other potential synergies with initiatives with similar interests could be fostered with institutions such as the Clean Energy for EU Islands Secretariat, the Sustainable Islands Observatory, and Local2030 Islands Network. Euroquality and E3Modelling, as well as the partners from the follower islands, that constitute key local actors, will ensure additional visibility via the MAESHA website and social media, to a much wider audience.

6. SCENARIO OUTLINE

Medium- and long-term assessments of the energy systems in follower islands will be developed in Task 10.2. These analyses will be aligned with the similar analysis performed for the demonstration case of Mayotte and will be possibly leveraged by other tasks in Work Package 10 for the replicability and scalability studies. These scenarios will account for a series of assumptions for the future development of the energy-economic system of the islands up to 2050, including:

- socio-economic baseline evolution (in terms of population, GDP, employment, international fuel prices, etc.),
- energy, economic and climate policies,
- Renewable Energy Sources (RES) potential and local resources,
- technology costs for energy equipment and power generation technologies.

The scenarios will explore both energy demand and supply trends (depending on the data availability) and the potential for sectoral integration (i.e., facilitated by power storage, demand response and power-to-X technologies) and demonstrate the impacts of the MAESHA's solutions, providing a deep understanding into the transformation barriers, challenges and opportunities in all energy demand and supply sectors on islands.

6.1. CO-DESIGN PROCESS

The MAESHA partners involved in Work Package 10, whose work is based on scenarios underpinning replicability and scalability studies beyond the case of Mayotte, along with those from the follower islands, will follow a participatory co-design approach for the definition of scenarios. In particular, the local partners will play an important role in the design of these scenarios aiming to capture local context, specificities and priorities and providing a reality-check for key scenario assumptions and model-based results.

These scenarios will simulate alternative visions of how the energy, policy, technology, and socio-economic context of the islands might evolve in the medium and long-term. The inclusion of MAESHA technical solutions is crucial in the design of scenarios to demonstrate that the solutions could be widely replicated by other islands under varying geographic, weather, energy, and socio-economic conditions. The scenarios will be to a great extent aligned with those of Mayotte to produce comparable results and will be based on the same objectives:

1. Explore ambitious energy transition pathways for the islands towards carbon neutrality by 2050 or sooner, depending on their specific vision.
2. Explore island dynamics regarding different mitigation options, energy consumption trends, level of activation of local communities, policy focus and technologies to reach carbon

neutrality.

3. Cover the medium- and long-term outlook of the energy system and the following sectors: Electricity, Heating & Cooling, Transport on, to and from the island (depending on the data availability).
4. Assess the energy and electricity costs of the different pathways.
5. Assess the impacts of higher RES deployment and the proposed flexibility solutions on the island energy system if MAESHA solutions are implemented.

The scenarios will be the following:

- **Business-as-usual scenario**: a Current Policies scenario, that implies no significant change in attitudes, activities, technologies, and policies about the energy system.
- **Consumer-driven Net Zero:** a decarbonization scenario, assuming the implementation of MAESHA clean energy solutions (e.g., PV plants, storage systems, demand response, etc.) with a focus on active involvement of communities (efficiency, demand response, etc.).
- **Supply-side Net Zero:** a decarbonization scenario, assuming the implementation of MAESHA clean energy solutions (e.g., PV plants, storage systems, demand response, etc.), with moderate communities' response and strong supply-side efforts.

Moreover, there are specific milestones and planned targets for the energy transition announced for each island that will shape the characteristics of each scenario accordingly. For instance, Saint-Barthélémy projects its energy transition in the framework of the Multiannual Energy Program (PPE), 2022. According to this document, intermediate goals exist before the island can reach net zero, particularly for RES penetration, as presented in the Table 9.

Table 9 RES targets for Saint Barthelemy.

Projected RES penetration in the power sector	2028	2033
Photovoltaics	10 MW	20 MW
Wind onshore	4 MW	4 MW
Wind offshore	0.4 MW	1 MW
Liquid biomass	50 MW	60 MW

The Canary Islands Energy Transition Plan (PTECan) charts the clean energy transition agenda for Gran Canaria and sets the decarbonization scenario of the archipelago by 2040. Similarly, Gozo anticipates its decarbonization earlier than the entire Maltese archipelago. The island of La Réunion has set forth a series of intermediary targets as part of its transition strategy. These targets are encapsulated within the framework of the Pluriannual Energy Programming (PPE 2019 -2028). In general, plans and projects, envisaged in the official energy planning documents will be seriously considered and encapsulated in the scenario analysis.

7. CONCLUSIONS

Task 10.1 of the MAESHA project aimed at gathering the data for the follower islands needed for the modelling and energy planning phase, has been completed successfully. A wide range of officially and publicly available data sources were used. Comprehensive data on the power system (demand and supply), in some cases on the entire energy systems, energy prices, vehicle stock, power plant inventories, GHG emissions, and the socio-economic structure of the follower islands were collected by the relevant partners and E3Modelling. Despite data limitations, Excel-based databases per island were compiled, with an additional file providing a complete overview of the data availability.

Data limitations do exist, nevertheless. Using multiple sources, we managed to overcome reliance on a single dataset and collect data from various available sources. In addition, the data collection process was smooth as it took stock of the similar previous work and tools developed for the case of Mayotte.

The next step is to integrate these data into energy system models for short-, medium-, and long-term horizons. The database will populate input files and calibrate the analysis to represent the energy reality in these islands, similar to the proposed solution's potential to increase RE penetration. Active MAESHA partners facilitated data gathering and fostered collaboration among institutes, serving as valuable tools for other islands. As the project progresses, the databases will expand if additional crucial data becomes available for subsequent modelling activities.

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ANNEX I – ISLAND DATABASES

The databases of MAESHA follower islands are included in a separate folder.

ANNEX II – OVERVIEW OF DATA AVAILABILITY PER ISLAND

A data mapping table is included in a separate folder, summarising the available data categories and the relevant sources for all six follower islands.

ANNEX III – ISLAND FACTSHEETS

The factsheets of MAESHA follower islands are included in a separate folder.

ANNEX IV – DATA TOOL

The MAESHA data tool is included in a separate folder.