CO2 PACMAN

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COoperation and CO-designing PArtnership for CliMAte Neutrality

Summary report of GHG balance of three target islands (D.1.4.1)

Date: June 2025

	D 1.4.1 Summary report of GHG balance of three target islands
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1. Purpose of the document

This report constitutes a key deliverable (D.1.4.1) of the CO2 PACMAN project and is part of Activity 1.4 "Preparing scenarios for climate neutrality of target islands," within Work Package 1 "CO2 PACMAN Cooperative Action." The main objective of the document is to present the greenhouse gas (GHG) inventories developed for the three pilot islands — Brač (Croatia), Crete (Greece) and Elba (Italy) — and to lay the analytical groundwork for the simulation of climate neutrality scenarios through the CO2 PACMAN Tool.

The report collects and summarizes each island's GHG balances, combining scientific data with visual formats such as tables, charts, and intuitive graphics. These data quantify emissions and carbon sinks and allow their translation into spatial references (i.e., equivalent forest area required to offset emissions), which are then integrated into the tool's interactive, game-like environment.

The results presented here serve as the starting point for the participatory scenario-building activities ("The Island I Would Like") and contribute to the broader goal of increasing local capacity to plan, visualize, and implement decarbonization strategies in a cooperative and transnational framework.

2. Introduction

The CO2 PACMAN project aims to guide Mediterranean islands toward climate neutrality by developing integrated climate change mitigation and adaptation strategies. Funded under the **Interreg Euro-MED Programme**, the project is part of the **Green Living Areas Mission**[1], which promotes greener, more resilient, and more livable Mediterranean territories. Building upon the outcomes of previous projects such as COMPOSE, FP7 CityZen, and BLUE DEAL, CO2 PACMAN emphasizes co-creation among public authorities, local stakeholders, experts, and citizens through a series of participatory "rooting labs" in the pilot islands of Brač, Crete and Elba (see *CO_2 PACMAN Cooperative Planning Guidelines – Deliverable 1.2.1*).

One of the project's core innovations is the **CO2 PACMAN Tool**, a dynamic, game-based platform ideated to support local communities in exploring, evaluating and co-designing decarbonization pathways across key sectors, including energy, transport, agriculture, and waste. The development of this tool was supported by a structured, multi-step methodological process involving the collection and elaboration of GHG data, the identification of emission sources and carbon sinks, and the simulation of policy related impacts.

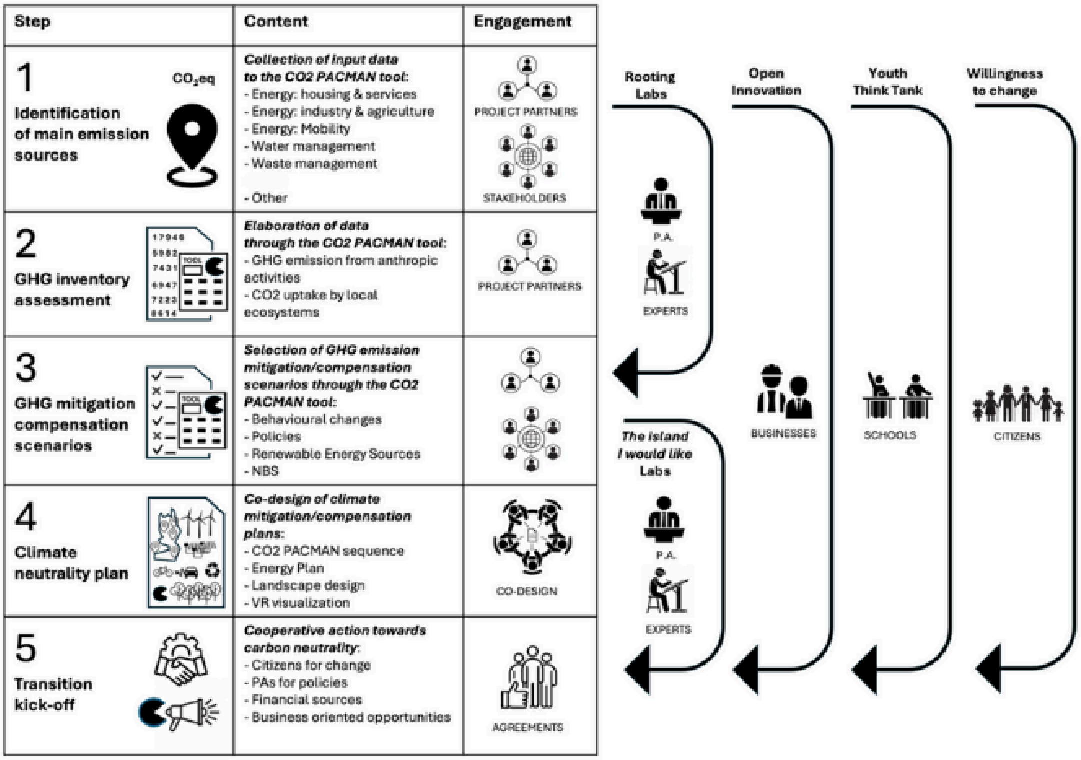

Figure 1 CO2 PACMAN methodological framework (Source: Deliverable 1.1.1 Fine-tuning of the CO2 PACMAN Assessment system)

The overall framework that has guided this development is illustrated in Figure 1, reproduced from Deliverable 1.1.1 "Fine-tuning of the CO2 PACMAN Assessment System. This scheme provides a comprehensive overview of the methodological pathway adopted by the project, covering the full sequence of actions, from the identification of emission sources to the launch of transition activities. In line with this framework, Step 1 has already been completed, and the present document focuses on the implementation of Steps 2 and 3, namely the GHG inventory assessment and the development of mitigation/compensation scenarios. The figure also illustrates how the engagement of various target groups (stakeholders, public authorities, schools, businesses, and citizens) has been progressively structured through specific participatory formats.

Within this context, **Activity 1.4** explicitly focused on the calculation of baseline GHG emissions and carbon absorption for the pilot islands (step 2 of Figure 1), drawing on data collected during Activity 1.3 (*See D1.3.1 CO2 Pacman datasets and tool*). These baselines are essential for enabling the CO2 PACMAN tool's policy simulation features and supporting participatory scenario development in the second round of living labs, "The Island I Would Like" (Activity 3.1) (step 3 of Figure 1).

The present report compiles and summarizes the GHG balances for the three pilot islands in a clear and accessible format, integrating tables, figures, and visual outputs from the CO2 PACMAN Tool. These results are the analytical foundation for the project's broader objective: co-creating actionable climate neutrality strategies with and for island communities.

3. GHG balance

The greenhouse gas inventories for the three pilot islands, Brač (Croatia), Crete (Greece) and Elba (Italy), were developed following the methodological guidelines of the Intergovernmental Panel on Climate Change (IPCC) (see D.1.3 – *CO2 PACMAN datasets and tool* for the complete explanation of the methodology used)[(2)] [(3)]. This approach ensures transparency, comparability, and scientific robustness in quantifying emissions across key sectors.

Figure 2 provides a summary of the IPCC methodology categories considered in the inventories, including sectors such as energy, transport, waste, and agriculture.

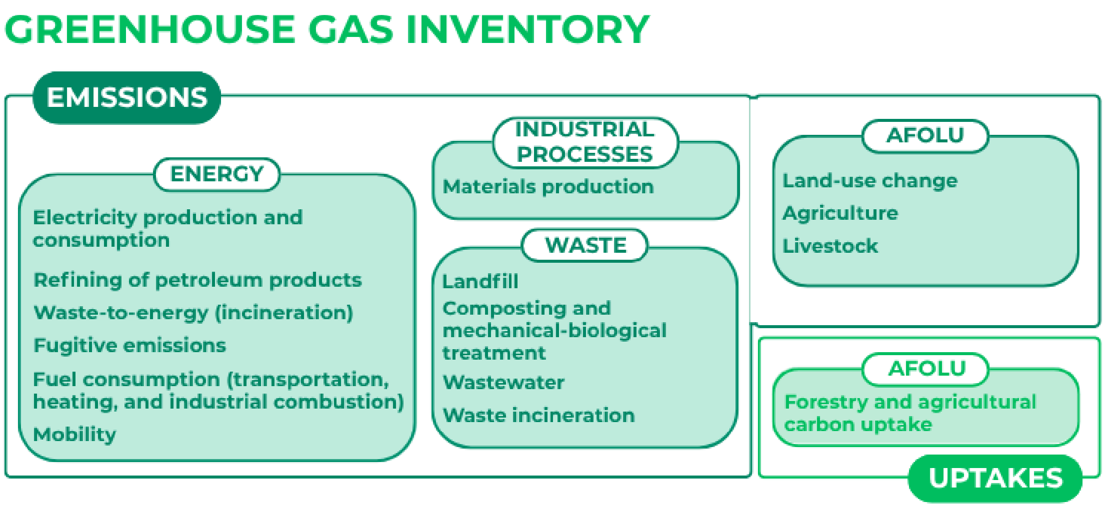

Figure 2 Summary of the category of emissions and uptakes sectors of the IPCC methodology (Source: Deliverable 1.3.1 *CO2 PACMAN datasets and tool*)

The following sections provide a detailed breakdown of the inventories for each island, offering insight into their specific emission profiles and setting the foundation for tailored decarbonization strategies developed within the CO_2PACMAN tool.

3.1 GHG balance of the three pilot islands

3.1.1 Brač

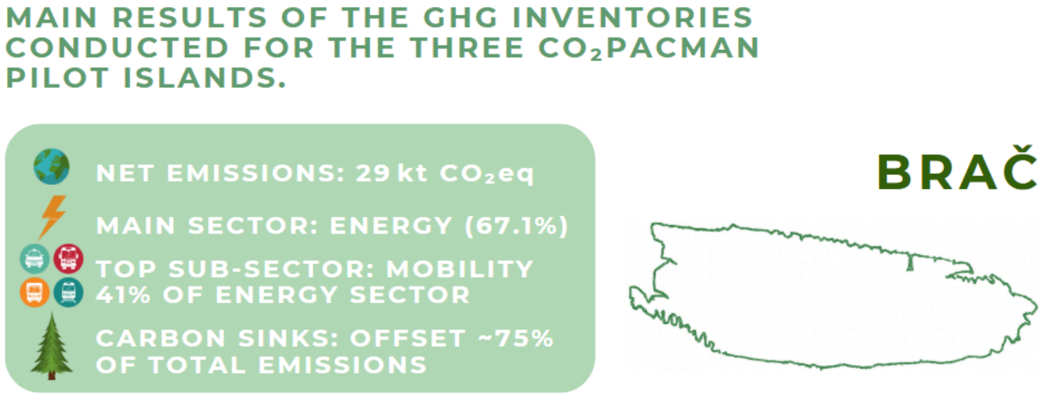

Figure 3 Summary of Brač GHG Inventories

Figure 3 offers an overview of the primary outcomes from the Brač GHG inventory, highlighting the dominant sources of emissions, the most impactful sub-sectors, and the relative contribution of natural carbon sinks.

Table 1 presents a summary of the greenhouse gas (GHG) inventory for the island of Brač and a detailed table of the various emission sectors and sub-sectors analyzed.

Table 1 GHG emissions by sector and sub-sector in Brač: values in $ktCO_2eq$ and their percentage contribution to total emissions

Emissions sectors and sub-sectors Brač	Value	Measurement unit	% on total
Energy	**76.8**	**$ktCO_2eq$**	**67.1%**
Electricity production/consumption (Household and Services, Public transport, Industrial, Agricultural)	19	$ktCO_2eq$	16.6%
Fuel consumption (Heating for Residential, Service, Industrial, Agricultural)	10	$ktCO_2eq$	8.7%
Mobility (Road transportation, Water-borne navigation, Civil aviation)	47	$ktCO_2eq$	41.1%
Industrial	**0**	**$ktCO_2eq$**	**0.0%**
Waste	**17.45**	**$ktCO_2eq$**	**15.3%**
Wastewater	8	$ktCO_2eq$	7.0%
Solid waste (Landfilled, Composted, Selection plants, Recycled)	10	$ktCO_2eq$	8.7%
AFOLU	**20.16**	**$ktCO_2eq$**	**17.6%**
Forest fires	15	$ktCO_2eq$	13.1%
Livestock (Breded, Wild and Stabled animals)	4.39	$ktCO_2eq$	3.8%
Agricultural production (Cereals, Roots and tubers, Temporary fodder, Permament fodder)	0.33	$ktCO_2eq$	0.3%
Total GROSS EMISSIONS	**114.41**	**$ktCO_2eq$**	100%
Land use (UPTAKE)	-86	$ktCO_2eq$	**-75%**
Total NET EMISSIONS	**29**	**$ktCO_2eq$**	**25%**

As clearly shown in the table, the energy sector is the largest contributor to emissions, with a total of 76.8 kt CO_2eq (67.1%), followed by the AFOLU sector with 20.16 kt CO_2eq (17.6%), and the waste sector with 17.45 kt CO_2eq (15.3%). The industrial sector amounts to 0 kt CO_2eq, as, according to the data available from the local partners on the island of Brač, there are no industries with direct emissions from material production. Total gross emissions amount to 114.4 kt CO_2eq, of which approximately 75% (86 kt CO_2eq) are offset by carbon sinks on the island. As a result, the island's final net emissions amount to 29 kt CO_2eq.

Table 1 also includes disaggregated CO_2 emissions data for the sub-sectors within each category. It can be observed that of the 76.8 ktCO_2eq emitted by the Within the Energy sector, which, as previously noted, accounts for 67.1% of the island's total emissions, 41.1% is attributable to the Mobility sub-sector, making it the largest single contributor to Brač's overall greenhouse gas emissions. The distribution of emissions within Brač's Mobility sub-sector reveals that maritime transport is the dominant source, accounting for 81.36% of the sector's emissions, followed by road transport with 14.09%, and civil aviation with 4.60% (**Figure 4**).

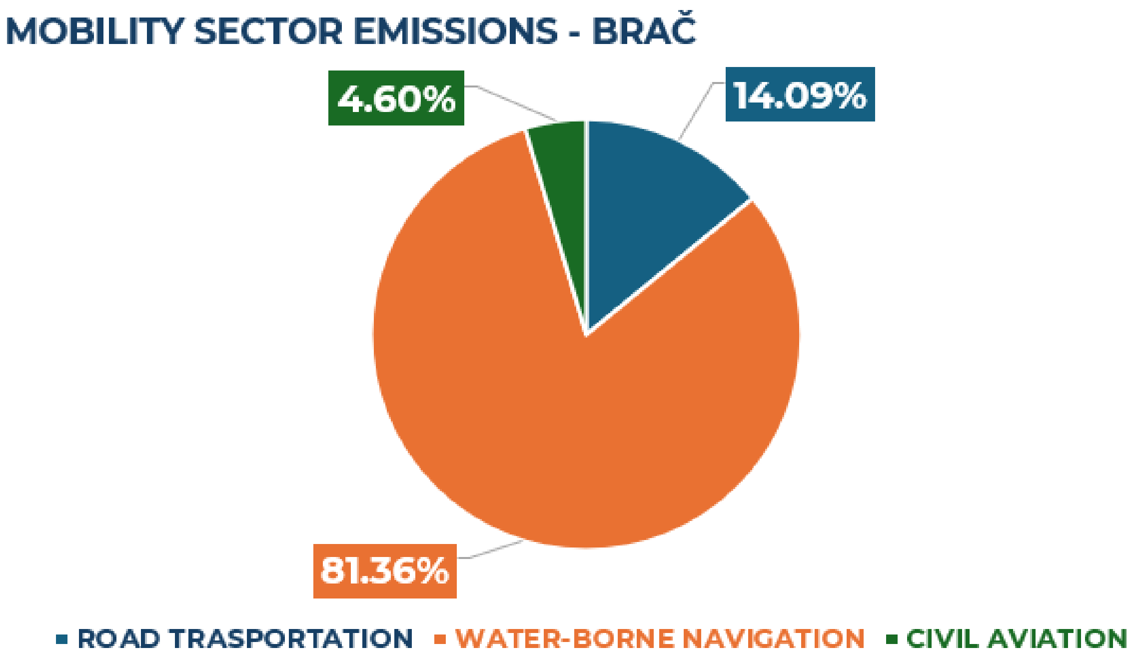

Figure 4 Distribution of GHG emissions within the Mobility sector of Brač

3.1.2 Crete

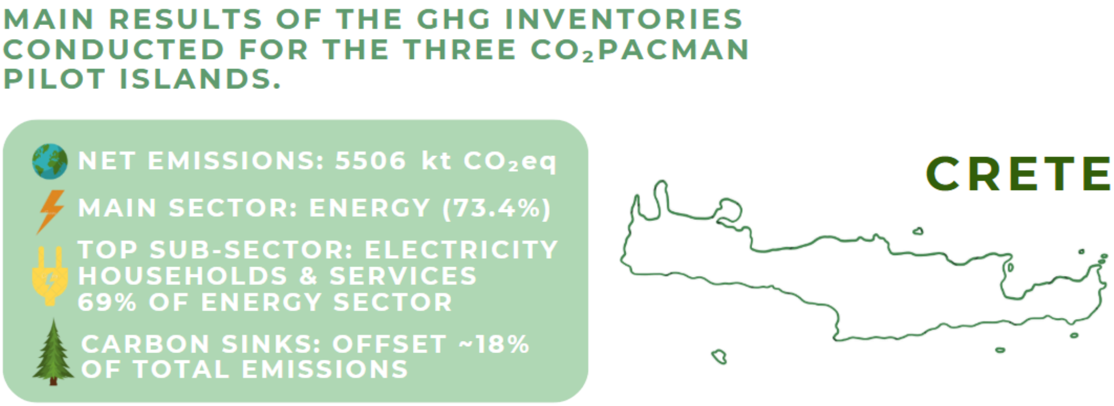

Figure 5 Summary of Crete GHG Inventories

Figure 5 offers an overview of the primary outcomes from the Crete GHG inventory, highlighting the dominant sources of emissions, the most impactful sub-sectors, and the relative contribution of natural carbon sinks.

Table 2 summarizes the greenhouse gas (GHG) inventory for the island of Crete and a detailed table of the various emission sectors and sub-sectors analyzed.

Table 2 GHG emissions by sector and sub-sector in Crete: values in $ktCO_2eq$ and their percentage contribution to total emissions

Emissions sectors and sub-sectors Crete	Value	Measurement unit	% on total
Energy	**4935.9**	**$ktCO_2eq$**	**73.4%**
Electricity production/consumption (Household and Services, Public transport, Industrial, Agricultural)	3688	$ktCO_2eq$	54.8%
Fuel consumption (Heating for Residential, Service, Industrial, Agricultural)	233	$ktCO_2eq$	3.5%
Mobility (Road transportation, Water-borne navigation, Civil aviation)	1014	$ktCO_2eq$	15.1%
Industrial	**0**	**$ktCO_2eq$**	**0.0%**
Waste	**885.29**	**$ktCO_2eq$**	**13.2%**
Wastewater	603	$ktCO_2eq$	9.0%
Solid waste (Landfilled, Composted, Selection plants, Recycled)	282	$ktCO_2eq$	4.2%
AFOLU	**904.49**	**$ktCO_2eq$**	**13.4%**
Forest fires	16	$ktCO_2eq$	0.2%
Livestock (Breded, Wild and Stabled animals)	825	$ktCO_2eq$	12.3%
Agricultural production (Cereals, Roots and tubers, Temporary fodder, Permament fodder)	64	$ktCO_2eq$	1.0%
Total GROSS EMISSIONS	**6725.67**	**$ktCO_2eq$**	100%
Land use (UPTAKE)	-1220	$ktCO_2eq$	**-18%**
Total NET EMISSIONS	**5506**	**$ktCO_2eq$**	**82%**

As clearly shown in the table, the energy sector is the most significant contributor to emissions, with a total of 4,935.9 kt CO_2eq (73.4%), followed by the AFOLU sector with 904.49 kt CO_2eq (13.4%), and the waste sector with 885.29 kt CO_2eq (13.2%). The industrial sector amounts to 0 kt CO_2eq, as, according to the IPCC Guidelines, this category (IPPU – Industrial Processes and Product Use) only includes direct process emissions from material production (e.g., cement, lime, chemicals, metals). Since no such industries are present in Crete at a scale relevant to the inventory, emissions in this category are reported as zero.

Total gross emissions amount to 6,725.67 kt CO_2eq, of which approximately 18% (1,220 kt CO_2eq) are offset by carbon sinks on the island. As a result, the island's final net emissions amount to 5,506 kt CO_2eq.

Table 2 also includes disaggregated CO_2 emissions data for the sub-sectors within each category. Of the 4,936 kt CO_2eq emitted by the Energy sector, which, as previously noted, represents 73.4% of the island's total emissions, 54.8% is attributable to the Energy production and consumption sub-sector, making it the most significant single contributor to Crete's overall greenhouse gas emissions. A further breakdown of energy consumption on the island of Crete shows that this sub-sector is primarily driven by the residential and services segment (approx. 69%), followed by the agricultural sector (23.06%), and the industrial sector (7.7%) (**Figure 6**). It is important to note that these industrial emissions reflect indirect emissions from electricity and fuel use in all types of industrial facilities, and are therefore accounted for under the Energy sector, not the IPPU sector.

Data on electricity consumption related to public transport were not available during the data collection phase on the island.

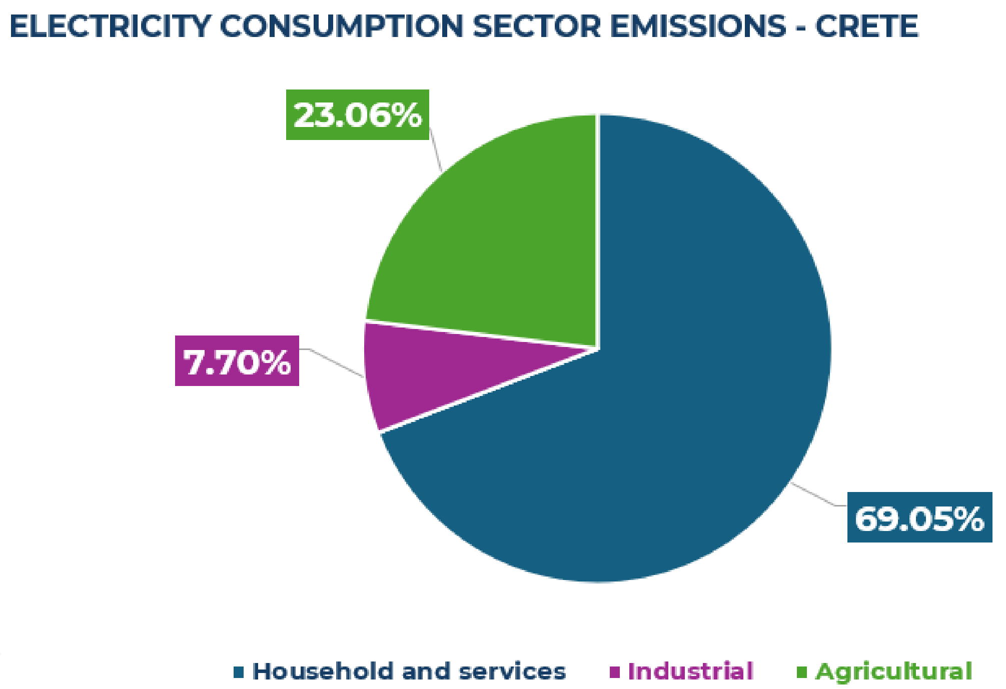

Figure 6 Distribution of GHG emissions within the Energy consumption sector of Crete

3.1.3 Elba

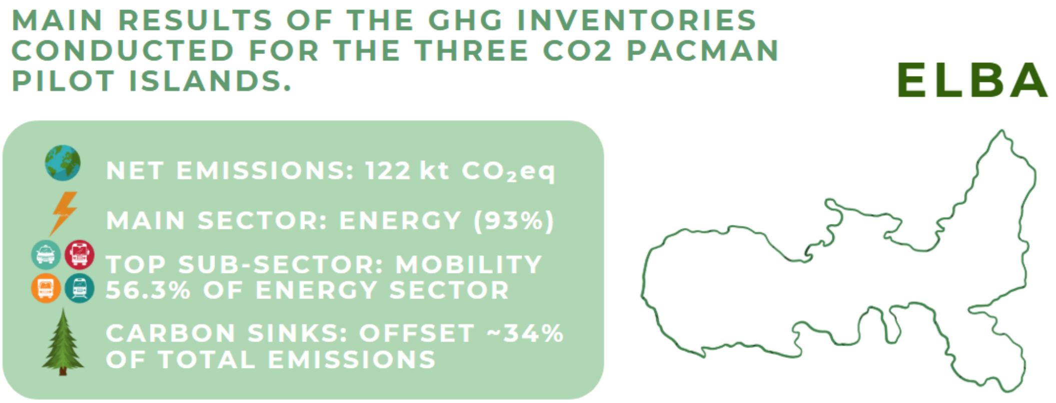

Figure 7 Summary of Elba GHG Inventories

Figure 7 offers an overview of the primary outcomes from the Elba GHG inventory, highlighting the dominant sources of emissions, the most impactful sub-sectors, and the relative contribution of natural carbon sinks.

Table 3 presents a summary of the greenhouse gas (GHG) inventory for Elba Island, and a detailed table of the various emission sectors and sub-sectors analyzed.

Table 3 GHG emissions by sector and sub-sector in Crete: values in $ktCO_2eq$ and their percentage contribution to total emissions

Emissions sectors and sub-sectors Elba	Value	Measurement unit	% on total
Energy	**171.7**	**$ktCO_2eq$**	**93.0%**
Electricity production/consumption (Household and Services, Public transport, Industrial, Agricultural)	52	$ktCO_2eq$	28.2%
Fuel consumption (Heating for Residential, Service, Industrial, Agricultural)	16	$ktCO_2eq$	8.7%
Mobility (Road transportation, Water-borne navigation, Civil aviation)	104	$ktCO_2eq$	56.3%
Industrial	**0**	**$ktCO_2eq$**	**0.0%**
Waste	**8.40**	**$ktCO_2eq$**	**4.6%**
Wastewater	2	$ktCO_2eq$	1.1%
Solid waste (Landfilled, Composted, Selection plants, Recycled)	6	$ktCO_2eq$	3.3%
AFOLU	**4.50**	**$ktCO_2eq$**	**2.4%**
Forest fires	4	$ktCO_2eq$	2.2%
Livestock (Breded, Wild and Stabled animals)	0	$ktCO_2eq$	0.0%
Agricultural production (Cereals, Roots and tubers, Temporary fodder, Permament fodder)	0.02	$ktCO_2eq$	0.0%
Total GROSS EMISSIONS	**184.61**	**$ktCO_2eq$**	100%
Land use (UPTAKE)	-63	$ktCO_2eq$	**-34%**
Total NET EMISSIONS	**122**	**$ktCO_2eq$**	**66%**

As clearly shown in the table, the energy sector is the most significant contributor to emissions, with a total of 1,71.7 kt CO_2eq (93%), followed by the waste sector with 8.40 kt CO_2eq (4.6%), and the AFOLU sector with 4.50 kt CO_2eq (2.4%). The industrial sector amounts to 0 kt CO_2eq, as, according to the data available from the local partners on the island of Elba, there are no industries with direct emissions from material production. Total gross emissions amount to 184.61 kt CO_2eq, of which approximately 34% (63 kt CO_2eq) are offset by carbon sinks on the island. As a result, the island's final net emissions amount to 122 kt CO_2eq.

Table 3 also includes disaggregated CO_2 emissions data for the sub-sectors within each category. Of the 172 ktCO_2eq emitted by the Energy sector, which accounts for 93% of the island's total emissions, 56.3% is attributable to the Mobility sub-sector, making it the most significant single contributor to Elba's overall greenhouse gas emissions. Within the transport sector, emissions are overwhelmingly dominated by road transportation, which represents 99.04% of the total, while aviation contributes only 0.07% (**Figure 8**).

During the initial data collection phase on the island, data on waterborne navigation were not available; however, they have since been acquired and are currently undergoing analysis.

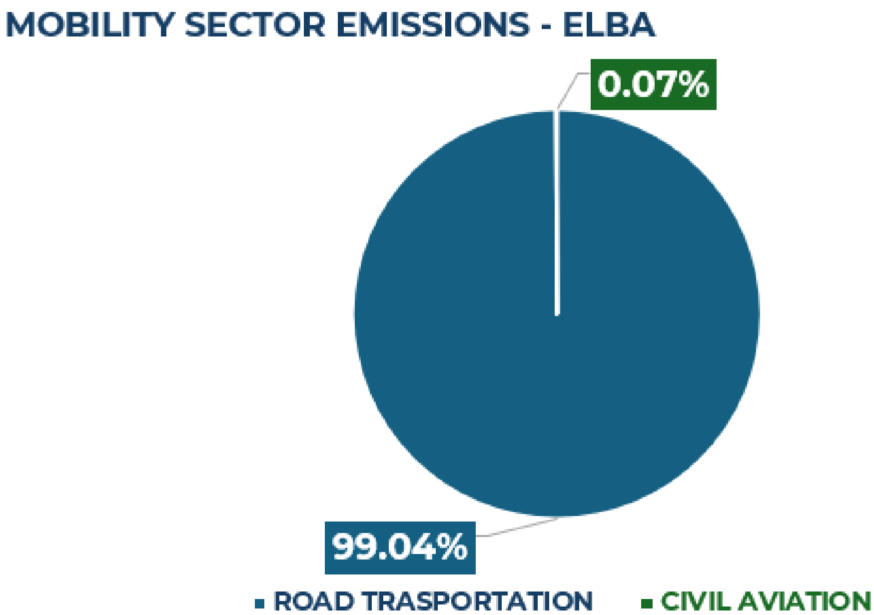

Figure 8 Distribution of GHG emissions within the Mobility sector of Elba

4. CO2 PACMAN Tool

The data collected in Deliverable D1.3.1 and further analyzed in this document have been translated into the CO2PACMAN Tool, which is designed to support the development and implementation of decarbonisation strategies tailored to the context of Mediterranean islands. While the policies illustrated in Figure 7 are presented in summary form, a more detailed discussion can be found in D1.3.1. These policies have been designed based both on the outcomes of the GHG balance assessments and on the aim of ensuring that they are broadly applicable and adoptable across all Mediterranean islands, and potentially beyond. Figure 9 illustrates the interconnections between data, sectors, and policies, showing how they integrate to support informed decision-making. The decarbonisation policies are presented in the same order in which they appear within the CO_2 PACMAN Tool, each policy is also color-coded according to the IPCC sector most directly affected by its implementation.

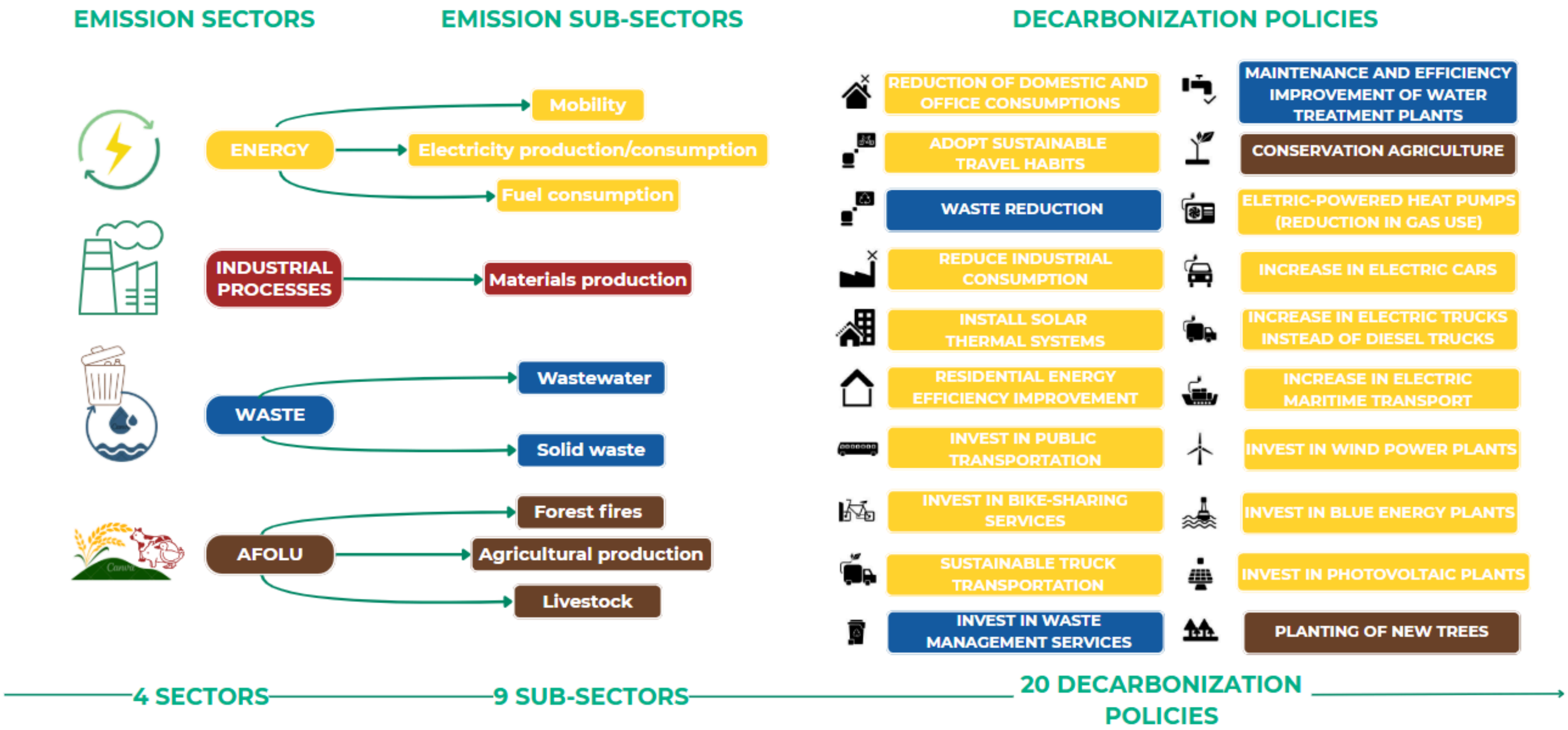

Figure 9 Relationship between key emission sectors and sub-sectors and the developed decarbonization policies. This conceptual map represents the structural foundation of the CO2 PACMAN Tool.

4.1 Overall architecture and technical structure of the tool

The following section provides a structured overview of the CO2 PACMAN Tool's architecture, outlining how its core functionalities are distributed across sequential operational steps. Each step corresponds to a specific phase in the data processing and decision-support workflow, from the inclusion of baseline information to the modeling of decarbonization strategies and potential compensatory measures. The section also clarifies how each functional block interacts with the user interface, specifying which datasets are visible or editable, and how the outputs are visualized to support interpretation and scenario comparison.

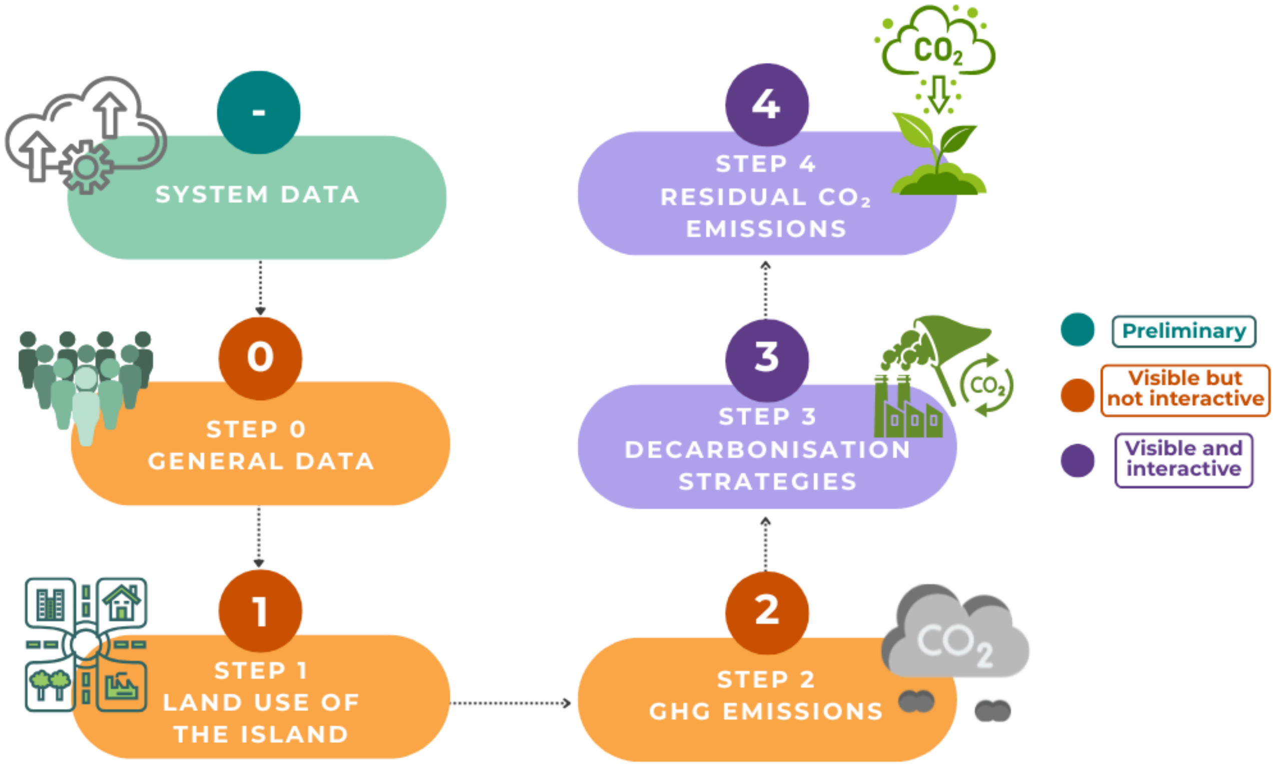

Figure 10 Structure and workflow of the CO2 PACMAN Tool.

The CO2 PACMAN Tool includes all relevant data that has been collected and categorized according to the methodology described in deliverable D1.3.1. It offers users both fixed baseline datasets and a selection of decarbonization policies, allowing them to simulate and compare various future scenarios. Specifically, the tool includes:

1. **System Data**:
   A set of general, both specific and non-site-specific parameters required for developing and quantifying decarbonization policies. These background data are used exclusively by technical operators during the processing of GHG balances and policy impact estimations and are, therefore, not visible or editable by the tool's end users.

2. **Step 0 - General Data:**
   General data about the selected island, which is displayed during the scenario selection step, alongside a general description of the territory.
   Specifically:
   a. Island area
   b. Resident population
   c. Annual number of tourists

3. **Step 1 - Land Use of the Island**
   Data related to the land use distribution (in hectares) of the island, classified into the following categories:
   a. Built-up areas
   b. Annual crops
   c. Forests
   d. Meadows and urban green spaces
   e. Orchards, olive groves and vineyards
   f. Other (beaches, rocky areas, etc…)

   These data are presented to the user in Step 1 of the tool (**Figure 13**).

4. **Step 2 - GHG balance**
   Results of the greenhouse gas emissions of the selected island. It includes

all the sectors considered in the emission inventories and their aggregation into main emission categories. These are then used to generate the visual "tiles" representing the island's equivalent forest (**Figure 15**). The equivalent forest is a communicative indicator representing the amount of CO_2 emissions avoided or reduced through decarbonization policies, expressed as the hypothetical forest area needed to absorb an equivalent quantity of CO_2 annually. This metric facilitates the understanding of climate benefits by translating abstract emission values into a tangible and relatable environmental reference.

These data are presented to the user in Step 2 of the tool (**Figure 15**).

5. **Step 3 - Decarbonisation strategies**

   This is where the user starts to interact with the tool. It includes the estimations of the effects of decarbonization policies. It contains the specific formulas developed to estimate the potential emission reductions that each policy can achieve for the selected island. The reductions are initially calculated in the unit of measurement corresponding to the emission source to which they refer, and subsequently converted into tonnes of CO_2 equivalent (tCO_2eq) avoided using the relevant emission factors provided by the IPCC methodology (as detailed in deliverable D.1.3.1).

   These data are presented to the user in Step 3 of the tool (**Figure 17**).

6. **Step 4 - Residual CO_2 emissions**

   Amount of the island's residual CO_2 emissions following the implementation of all selected decarbonization policies, along with a proposed afforestation measure designed to account for both the available physical space on the island and the remaining CO_2 to be absorbed.

   This section will be integrated into the tool in the next development phase.

4.2 The inclusion of Brac, Crete and Elba's data into the CO2 PACMAN Tool

Once the GHG balance calculations were completed and the relative impact of each sector on the total emissions for the three pilot islands was assessed, the project's next phase involved transferring this data into the CO2 PACMAN Tool. This transition involved a meticulous technical process in which raw data from various Excel sheets, comprising all previously described collected and calculated information, were harmonized and translated into a structured online spreadsheet, then shared with the IT partner responsible for the tool's development.

As shown in **Figure 9**, from the 4 sectors defined by the IPCC methodology and the corresponding 9 sub-sectors considered in the greenhouse gas inventories assessment for the three pilot islands of the project, 20 overarching decarbonization policies were created. Each policy influences or has the potential to affect one or more sub-sectors, allowing users to visualize and simulate how specific interventions, such as investing in electric transport or sustainable agriculture, can directly impact emission sources.

4.3 Procedures and graphical visualization

The tool is currently in its alpha version, and further qualitative and quantitative improvements need to be made. The operational version will be released in September 2025, but some images of the homepage and all steps (1-2-3) of the tool, will be shown to describe them.

4.3.1 Welcome page and island selection

This is the **Welcome page** (Figure 11), which introduces users to the tool. At the top, the interface features the project name *CO2 PACMAN* and a placeholder for partner logos. The central section includes a welcoming message and an overview of the tool's purpose, which is aimed to raise awareness and guide users through the decarbonization process.

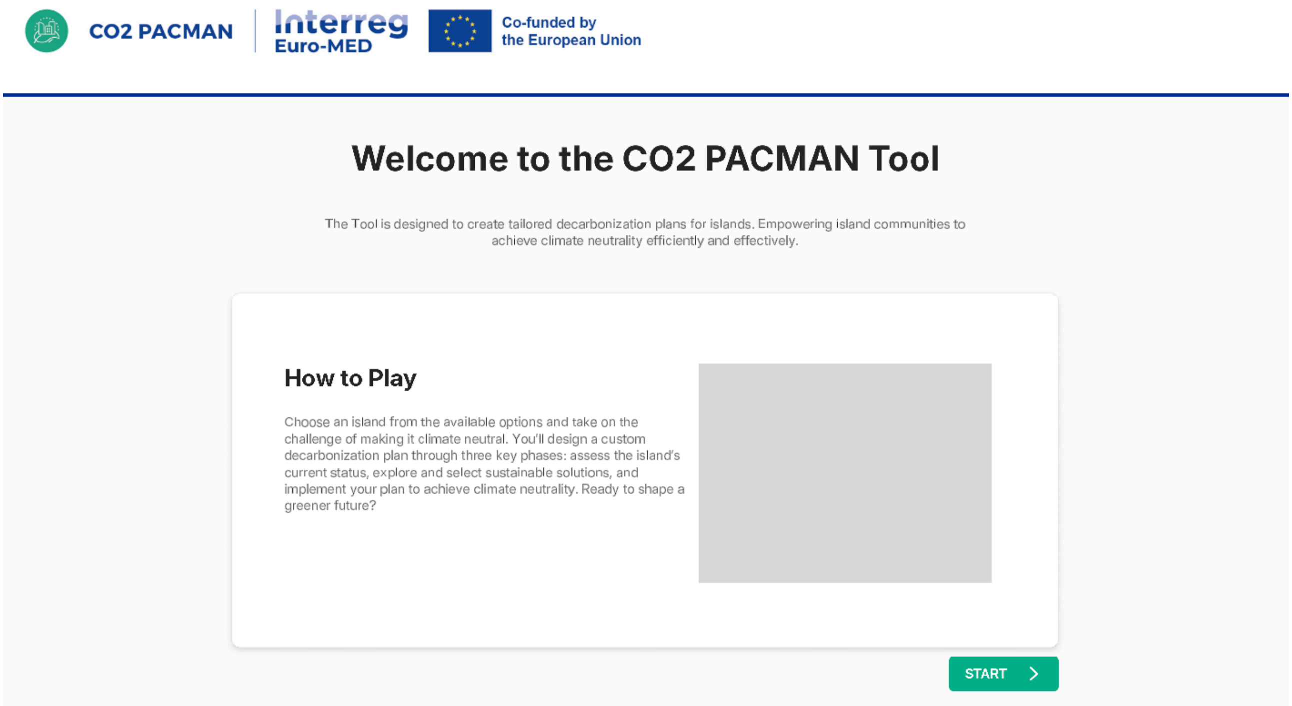

Figure 11 Welcome page

A clearly defined "**How to Play**" section outlines the basic instructions for engaging with the tool. This section is structured in a framed box, with supporting visual elements on the right. At the bottom right, a "**Start**" button invites users to begin the experience, ensuring intuitive navigation into the following stages of the tool. The design is clean and accessible, providing users with a clear and structured entry point into the interactive learning journey.

After the **Welcome** screen, the user arrives at the **Select Island** page, which invites them to choose the island they intend to decarbonise.

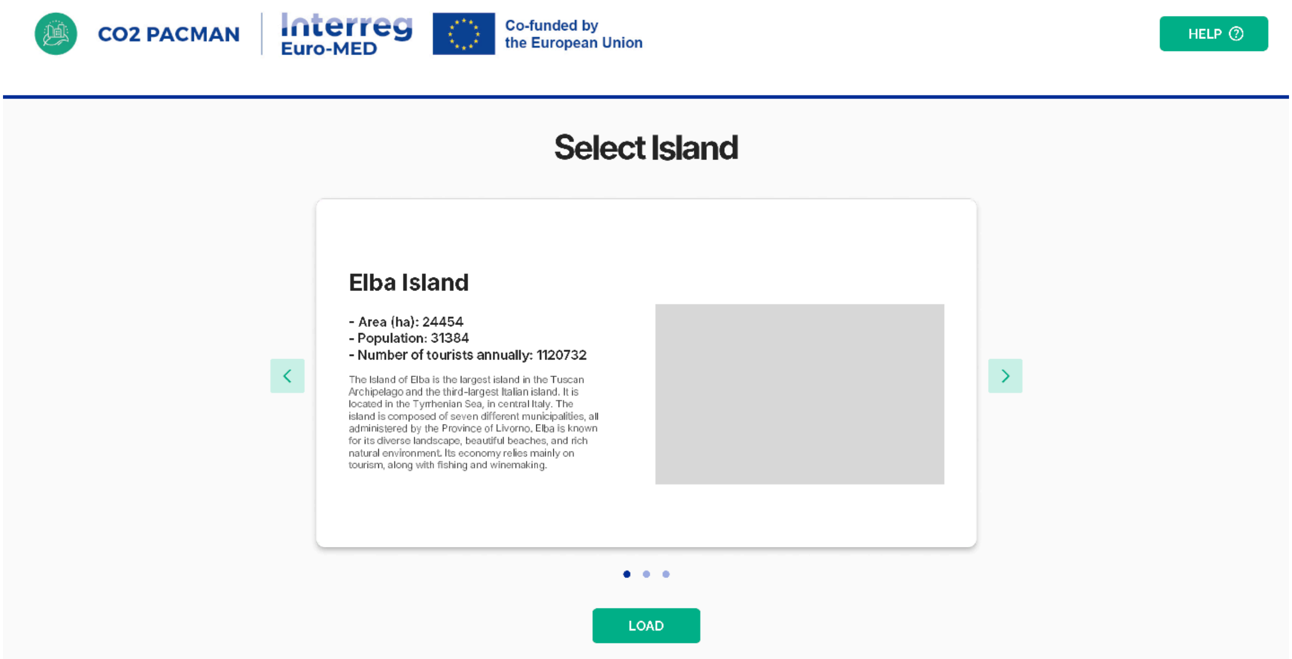

Figure 12 Select a Scenario page

At the centre of the interface, a framed panel presents one **island profile** at a time. The island's name appears prominently, followed by key statistics such as total area, resident population, and annual tourist arrivals, so users immediately grasp the scale and baseline conditions. A brief descriptive paragraph offers additional geographical and socio-economic context. At the same time, an adjacent placeholder image is reserved for a map or representative photograph that will help users visualise the territory.

Beneath the panel, a single ***LOAD*** button prompts the user to confirm its selection. Activating this control uploads the relevant dataset and takes the user into the subsequent interactive steps, where they will analyse emissions, apply mitigation policies, and monitor progress toward climate neutrality for the chosen island. In this way, the scenario page functions as an informative gateway between the general introduction and the detailed decarbonisation workflow.

The **Help** button links to the tool's tutorial, corresponding to the content presented in the previous 'How to play' section. It allows users to review the tool's rules before starting.

From this point onward, this feature (Help button) will be available in every tool step, briefly explaining the current step's specific objectives and what it represents/visualises.

4.3.2 Step 1 (Interactive Land Use Map of the Island)

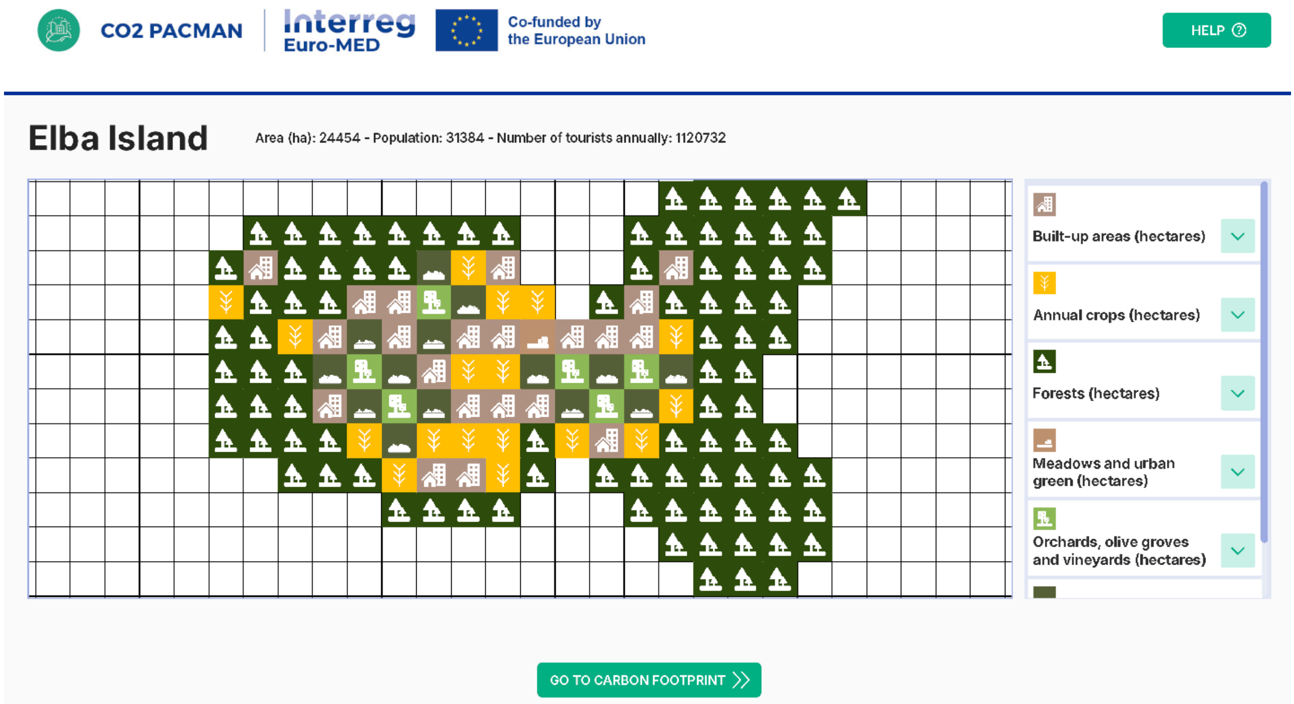

Figure 13 Step 1 page

In this tool stage, users are presented with a **schematic representation of the island** (e.g. Elba Island) divided into a **grid of tiles** (Figure 13). Each tile corresponds to 100 hectares for Brač and Elba and 1500 hectares for Crete. Every tile is color-coded with icons to denote different land use categories, such as built-up areas, forests, meadows, agricultural land, or coastal zones.

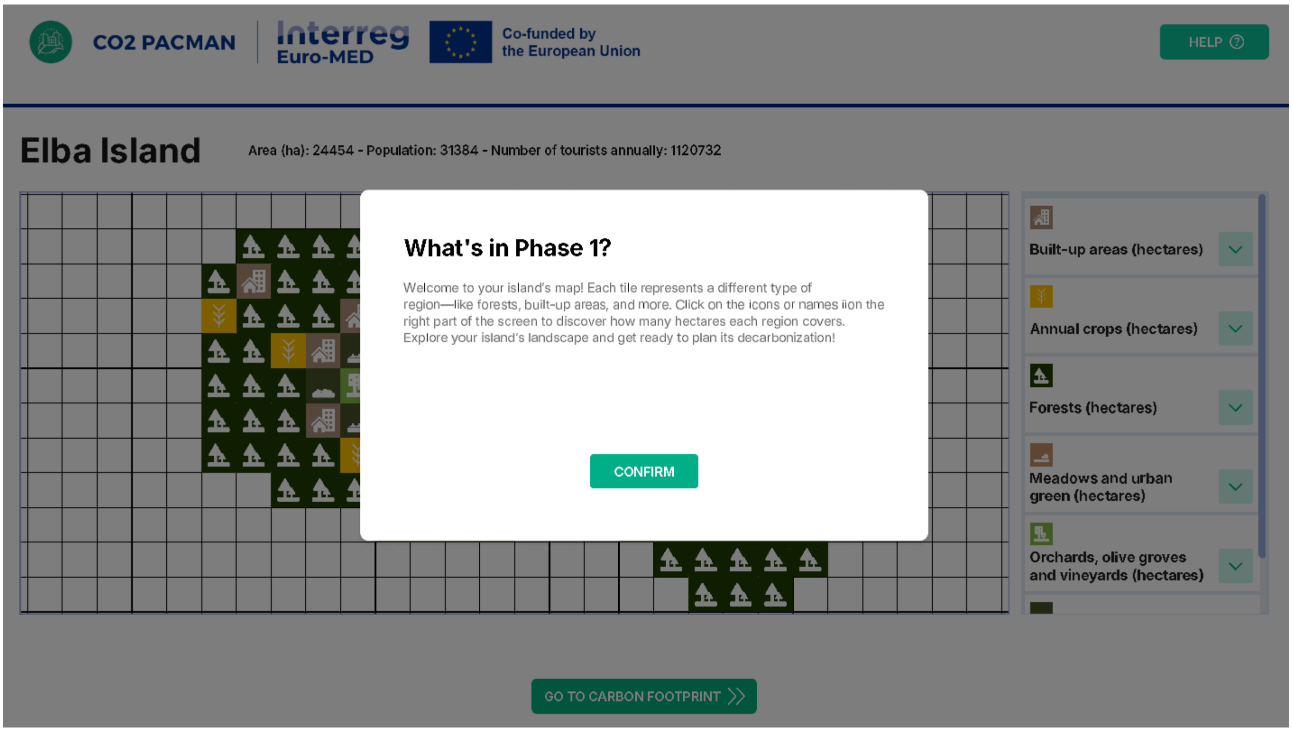

Figure 14 Step 1 page - Help button

The Help button briefly explains the user's current step (here, Step 1) and provides a short tutorial on how to interact with the tool during this step.

On the right-hand side, a summary panel displays a categorized breakdown of land cover types and their respective total surface area in hectares. This visual layout enables users to quickly understand the spatial distribution and scale of various land types on the island. It provides a foundational understanding of the territory before assessing its GHG emissions and exploring decarbonisation strategies in subsequent steps. From here, users may proceed to the next step through the "***GO TO CARBON FOOTPRINT***" button.

4.3.3 Step 2 (GHG emissions results)

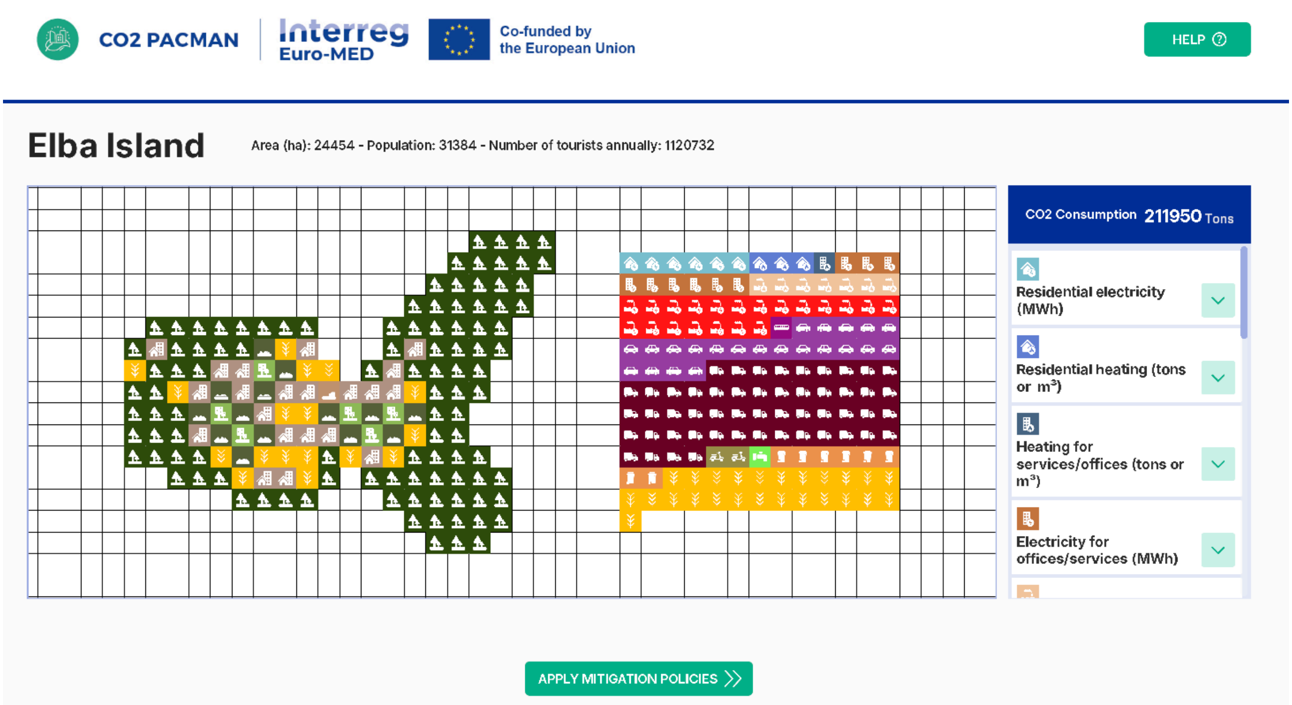

Figure 15 Step 2 page

In this tool stage, users are shown a schematic view of the island's different consumptions and their relative CO_2 emissions, structured in a tile-based grid. Each tile corresponds to 100 hectares for Brač and Elba and 1500 hectares for Crete. On the left, the island is represented with land-use tiles from Step 1. The tiles distributed on the right part represent a **translation of the CO_2 emission into a spatial reference**, corresponding to 100 hectares of **forest equivalent** that would be necessary to absorb that quantity of CO_2. All these tiles are differentiated into color-coded and icon-labeled consumption types, such as residential electricity, transport, heating, or agriculture.

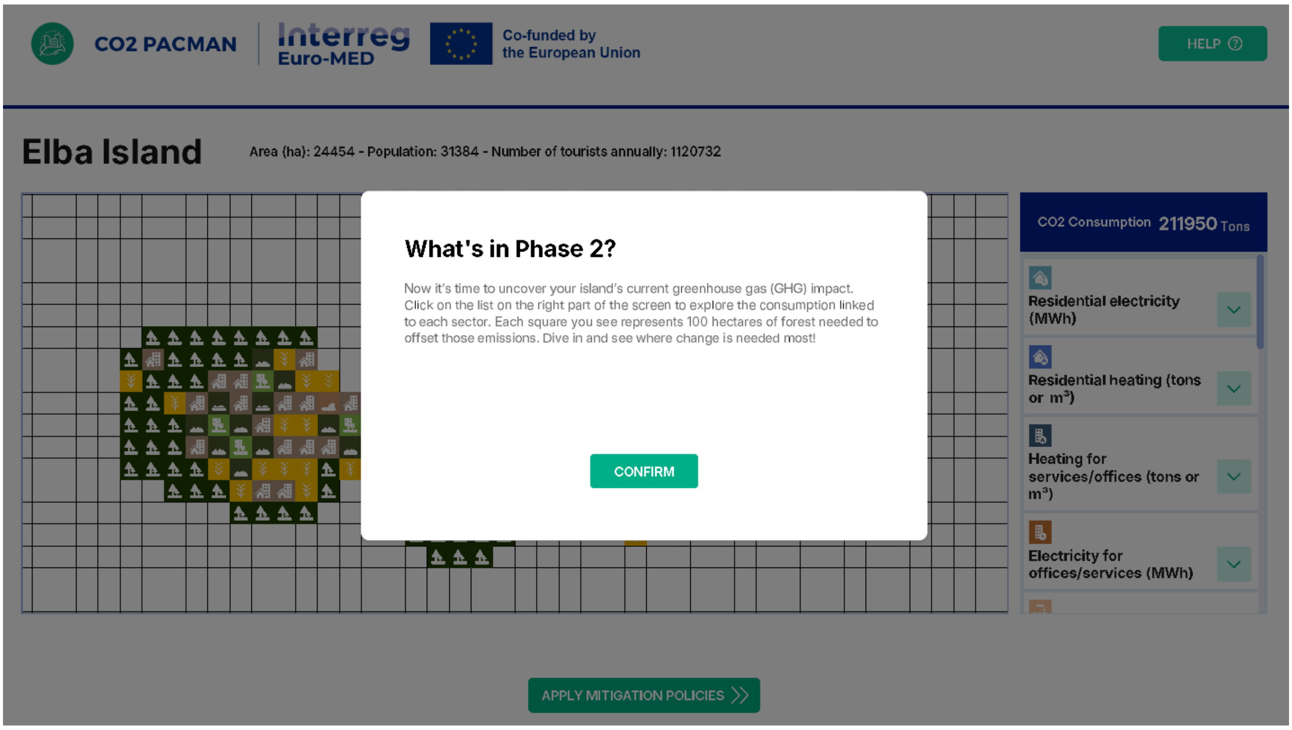

Figure 16 Step 2 page - Help button

The Help button briefly explains the user's current step (here, Step 2) and provides a short tutorial on how to interact with the tool during this step.

A summary panel on the right-hand side displays the island's total CO_2 emissions. It lists each consumption category (namely, residential electricity, transport, heating, agriculture) with its corresponding value, allowing users to explore the GHG emissions in detail. This step provides a sector-specific visualization of emissions to support the development of targeted decarbonisation strategies. To proceed to Step 3, a button "**GO TO POLICY**" is below the icons.

4.3.4 Step 3 (Selection of decarbonisation strategies)

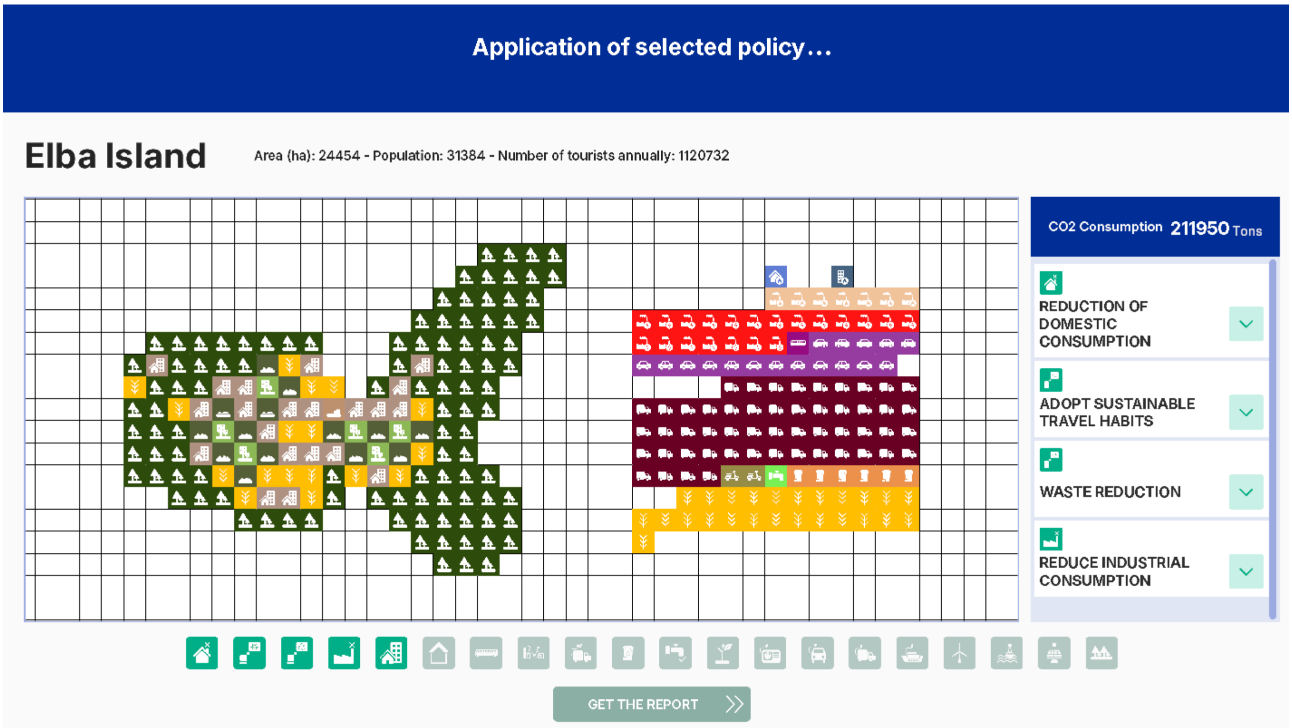

Figure 17 Step 3 page

In this tool stage, users are invited to explore and apply decarbonisation strategies to reduce the island's GHG emissions. The left side of the interface continues to display the schematic land-use representation of Elba Island introduced in Step 1. On the right, CO_2 emissions, initially presented in Step 2 as color-coded tiles corresponding to consumption sectors, are now dynamically updated in response to the implementation of one or more decarbonisation policies, which drive changes in the respective consumption categories.

At the bottom of the screen, a series of icons represent different policy measures, each corresponding to strategies described in detail in Deliverable 1.3.1; a summary is depicted in Figure 9. These include interventions such as reducing domestic consumption, promoting sustainable travel habits, increasing energy efficiency, or investing in public transport. By selecting these policies, users can **observe in real time how the number of emission tiles decreases** within the relevant sectors, visually illustrating the potential impact of each measure on overall emissions.

On the right-hand side, a summary panel categorizes and names each decarbonisation strategy, supporting users in identifying and combining effective actions. This step serves as an **interactive scenario-building tool**, allowing stakeholders to test various policy pathways and better understand their implications for achieving emissions reduction on the island.

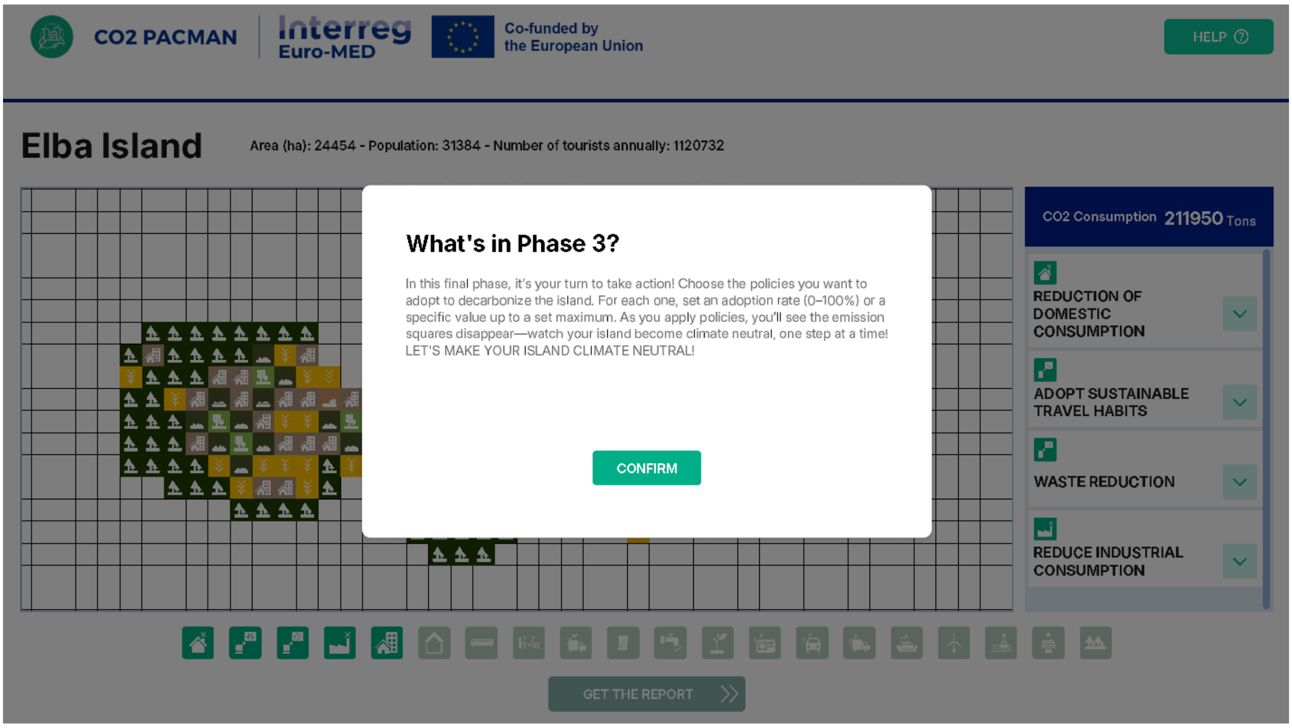

Figure 18 Step 3 page - Help button

The Help button briefly explains the user's current step (here, Step 3) and provides a short tutorial on how to interact with the tool during this step.

Once the desired set of policies has been selected, users may click the "**FINISH**" button to conclude the interactive planning sequence.

4.3.5 Step 4 (Residual CO_2 emissions)

In the forthcoming Step 4 of the CO2PACMAN tool, users will be presented with a final synthesis of the island's residual CO_2 emissions after implementing all selected decarbonisation policies from Step 3. This stage offers a conclusive visualisation of the remaining CO_2 emissions, enabling users to assess whether the strategies adopted are sufficient to achieve climate neutrality.

Building on the previous emissions grid, this step will display only the residual CO_2 emissions that persist after policy interventions. At this point, users can apply an additional measure: afforestation, or planting new trees. This strategy, however, will be constrained by the actual availability of suitable land on the island, as defined in Step 1's land use mapping.

The step will simulate the absorption potential of newly planted forests and compare it against the residual emissions. If prior policies have been effective, only a small portion, or potentially none, of the available area will be needed for afforestation. Conversely, even the full use of all eligible land may prove insufficient to achieve climate neutrality if significant emissions remain.

This final step is currently under development and will feature a dedicated visual layout to communicate the spatial and quantitative relationship between emissions and the compensatory capacity of forest expansion. It aims to reinforce the importance of both mitigation and land-based compensation strategies, offering a comprehensive and realistic assessment of the island's path toward carbon neutrality.

After this last step, the tool will produce a document report summarizing all the strategies applied and their results.

5. Conclusion

The calculation of greenhouse gas (GHG) inventories for the pilot islands of Brač, Crete, and Elba marks an important advancement in the CO2 PACMAN project's mission to facilitate local transitions toward climate neutrality. These inventories present a thorough and transparent assessment of emissions and carbon sinks across key consumption sectors, employing a scientifically robust methodology that adheres to IPCC guidelines(2) (3). This shared framework promotes consistent interpretation of data across various territories and over time, establishing a firm foundation for informed decision-making and policy development.

In addition to the inventories, this deliverable launches the CO2 PACMAN Tool, an innovative resource designed to simplify complex environmental data and foster an interactive and participatory planning environment. The tool guides users through a structured series of steps, allowing them to explore emission sources, implement decarbonization policies, and visualize their impacts using intuitive, spatial formats. This flexibility enables users to tailor scenarios to their territory's specific characteristics while maintaining methodological consistency within the core assessment framework.

The tool's modular design, combined with clear inputs and sector-specific policy options, allows for broad adaptability. It can not only be applied to the pilot islands involved in this project but also extended to other Mediterranean islands and coastal regions encountering similar decarbonization challenges. This adaptability is underpinned by the use of open, traceable data structures and well-defined parameters, facilitating integration with other planning processes and tools.

Moreover, the CO2 PACMAN Tool empowers local actors, public authorities, citizens, and experts to transition from passive observers to active participants in climate planning. It transforms the climate planning process into a collaborative, visual, and strategic endeavor that enhances both individual understanding and collective efficacy.

This project aligns well with the broader vision of the Interreg Euro-MED Green Living Areas Mission(1), which seeks to foster climate-resilient, resource-efficient, and inclusive territories across the Mediterranean. By prioritizing local engagement, data transparency, and spatialized planning, the CO2 PACMAN approach significantly contributes to this vision, equipping small islands with the necessary tools to pursue their transitions in a structured, inclusive, and replicable manner.

In doing so, the project contributes to the advancement of multiple Sustainable Development Goals (SDGs)[(4)]. It enhances **SDG 13 (Climate Action)** by enabling targeted, data-driven strategies for emission reduction; supports **SDG 7 (Affordable and Clean Energy)** by facilitating energy transition simulations; promotes **SDG 11 (Sustainable Cities and Communities)** through inclusive, place-based planning initiatives; fosters **SDG 17 (Partnerships for the Goals)** through collaboration and dialogue across sectors and regions; encourages **SDG 12 (Responsible Consumption and Production)** by linking emissions to both behavioral and systemic change; contributes to **SDG 9 (Industry, Innovation and Infrastructure)** by supporting the application of innovative tools and methodologies; strengthens **SDG 4 (Quality Education)** by raising awareness and building capacity among local actors; and supports **SDG 16 (Peace, Justice and Strong Institutions)** through transparent, participatory governance processes in climate planning.

Ultimately, this deliverable establishes the foundation for a forward-looking and replicable planning model. While it outlines the necessary structure, data and calculations to understand GHG emissions and assess policy options, the tool itself remains under development. It will adhere to the proposed approach but still requires testing and refinement to ensure full functionality. The finalized version is expected to be deployed for the three target islands of the CO2 PACMAN project. As such, this version should be seen not as a definitive product, but as a tool in a continuous, iterative process toward a finalized fully complete version.

6. References

1. Interreg Euro-MED. (n.d.). *Green Living Areas Mission*. Interreg Euro-MED Programme. Retrieved June 5, 2025, from https://green-living-areas.interreg-euro-med.eu/

2. IPCC, 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan.

3. IPCC, 2019. 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Report.

4. United Nations. (n.d.). *Sustainable Development Goals*. United Nations. Retrieved June 5, 2025, from https://sdgs.un.org/goals