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Abbreviations

AFOLU	Agriculture, Forestry and Other Land Use
CER	Renewable Energy Communities
DEDISA	Intermunicipal Solid Waste Management Company (Crete)
GHG(s)	GreenHouse Gas(es)
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
LTC	Local Technical Committee
LULUCF	Land Use, Land-Use Change and Forestry
MW / MWh	Megawatt / Megawatt-hour
NIMBY	“Not In My Back Yard”
RETs	Renewable Energy Technologies
SMEs	Small Medium Enterprises
VR	Virtual Reality
WP	Work Package



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Executive summary

This document presents the **Climate Neutrality Roadmaps** developed within the CO2 PACMAN project, aimed at supporting Mediterranean island territories in their transition towards climate neutrality. The roadmaps build upon the **CO2 PACMAN Toolkit** introduced in Output 1.1, translating its methodological framework into the development of locally adapted and socially supported decarbonisation pathways.

The process follows a **structured approach** combining technical analysis, participatory methodologies, and innovation-oriented activities. It builds on the comprehensive assessment of greenhouse gas (GHG) emissions and carbon sinks carried out in the first phase of the Toolkit, which provided a clear understanding of territorial emission profiles and **identified key sectors** requiring targeted intervention. Particular attention is given to the role of energy systems and mobility patterns as primary emission sources, alongside the contribution of natural ecosystems in carbon absorption. This dual perspective enables the design of **balanced strategies** integrating mitigation measures with the preservation and enhancement of existing sinks.

Building on this analytical foundation, the present document focuses on the **Scenario Development Phase** of the Toolkit, where future **transition pathways** are explored, tested, and refined. A key element in this phase is the application of the **CO2 PACMAN Tool**, which supports the simulation of different intervention scenarios and allows stakeholders to **visualise the potential impacts** of their choices, strengthening the link between data analysis and decision-making.

A central component of the methodology is the adoption of a **Living Lab approach**, ensuring the **active involvement** of a wide range of **stakeholders**, including public authorities, businesses, SMEs, civil society organisations, academia, and citizens. Through participatory formats—such as citizen engagement activities, interactive exhibitions, co-design workshops, and scenario simulations—participants were able to explore future development pathways, assess policy options, and contribute to the identification of **shared priorities**.

The process is further enriched by the integration of **complementary dimensions**, including SME engagement through open innovation activities and the consideration of financial aspects related to the implementation of transition measures. A central element of this approach is the development of landscape scenarios, which translate the energy transition from abstract targets into concrete spatial configurations, illustrating how renewable energy technologies can be deployed in relation to the specific territorial characteristics, land uses, and ecological functions of each island. Immersive visualisation tools further support this spatial dimension by making proposed transformations tangible and accessible to diverse audiences. This **holistic approach** ensures that the proposed



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roadmaps are not only **technically robust**, but also **economically feasible** and **socially acceptable**.

Key findings highlight a strong convergence towards transition pathways centred on energy efficiency, electrification, sustainable mobility, and nature-based solutions, while also reflecting the specific territorial, cultural, and ecological characteristics of each island context.

Overall, the **Climate Neutrality Roadmaps** provide a structured and **replicable framework** for **supporting island territories** in their decarbonisation efforts. By operationalising the CO2 PACMAN Toolkit and combining data-driven analysis with participatory processes and innovation tools, they contribute to the development of **transition strategies** that are **context-specific**, inclusive, and **aligned** with long-term climate objectives.



Introduction

This deliverable builds upon the methodological framework developed in **Output 1.1**, where the **CO2 PACMAN Toolkit** (Figure 1) was introduced as a structured approach to support islands in their transition towards climate neutrality. The Toolkit was conceived as a two-phase process, articulated into an **Assessment Phase** and a **Scenario Development Phase**, complemented by a set of Technical Notes providing detailed methodological guidance for each component.

In Output 1.1, the different elements of the Toolkit were presented and their methodological foundations were outlined. The application of the framework focused primarily on the Assessment Phase, enabling the **collection** and **analysis of baseline data**, the **identification** of **key challenges**, and the establishment of a **shared knowledge** base across the three pilot islands. This phase represented a crucial step to ensure a comprehensive understanding of **local contexts**, as a prerequisite for informed decision-making.

The present deliverable advances this work by operationalising the **Scenario Development Phase** of the Toolkit. Following the methodologies defined in the Technical Notes, the project partners have applied the framework to **co-develop** and assess **future transition scenarios**, translating analytical insights into **actionable pathways**. This phase aims to explore alternative trajectories, evaluate their impacts, and support stakeholders in identifying **feasible** and **effective strategies** for reducing greenhouse gas emissions.

A central role in bridging the Assessment and Scenario Development phases is played by the **CO2 PACMAN Tool**, which acts as an **interactive decision-support instrument**. The tool enables the simulation of different intervention scenarios, allowing users to **visualise** potential outcomes and better understand the relationships between actions and emission reductions. Its application within this deliverable strengthens the integration between data analysis and **participatory processes**, fostering a more informed and inclusive approach to local transition planning.

Overall, this deliverable contributes to moving from analysis to action, demonstrating how the **CO2 PACMAN Toolkit** can be effectively implemented to support scenario building and decision-making processes. By presenting the results obtained through the application of the Scenario Development methodologies, the document provides evidence of the Toolkit's capacity to guide islands in designing tailored, data-driven, and participatory transition pathways.

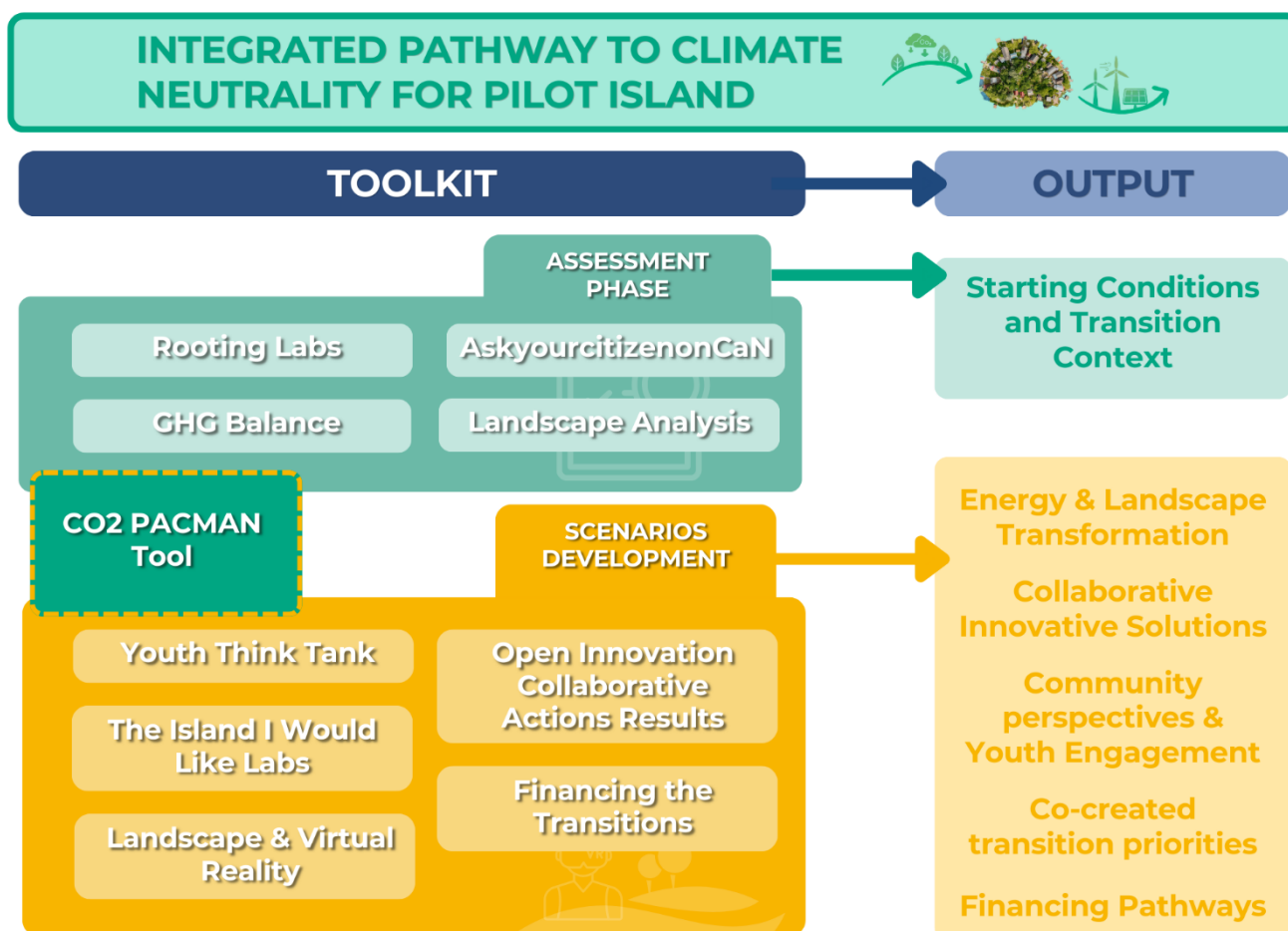


Figure 1: From CO2 PACMAN Toolkit Intervention Logic to Climate Neutrality Roadmaps



The Island I Would Like lab

The **Island I Would Like** Lab represents the second phase of the CO2 PACMAN Living Lab process, shifting from assessment and data collection towards the **co-creation** of locally grounded **decarbonisation pathways**. Building on the **evidence** and **insights** generated during the initial phase, the Lab was designed as a **structured, multi-day participatory** process aimed at translating technical knowledge into **shared visions** and actionable strategies for a climate-neutral future. The activity brought together a broad range of **stakeholders**—including public authorities, businesses, civil society actors, students, and citizens—in order to **foster dialogue** across different perspectives and ensure that proposed solutions reflect **local priorities, constraints, and expectations**.

The Lab was organised around a combination of complementary formats, each addressing a specific dimension of the transition process. These included **open** and **accessible activities** for **citizen engagement**—such as **vox populi interviews** and **interactive exhibition areas**—alongside more structured sessions focused on scenario simulation, **co-design**, and **policy discussion**. Through this integrated approach, participants were able not only to explore and better understand the island's current emission profile, but also to **actively contribute** to the definition of future pathways by testing solutions, discussing trade-offs, and identifying **shared priorities**. Overall, the Lab functioned as a bridge between knowledge and action, supporting the development of a community-informed transition roadmap grounded in both technical evidence and social consensus.

Vox populi

A complementary dimension of the **participatory approach** was represented by the **vox populi** activity, designed to **directly capture** the **perceptions, expectations, and concerns** of local citizens regarding climate change and the island's transition pathway. While the co-design sessions engaged structured stakeholder groups in a facilitated decision-making process, the interviews provided a more **spontaneous** and **qualitative insight** into the broader social context within which decarbonisation strategies would need to be implemented. This component is particularly relevant in light of the growing recognition that climate neutrality cannot be achieved solely through top-down planning and technical optimisation, but requires the active engagement, acceptance, and behavioural contribution of the local population.



Youth Think Tank

The **Youth Think Tank** represents a structured participatory pathway within the CO2 PACMAN project aimed at **actively involving young people** in climate neutrality processes. The methodology combines **awareness-raising, knowledge transfer, scenario exploration**, and **co-design**, progressively guiding students from initial reflection to the development of concrete decarbonisation proposals. Further methodological details and a comprehensive analysis of activities and results are provided in Deliverable 2.2.1 (Citizen Survey, Youth Think Tank Report, Financing the Transition: evaluation report).

Open Innovation Collaborative Action

The **Open Innovation Collaborative Action** represents a complementary **participatory** dimension of the CO2 PACMAN roadmap-building process, aimed at connecting local decarbonisation challenges with external innovative solutions developed by **SMEs, startups**, and **research** actors across Europe. Within the project framework, the activity functions as a strategic **bridge** between **territorial needs** and technological or organisational **innovation**, fostering **collaboration** between island stakeholders and external solution providers. Building on the experience acquired during the previous Blue Deal project, the activity adopts a **bottom-up** approach in which local communities, public authorities, and stakeholders actively contribute to identifying the most relevant challenges affecting their territories. A total of **three challenges** per island were selected and published through a dedicated online platform, where European SMEs and startups were invited to propose innovative solutions. Through this process, **55 solutions** were submitted by external actors. The proposed solutions were subsequently evaluated by the Local Technical Committees (LTCs), which selected the three most promising proposals per challenge. Selected SMEs and startups were invited to present their solutions allowing direct interaction between challengers and solution providers exploring of potential collaborations and future agreements. The second round of Living Labs was conceived as an additional opportunity to strengthen these relationships and further assess the applicability of the proposed solutions within the local island contexts.

All submitted solutions were compiled into an online catalogue and repository¹, creating an accessible collection of innovative approaches addressing island decarbonisation challenges.

¹ The Open Innovation Colab platform is available at: openinnovationcolab.com



CO2 PACMAN Tool co-design

The **co-design sessions** carried out using the CO2 PACMAN Tool² represent a central component of the roadmap development process, providing a structured and **interactive environment** to support **participatory climate planning**. The Tool is designed to translate complex greenhouse gas (GHG) data into an accessible and operational format, enabling stakeholders to **explore decarbonisation pathways** through scenario-based simulations.

Building on the GHG balance as a baseline, the Tool allows participants to **visualise** the **emission** profile of their territory, **identify** key **hotspots**, and **test** the **effects** of different policy measures across sectors such as energy, mobility, buildings, waste, and land use. By combining **quantitative modelling** with a **user-friendly interface**, it supports evidence-based decision-making while remaining accessible to non-expert users.

The co-design process is structured around **collaborative simulation exercises**, where participants are invited to design their “ideal island” by selecting and combining different policy options. This approach reflects real-world planning dynamics, requiring the **integration of environmental objectives** with considerations related to technical **feasibility**, **economic sustainability**, and **social acceptability**. The Tool therefore acts as an enabling platform for dialogue, negotiation, and **collective learning**.

A key added value of the CO2 PACMAN Tool lies in its ability to make the **impacts** of **policy** choices **immediately visible**, allowing participants to understand the **cause-effect relationship** between selected measures and overall emission reductions. This fosters systems thinking and encourages more informed and coherent decision-making processes. At the same time, the participatory nature of the exercise promotes the **inclusion of diverse perspectives**, strengthening the social dimension of climate planning and enhancing the legitimacy of proposed solutions.

Overall, the use of the CO2 PACMAN Tool within the co-design sessions contributes to **bridging the gap** between **technical analysis** and **participatory planning**. It enables stakeholders to **move from awareness to action**, supporting the development of decarbonisation strategies that are not only technically sound, but also **context-specific**, **collectively defined**, and **aligned** with **local needs** and **capacities**.

² The CO2 PACMAN Tool is available at: co2pt.unisi.it



Landscape scenarios

The landscape scenarios represent a concrete **spatial dimension** of the roadmap development process, **integrating spatial, environmental**, and **perceptual aspects** into the definition of decarbonisation pathways. Developed within the CO2 PACMAN framework, the landscape approach considers the **territory** not only as a physical space for the deployment of renewable energy technologies, but also as a **living system shaped by the interaction between natural features, human activities**, and **cultural values**. Starting from the analysis of landscape characteristics and their suitability for renewable energy generation, the approach **identifies** the potential of **different land uses** to **host transition-related interventions**, such as solar and wind energy systems. This allows for the **definition** of **landscape capabilities**, linking **technical feasibility** with **ecological functions** and potential **co-benefits for local communities** and **ecosystems**. Based on this analytical framework, a set of landscape-based scenarios is developed to explore alternative yet complementary visions of the energy transition. Rather than representing fixed planning solutions, these scenarios are conceived as discussion tools aimed at **supporting stakeholder engagement, raising awareness**, and **facilitating** the collective **evaluation of trade-offs** between **energy production, environmental protection**, and **landscape preservation**.

A key added value of this approach lies in its ability to make the spatial implications of decarbonisation strategies more **tangible**. Through **visual representations** and **design prototypes**, participants are able to better understand how different interventions may transform the territory, thereby supporting more **informed** and **conscious decision-making processes**. This visual and narrative dimension also contributes to enhancing **social acceptance**, by enabling stakeholders to **express preferences, concerns**, and **expectations** regarding possible future transformations.

Overall, the landscape scenarios contribute to **bridging the gap** between **technical planning** and **territorial perception**, promoting a more integrated and place-based approach to climate neutrality. By linking renewable energy deployment with landscape identity and community values, they support the development of **transition pathways** that are not only **effective**, but also **context-sensitive** and **socially grounded**.



Virtual reality

The **Virtual Reality (VR) Experience** developed within the CO2 PACMAN project represents an **immersive** and participatory **visualization tool** designed to support dialogue and awareness-raising around renewable energy scenarios and climate-neutral transition pathways on the pilot islands. By translating spatial analyses and landscape studies into **realistic three-dimensional environments**, the VR application enabled citizens and stakeholders to directly **explore** possible future transformations of their territories within a recognisable geographical context. Rather than relying exclusively on maps, technical reports, or static visualisations, the experience allowed participants to observe future scenarios at human scale and from multiple perspectives, including ground-level, coastal, and aerial viewpoints.

Within the framework of *The Island I Would Like Labs*, the VR experience played a significant role in **strengthening participatory** planning processes and **facilitating** more informed **discussions** on the spatial implications of the energy transition. The immersive dimension of the tool supported a clearer understanding of the scale, visibility, and territorial integration of renewable energy infrastructures, helping participants assess potential impacts in a more intuitive and tangible way. In this sense, the VR application contributed to bridging the gap between technical planning and public perception, transforming abstract policy discussions into concrete spatial experiences grounded in the everyday landscape of the islands.

Particular attention was given to the **landscape sensitivity** and **territorial identity** of the pilot islands. Renewable energy installations were integrated into recognisable local environments, including agricultural areas, coastal landscapes, and village perspectives, allowing participants to evaluate how different transition pathways could interact with existing cultural and environmental characteristics.

Building on this immersive approach, a further **digital tool** was developed to extend the communicative reach of the project beyond the Lab activities. The **CO2 PACMAN Mini-Game³** is an **interactive educational game environment** designed to enhance engagement with the project's results through exploration, interaction, and **gamification**. Rather than relying on conventional documents or static displays, the platform transforms educational content into an interactive journey where learning is achieved through discovery, movement, and active participation within a **virtual landscape**. Participants navigate a three-dimensional environment structured around a central island functioning as a shared hub, from which they can access **tutorial materials** and travel through portals to three themed island environments, each corresponding to one of the pilot islands. Each environment incorporates **educational posters, voice-over explanations, and quiz-based progression systems** (Figure 2), allowing users to explore the climate scenarios developed for each island at their own pace while following structured learning pathways. Additional

³ The CO2 PACMAN Mini-game is available at: [CO2PACMAN-MINIGAME](#)



gamification elements, including **collectible rewards**, **staged exploration areas**, animated content, and achievement-based mechanics, further encourage participation and motivate users to discover all sections of the virtual world. The platform is accessible via web browsers, desktop computers, mobile devices, and augmented reality and virtual reality systems, and has been designed to support future educational and dissemination activities, including its use within the European Academy as an interactive learning tool. In this way, the Mini-Game successfully extends the communicative potential of the immersive tools developed within the project, making complex climate-related content accessible to wider and more diverse audiences while reinforcing the role of digital technologies as strategic instruments for climate awareness and community engagement.



Figure 2: CO2 PACMAN Mini-Game interactive environment, showing the educational posters (top) and the quiz-based progression system with collectible coin rewards (bottom).



Financing the transition

The **Financing the Transition** activity represents the economic and operational dimension of the **CO2 PACMAN roadmap-building process**, supporting the transformation of climate-neutrality scenarios into **financially feasible** and implementable **actions**. Its role is to connect the participatory and creative outputs of the project with the financial conditions required for implementation, acting as a **bridge** between **strategic planning** and **concrete transition pathways**. The activity builds directly on **three components** of the Toolkit that were particularly relevant for this purpose: the **CO2 PACMAN Tool**, which enabled stakeholders to analyse and compare alternative policy combinations and estimate their effects on GHG emissions; the **landscape scenario** development, which translated mitigation priorities into spatial configurations, exploring how technological and policy interventions would interact with territorial characteristics and land-use patterns; and the **Open Innovation Collaborative Action**, which connected local challengers and solvers, including SMEs, to explore concrete technological and business responses. The financing activity builds on those scenarios, offering **examples** and **suggestions** — not prescriptive proposals — of instruments and mechanisms that could potentially support their implementation.

Within the specific context of Mediterranean islands such as **Brač**, **Elba**, and **Crete**, the activity highlighted the importance of adopting **integrated** and **blended financing approaches**. Islands face an "Island Premium" due to higher logistics costs, small-scale inefficiencies, and seasonal demand fluctuations, meaning that a single grant or loan is rarely sufficient to cover an entire transition project. Particular relevance was attributed to European instruments such as LIFE+, Horizon Europe, Interreg, and national recovery and resilience frameworks, which together provide opportunities for supporting both large-scale infrastructure interventions and smaller community-based initiatives.

The framework of funding instruments was presented during the **Living Labs** to participants and **stakeholders**, and the discussion was further enriched by the contribution of **external experts in public and private financing**. Among them, Angela Pispola (Partner, Accounting and Financial Advisory Services, Ernst & Young S.p.A.) and Constantina Kottaridi (Associate Professor, Department of Economics, University of Piraeus) offered their perspectives on financing mechanisms and investment strategies relevant to the climate neutrality transition.

Further methodological details and a comprehensive analysis of activities and results are provided in **Deliverable 2.2.1** (Citizen Survey, Youth Think Tank Report, Financing the Transition: evaluation report).



Brač Transition Roadmap

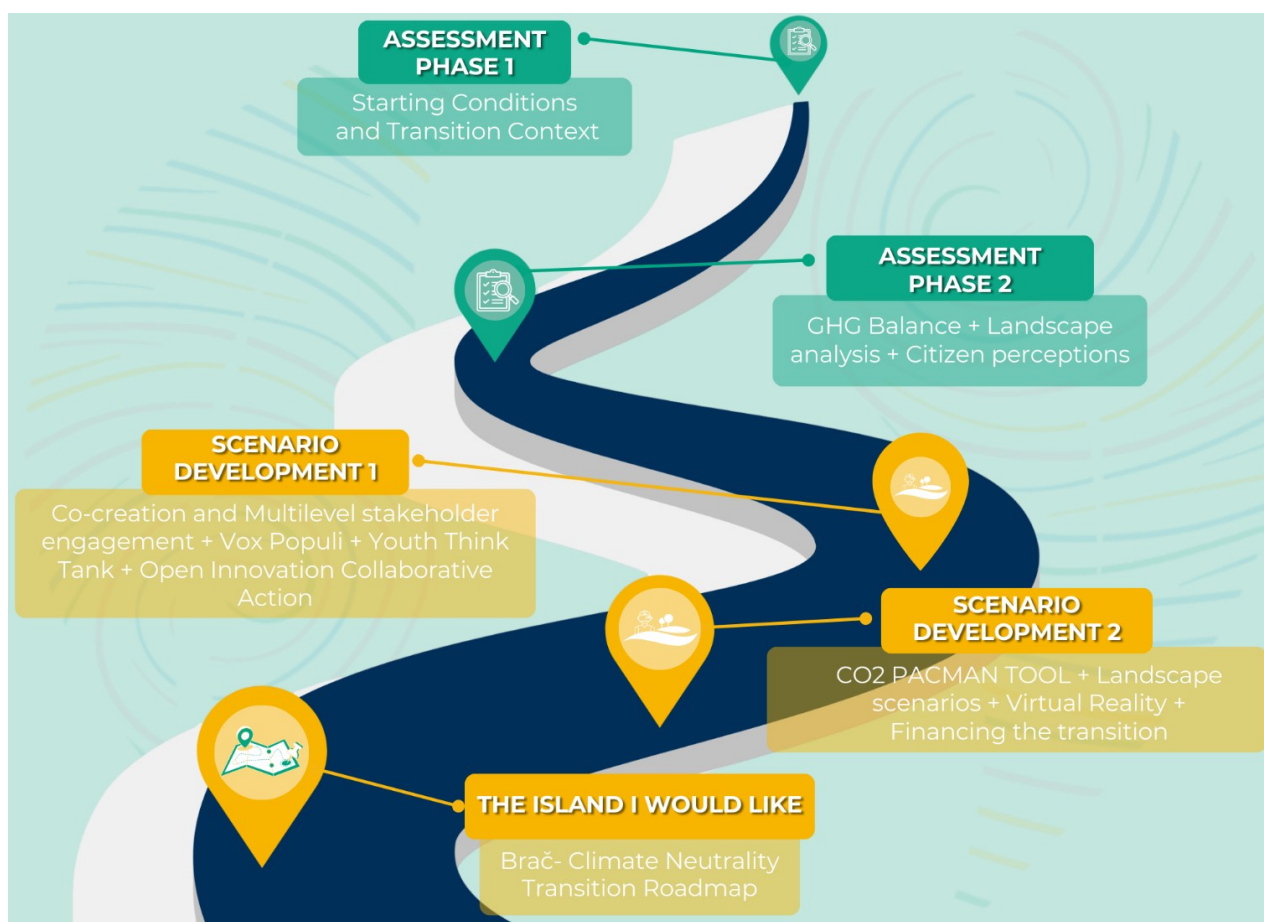


Figure 3: Conceptual pathway guiding the development of the Climate Neutrality Transition Roadmap for Brač.

The **Climate Neutrality Roadmap** for **Brač** (Figure 3) Island represents the outcome of an **integrated, participatory, and evidence-based** process aimed at supporting the island's transition towards a **low-carbon** and **climate-resilient** future. Developed within the framework of the CO2 PACMAN project, the roadmap combines **technical analysis, stakeholder engagement, and co-creation activities** to define a shared and locally grounded vision for decarbonisation.

The process builds on a comprehensive analysis of the island's greenhouse gas (GHG) balance, which identifies **key emission hotspots**—particularly within the energy and mobility sectors—while also highlighting Brač's significant natural carbon sinks. This **dual perspective** provides a solid foundation for designing targeted transition pathways that



balance emission reduction with the preservation and enhancement of absorption capacity. A defining feature of the roadmap is its **multi-layered participatory approach**. Through a series of **Living Lab activities**, a wide range of actors—including public authorities, businesses, SMEs, civil society organisations, students, and citizens—were involved in exploring future scenarios and defining priorities. **Citizen engagement** was fostered through activities such as **vox populi interviews** and **interactive exhibition areas**, while **co-design sessions** and simulations using the **CO2 PACMAN Tool** enabled stakeholders to test policy options and assess their impacts on emissions. In parallel, the roadmap integrates additional dimensions essential for a comprehensive transition strategy. These include the involvement of **SMEs** through open innovation activities, **landscape scenario** analysis supported by immersive **virtual reality tools**, and a dedicated focus on **financing the transition**, recognising the importance of aligning decarbonisation pathways with available resources and investment capacity.

The roadmap is therefore not conceived as a purely technical document, but as a **shared strategic framework** that integrates **quantitative evidence** with **qualitative insights**. It highlights a transition model based on a combination of energy efficiency, electrification, sustainable mobility, and the preservation and enhancement of natural ecosystems. At the same time, it acknowledges key challenges, including the social acceptability of large-scale infrastructure, the need for behavioural change, and the importance of aligning local actions with broader governance and investment frameworks.

Overall, the Brač Climate Neutrality Roadmap provides a **coherent** and **actionable** foundation for guiding future planning and **policy development**. By linking data-driven analysis with participatory decision-making, it supports the development of a transition pathway that is not only environmentally effective, but also **inclusive, context-specific**, and broadly **supported by the local community**.

The Island I Would Like lab

"The Island I Would Like" took place in over three days in Brač in October 2025, bringing together a diverse range of local and regional stakeholders around a structured programme of interactive activities, participatory simulations, and co-design sessions. The event successfully combined **technical engagement** with broad **community involvement**, reaching participants across multiple stakeholder categories including local and regional public authorities, SMEs, NGOs, higher education and research organisations, business support organisations, and education and training centres. As the second phase of the CO2 PACMAN Living Lab process, the Lab functioned as a **bridge** between **knowledge** and **action: shifting** from **assessment** towards **co-creation**, it served as a structured space for translating technical evidence into **shared visions**, testing decarbonisation solutions, and building social consensus around locally grounded **transition pathways** (Figure 4).

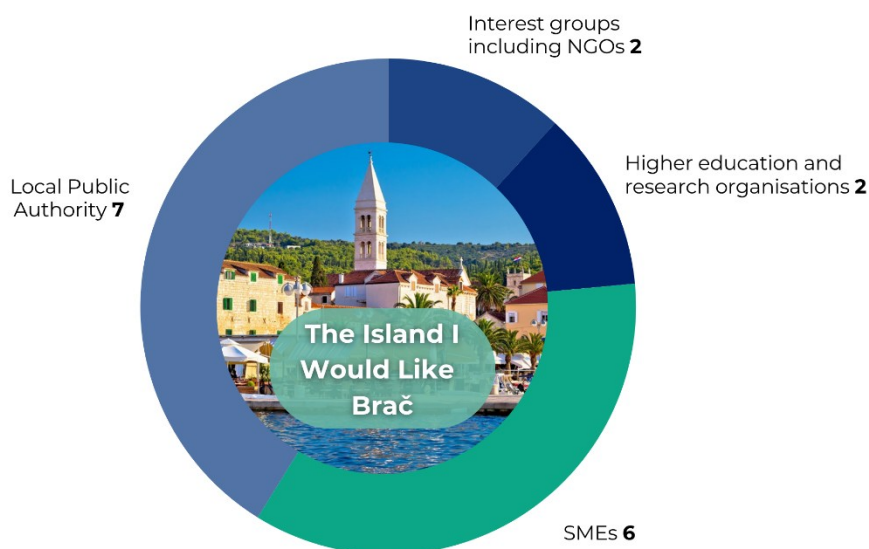


Figure 4: Stakeholders engaged in the Brač The Island I Would Like Lab, categorized by stakeholder typology rather than absolute number of participants.

Vox populi

The interviews conducted with residents of Brač reveal a generally high level of **awareness** of **climate change issues**, broadly consistent with the survey results presented during the workshop in the interactive exhibition areas. Several respondents explicitly confirmed that the findings were “**realistic**” and **representative** of **local perceptions**. However, a recurring theme emerging across multiple responses is the **perceived gap** between **awareness** and **action**. While a large share of the population is considered **informed** about climate change, participants frequently highlighted that this awareness does **not** necessarily **translate** into **concrete behavioural changes**, suggesting the presence of **structural**, **cultural**, or **motivational barriers** that **limit** individual engagement in mitigation efforts.

In relation to specific sectors, **mobility** emerged as a salient concern. Some respondents pointed to the continued presence of **older, high-emission vehicles** on the island, indicating that the **transition** towards cleaner transport solutions is still perceived as **insufficiently advanced**. At the same time, there was a clear **demand** for improved and more sustainable mobility options, including **electric vehicles** and enhanced **public transport** services. This focus is fully consistent with the island’s GHG emissions profile, where the mobility sector accounts for the largest share of emissions (50.8%), suggesting that citizens are not only aware of climate change as a general issue, but also capable of identifying the most critical emission **hotspots** within their own territorial context.



The question of **renewable energy** development elicited more nuanced and, in some cases, ambivalent responses. While several participants expressed **openness** or **cautious optimism** towards the deployment of new renewable technologies, others raised **concerns** regarding their **potential impact** on the island's **landscape**. This aspect is particularly sensitive in a context such as Brač, where **tourism** represents a **central economic pillar** and the preservation of natural and visual identity is closely linked to local livelihoods. The responses suggest that **social acceptance** of large-scale energy infrastructure may **depend** strongly on careful **spatial planning**, scale considerations, and **transparent communication** about impacts and benefits.

When invited to describe their “**ideal island**,” respondents articulated a **vision** that closely aligns with the pathways explored in the simulation exercises. Common elements include a **reduction in private car use**, increased reliance on **public and active mobility**, widespread adoption of **renewable energy** technologies (particularly solar energy), improved **waste management** and recycling practices, and the **preservation of natural ecosystems**. At the same time, several interviewees emphasised the value of **maintaining** the island's current **qualities**—such as **tranquillity**, environmental quality, and suitability for **family life**—indicating that the transition is not perceived as a radical transformation, but rather as a process of **improvement** and **safeguarding** of **existing assets**.

Overall, the vox populi results highlight a population that is broadly **aware** of climate challenges and generally **supportive** of sustainability-oriented changes, while also attentive to potential trade-offs, particularly in relation to landscape and economic implications. From a policy perspective, these insights underline the importance of complementing technical and strategic planning tools with **targeted communication**, awareness-raising initiatives, and **participatory mechanisms** capable of bridging the **gap** between **knowledge** and **action**. In this sense, the integration of citizen perspectives represents a crucial element for ensuring the social feasibility and long-term effectiveness of decarbonisation pathways on Brač Island.

Youth Think Tank

On Brač, the pathway engaged both **high school** and **university** students through a multi-phase process, starting with introductory activities during the Rooting Lab and evolving into more advanced analytical and design-oriented exercises. Initial phases revealed a high level of **concern** about **climate change** among younger participants, coupled with a **limited familiarity** with the concept of **climate neutrality**. Through interactive sessions and the use of simplified data, students progressively developed a clearer understanding of the relationship between everyday behaviours, territorial dynamics, and emissions.

The subsequent phases strengthened the analytical dimension of the process, particularly through collaboration between high school students and university students specialising in spatial and environmental disciplines. The integration of **geospatial analyses**, territorial data, and **simulations** using the **CO2 PACMAN Tool** enabled participants to explore the



feasibility and impacts of different **mitigation measures**, fostering systems thinking and **intergenerational knowledge exchange**.

The most significant contribution of the Youth Think Tank emerged during the **co-design** phase, where students actively participated in **shaping concrete proposals** for the island's **transition**. Building on both technical analyses and local perspectives, they contributed to the definition of **integrated solutions** across key sectors. In the energy domain, proposals included the large-scale deployment of **rooftop photovoltaic systems**—supported by detailed assessments of available roof surfaces—and the energy renovation of residential buildings. In the mobility sector, students played a central role in developing scenarios for the **electrification of transport**, including the introduction of electric **buses**, increased uptake of electric vehicles, and the electrification of **ferry** services, supported by analyses of **traffic patterns** and **seasonal population dynamics**. Additional contributions addressed **waste and circular economy strategies**, with proposals aimed at reducing unsorted waste through **behavioural change and education**, as well as environmental measures such as the **afforestation** of degraded areas to enhance carbon sinks. **Water management** solutions were also explored, including the introduction of smart metering systems to improve efficiency and reduce losses.

Overall, the Youth Think Tank on Brač demonstrates the added value of integrating young people into co-design processes. By combining technical knowledge with local awareness and **future-oriented perspectives**, students contributed to the development of proposals that are both **ambitious** and **context-sensitive**. Their involvement not only enriched the content of the roadmap, but also reinforced its social dimension, highlighting the role of younger generations as active contributors to the island's long-term transition towards climate neutrality.

Open Innovation Collaborative Action

The first Lab held from 14th to 16th October 2025, “The Island I would like” in Brâc, Croatia, invited the 3 chosen solutions (1 per challenge) (Figure 5) to travel to the island, giving them the opportunity to interact with the island's population, the challengers, public administrations, and stakeholders on each island. In fact, the problem solvers participated in the **open-air fair**, where they presented their proposals to the public. During this second Brâc lab, **conversations** between the challengers and the problem solvers were developed, and efforts were made to help them reach **agreements**. A roundtable discussion was also held to present the challenges and the chosen solutions to the island's public.

The first Open Innovation Lab, held from 14th to 16th October 2025 on Brač under the framework “The Island I would like”, brought together the selected solutions for each challenge and enabled their direct engagement with the island context. The initiative provided an opportunity for the selected problem solvers to present their proposals on-site, **fostering interaction** with local stakeholders, public administrations, and the broader island community. The lab was structured as an open and participatory setting aimed at



strengthening the **dialogue** between **innovation providers** and **local actors**, allowing solutions to be confronted with real operational needs and territorial specificities. Throughout the three-day programme, the problem solvers actively engaged in exchanges with challengers and stakeholders, refining their proposals through feedback and discussion and contributing to a shared understanding of implementation conditions and constraints. A key moment of the lab was the public open-air fair, where the selected solutions were presented to the wider community. This format enabled direct communication between innovators and residents, supporting **transparency** and facilitating the social appropriation of the proposed ideas. In addition, a dedicated roundtable session was organised to collectively present the challenges and discuss the proposed solutions, further reinforcing the participatory dimension of the process and encouraging dialogue across institutional, technical, and civic actors.

Overall, the second Brač Lab confirmed the value of embedding open innovation processes within real territorial contexts. By combining public engagement activities with structured moments of dialogue, the initiative supported the alignment between innovative solutions and local needs, while also strengthening mutual understanding among stakeholders and contributing to the broader objective of co-developing actionable and context-sensitive responses for the island's transition.

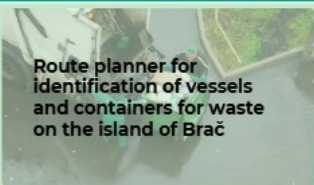
BRAČ CHALLENGE	SOLVERS		
 Route planner for identification of vessels and containers for waste on the island of Brač	Integra Estrategia y Tecnología		5
	LIS Data Solutions		
	Nordsense		
	SmartEnds BV		
	4 Colors		
 FireSafeEV - increasing knowledge and safety for electric vehicle fires	Argos		6
	Fire Isolator		
	Legal Pythia		
	Luveti		
	Simon Rack EcoFire		
	University of Central Lancashire		
 Applicative solution for monitoring and reducing drinking water losses from the water supply system	Defcom 8		7
	Fibsen		
	Immersia		
	Hulo		
	NRW Cockpit / Hydrosan		
	Uclan		
	Waterness		

Figure 5: Open Innovation Collaborative Action in Brač: challenges (on the left), solutions received (in the middle), categorized by nationality of the solvers and the number (on the right). The selected solvers are highlighted in green.



GHG Baseline and CO2 PACMAN Tool Co-designing

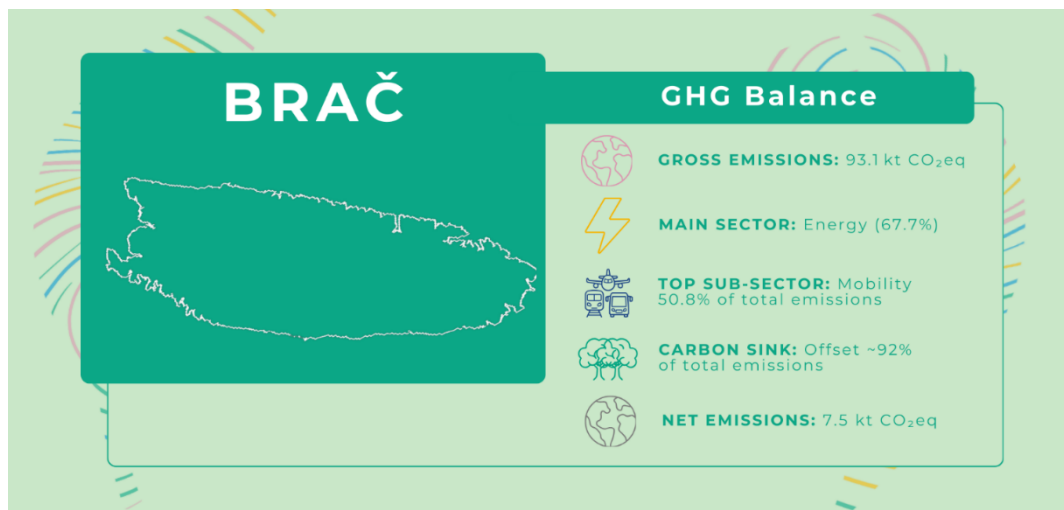


Figure 6: Summary of Brač GHG balance

The **greenhouse gas (GHG) balance** of Brač Island (Figure 6) represents the **baseline** scenario from which participants started the **co-design process**. The inventory provides a **quantitative picture** of the island's **emission** profile and identifies the main **hotspots** requiring **targeted intervention**. The **Energy sector** emerges as the dominant source of emissions, accounting for approximately two-thirds of total gross emissions (around **68%**). This reflects the relevance of electricity consumption, heating demand, and transport-related fuel use within the island system. The **AFOLU sector** represents the second largest contributor (approximately **21%**), while the **Waste sector** accounts for the remaining share (around **11%**). No emissions are attributed to industrial processes, as the island does not host mineral, chemical, or metal production activities generating process-related emissions under IPCC categorisation. Overall, **total gross emissions** amount to **93.1 kt CO₂eq**. A key structural feature of Brač Island, however, is its **extensive forest coverage** and associated **carbon sinks**, which **compensate** for approximately **92%** of gross emissions (**85.5 kt CO₂eq**). As a result, **net emissions** amount to only **7.5 kt CO₂eq**, placing the island in a structurally advantageous position and relatively **close to carbon neutrality** compared to many other territorial contexts. For the purposes of the **co-design** session, this baseline configuration is particularly significant. On the one hand, it **clearly identifies** the Energy sector as the primary mitigation **hotspot** and therefore a strategic area for intervention. On the other hand, the strong carbon uptake capacity highlights the importance of preserving and enhancing **natural sinks** as a **complementary strategy** within decarbonisation pathways. Participants were therefore invited to design their “ideal island” starting from a context that is already close to climate neutrality, where strategic choices could focus not only on emission reduction but also on maintaining and strengthening existing absorption capacities. Further methodological details on the GHG accounting framework and sectoral disaggregation are provided in **Technical Note 2: GHG Balance**, within **Output 1.1** (Toolkit



for the Development of Climate Neutrality Scenarios) and **Deliverable 1.3.1** (CO2 PACMAN Datasets and Tools).

The simulation activity was carried out within a structured co-design session conceived as a participatory tool to support territorial planning for decarbonisation. Participants were divided into **four mixed working groups**, each composed of representatives from different categories of local **stakeholders**, including high school **students**, university students, **public administration** technical staff, and representatives of **local enterprises**. The heterogeneous composition of the groups was intentionally designed to **foster dialogue** among diverse **perspectives**, integrate **technical expertise** with **intergenerational viewpoints**, and stimulate a shared decision-making process. This methodological approach allowed for the simulation of real-world territorial planning dynamics, which typically require **balancing environmental objectives** with **technical feasibility**, **economic sustainability**, and **social acceptability**. Within this framework, the CO2 PACMAN Tool functioned as an enabling instrument to support informed discussion, allowing participants to comparatively assess different policy options and collaboratively design “the Island they would like” through **conscious** and **negotiated choices**. The co-design phase therefore plays a central role in strengthening participatory approaches to climate planning, promoting the active involvement of the local community in energy transition processes.

Building on the baseline scenario, which already showed a structurally favourable position due to the island’s high carbon uptake capacity (approximately 92% of gross emissions compensated), the simulation results demonstrate a consistently strong performance across all participating groups. **All four groups** not only **achieved carbon neutrality**—defined as the **full compensation** of territorial emissions—but **exceeded** this threshold by a substantial margin. As illustrated in Figure 6, each group developed a scenario in which total mitigation effects went beyond the neutrality benchmark, resulting in an **overall positive balance** between emissions and compensations. Within the simulation framework, this confirms that all groups were able to **design a coherent policy mix** capable of **fully offsetting net emissions** and **generating an additional mitigation surplus**. While the favourable starting point, characterised by substantial forest-based carbon sinks, clearly facilitated the pathway towards neutrality, the results nonetheless reflect the effectiveness of the selected mitigation measures in addressing the island’s primary emission hotspots, particularly within the Energy sector. The overachievement observed across all groups suggests that, when provided with structured tools and a collaborative decision-making environment, diverse stakeholder groups are able to identify and combine policy options capable of delivering **ambitious decarbonisation outcomes**.

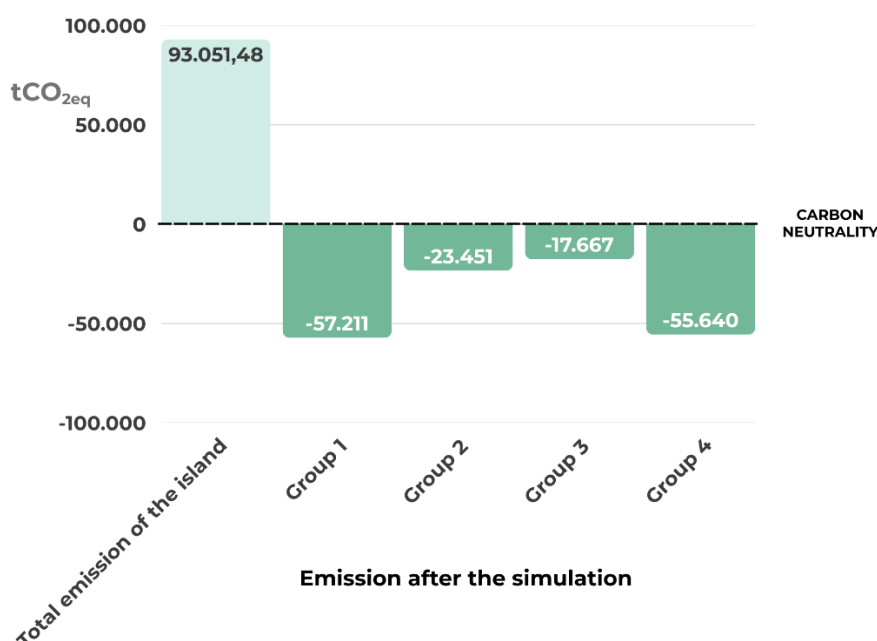


Figure 7: Summary of Brač Carbon Neutrality scenarios achieved during the simulations with the CO2 PACMAN Tool

The aggregated analysis of the results generated through the CO2 PACMAN Tool highlights a clear common trend across the four participating groups. Out of the **28 policies** available within the simulation framework, **11** were **excluded at least once**, while **17** were consistently **selected** by all groups, indicating a strong level of **convergence** around a substantial core of **measures** perceived as **priorities** (Figure 7). Among the mobility-related measures, the **electrification of maritime transport** emerged as particularly relevant for the island's transition pathway. As highlighted in the assessment phase, Brač is already relatively close to climate neutrality on a net basis, and scenario discussions showed that interventions in the maritime sector could play a decisive role in closing the remaining emissions gap. In particular, **replacing two conventional ferries** serving the island with electric alternatives **would be sufficient** to **exceed** the **remaining emissions balance**. This option attracted strong interest among participants, who widely recognised its potential impact and compatibility with the island's territorial context, although its **implementation** ultimately **depends** on investment decisions taken by **private ferry operators** and higher-level **transport authorities**.

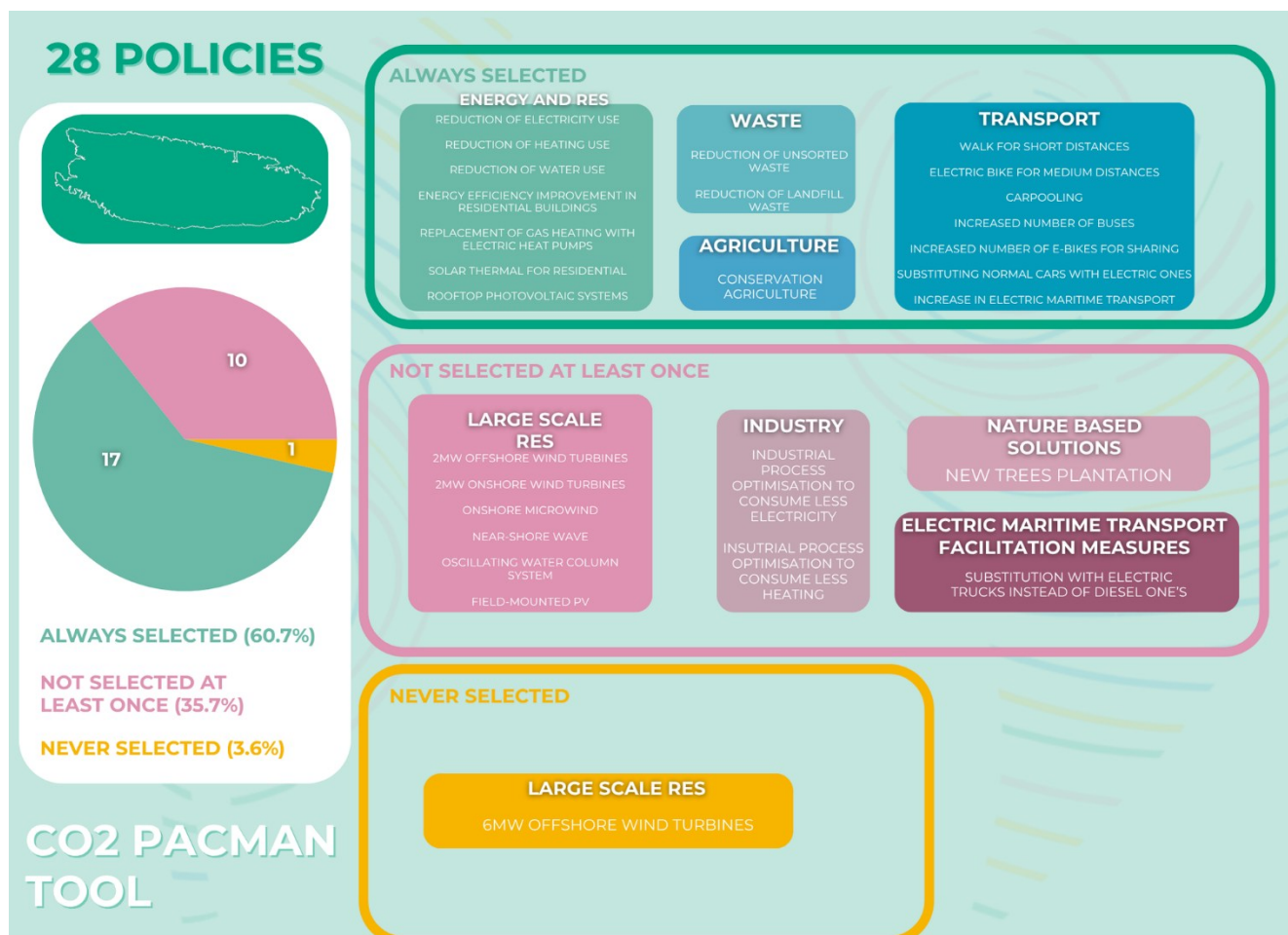


Figure 8: Selection for the CO2 PACMAN Tool policies

A closer examination of the excluded measures reveals different levels of recurrence in their exclusion across the four simulations (Figure 8). One policy—the deployment of **large-scale 6MW wind turbines**—was **excluded by all groups (4 out of 4)**, representing the only measure that did not receive support in any of the scenarios developed. Two additional measures were excluded by **three groups out of four**: the deployment of **2MW offshore wind turbines** and the use of **near-shore wave energy converters**. A further three policies were **excluded by two groups**, including the deployment of **2MW onshore wind turbines**, the implementation of **wave power** based on oscillating water column systems, and the installation of **microwind systems**. Finally, five policies were **excluded by only one group**, including the **optimisation of industrial processes** to reduce electricity and heating consumption, the increase in **electric trucks**, renewable electricity generation from **field-mounted photovoltaic systems**, and **tree plantation**.

Overall, the distribution of exclusions highlights a clear pattern: policies most frequently set aside are those related to **large-scale renewable energy infrastructure**, particularly **offshore wind** and **marine energy solutions**. In contrast, all groups consistently retained



measures addressing **household energy consumption, building efficiency, sustainable everyday mobility** (such as walking, carpooling, and electric bikes), **waste reduction**, and the **electrification of residential technologies**. This pattern indicates a strong preference for **distributed and locally embedded solutions** directly connected to the **urban and domestic sphere**, rather than **large infrastructural interventions** with significant territorial impact. In designing their “ideal island,” participants therefore prioritised an energy transition pathway centred on **energy efficiency, widespread electrification**, and **behavioural change**, while showing greater reluctance towards **industrial-scale solutions**. This orientation may be influenced by factors such as **perceived landscape impacts, lower social acceptability, higher technical complexity**, and **greater economic barriers** associated with major investments. Overall, the co-design exercise reveals a vision of the energy transition that is primarily grounded in **local, behavioural, and community-based dimensions**, rather than **large-scale infrastructural transformation**.

Following the individual simulation exercises, a **joint co-creation session** was organised to **consolidate** the **results** and **explore potential convergence** among participants. During this phase, representatives from the four groups were invited to collectively **review** the **policies** that had been **excluded** in the previous simulations and discuss their potential inclusion within a shared decarbonisation pathway. This step was designed to replicate a collaborative policy-design process, allowing participants to exchange perspectives, clarify assumptions, and negotiate common priorities. The comparison between the outcomes of the individual simulations and the final co-creation exercise reveals that several **initial positions evolved** through the deliberative process. In particular, **four policies that had been excluded** by at least one group during the individual simulations **were reconsidered and ultimately included in the jointly defined scenario**. These measures include the **optimisation of industrial processes** to reduce electricity and heating consumption, the installation of **microwind systems**, and renewable electricity generation from **field-mounted photovoltaic systems**. Their inclusion suggests that, **once discussed collectively**, these options were **perceived** as **technically or strategically relevant** within the overall decarbonisation pathway.

Overall, this iterative process highlights the **added value** of **combining individual scenario** development with a subsequent **co-creation phase**. While the initial simulations captured the diversity of perspectives across stakeholder groups, the joint exercise enabled participants to reassess certain options and move towards a more coherent and **collectively** endorsed **set of priorities**. From a roadmap development perspective, this step illustrates how participatory tools can support the progressive **refinement of decarbonisation strategies through dialogue, negotiation**, and **shared learning** among local stakeholders.



Landscape scenarios

The landscape-based approach to the energy transition roadmap for Brač was developed following the same methodological framework applied across the CO2 PACMAN pilot islands, grounded in the principle that every landscape embodies renewable natural energies and that a sustainable transition can be planned by **designing** with regard to the **specific features** of each **territory**. Landscape is treated not only as a technical parameter but also as a **medium** for **public involvement**, offering citizens and stakeholders an accessible and spatially grounded entry point into **climate neutrality discussions**.

The technical process began with the **quantification** of the **energy target**: achieving carbon neutrality requires installing approximately **8.5 MW** of **additional renewable energy** capacity on Brač. Building on this objective, a **landscape suitability** and **capability analysis** was conducted, combining solar and wind energy **potential maps** with a **land-use assessment** to identify where renewable energy technologies could generate co-benefits beyond decarbonisation. The analysis confirmed a high and relatively **homogeneous solar potential** across the island, with peak irradiance concentrated in the south-western region. Terrestrial **wind potential** is more **limited**, with the most significant resources concentrated in the Brački Channel along the eastern coastline.

On this basis, **three landscape-based scenarios** for the energy transition were developed, framed not as mutually exclusive alternatives but as **complementary perspectives** through which different transition pathways could be explored and discussed.

Scenario 01 – Urban and Coastal Energy Integration

The first scenario (Figure 9) supports the **preservation** of Brač's **traditional landscape** mosaic of **vineyards**, **olive** groves, and arable land through the deployment of **agrivoltaic pergola** systems in valley plains with fertile alluvial soils. These systems can **support arable cultivation**, **water saving**, and **regenerative farming practices**, while simultaneously enabling the formation of local energy communities. The scenario is fully capable of **satisfying** the **8.5 MW target** through a combination of farm-scale, cooperative, and peri-urban installations, complemented by subsidised photovoltaic systems on building rooftops and facades.

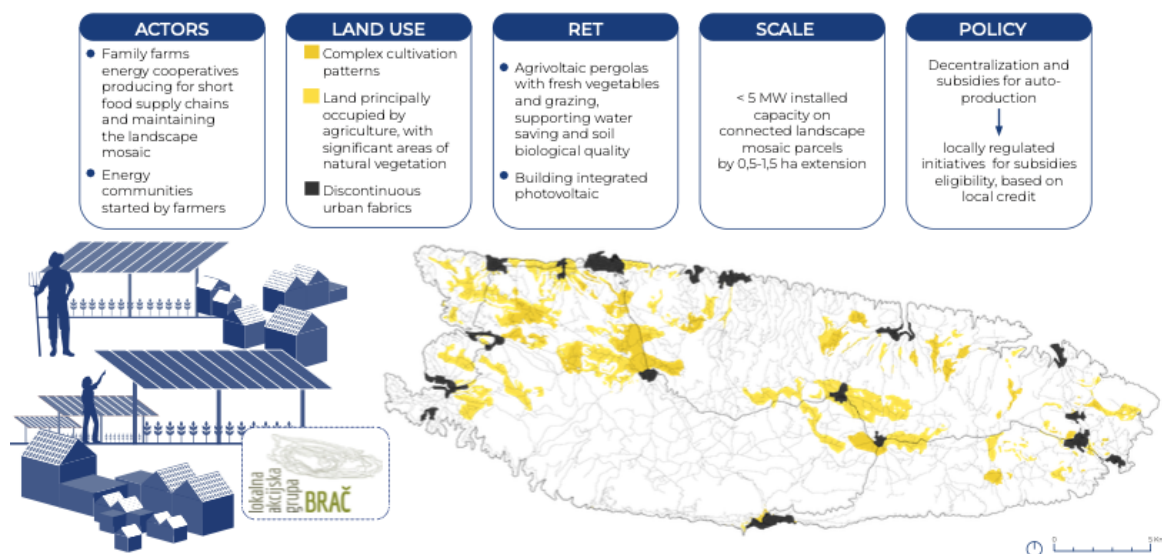


Figure 9: factsheet reporting on scenario main actors, potentially suitable land uses, technology, spatial and investment scale and possible policy sustaining the scenario.

Scenario 02 – Renewable Energy and Ecological Coexistence

The second scenario (Figure 10) combines **wind** and **solar development** with the **recovery** of **natural habitat** and enhanced landscape experience, following the island's touristic vocation. Wind turbines installed on **pastureland** in elevated and windy areas can coexist with **ecotourism** pathways, while **ground-mounted photovoltaic** arrays integrated into **former mineral extraction sites** can support ecological succession from pioneer grassland to sclerophyllous vegetation, with solar revenue funding the regeneration process over time.

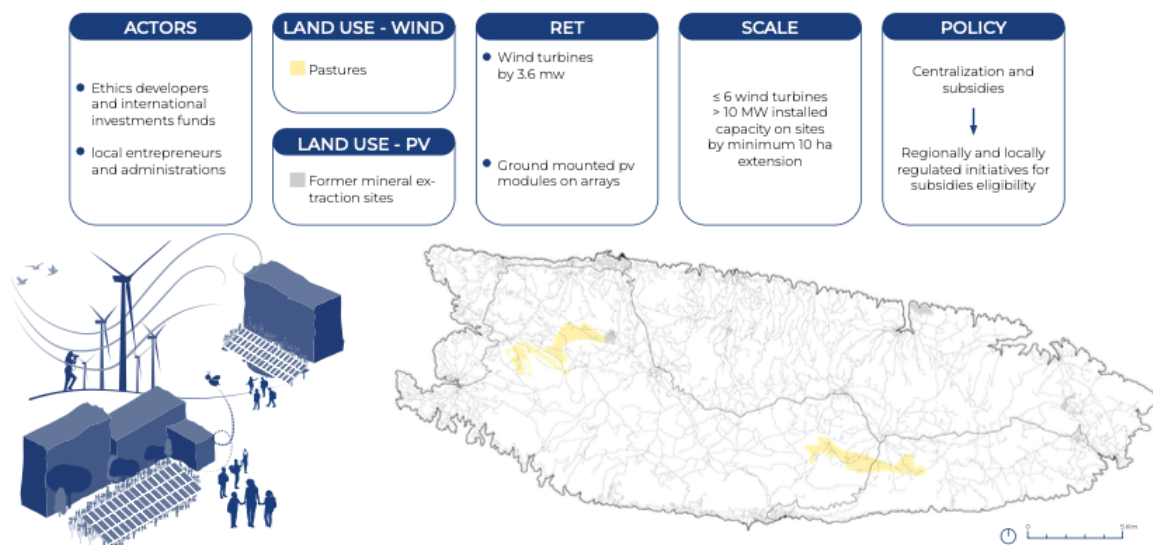


Figure 10: factsheet reporting on scenario main actors, potentially suitable land uses, technology,



spatial and investment scale and possible policy sustaining the scenario.

Scenario 03 – Agrivoltaics and Rural Resilience

The third scenario (Figure 11) proposes **agrivoltaic** systems in **olive groves** and **vineyards** to support **adaptation** to **climate change**, particularly in contexts affected by **summer heat waves**, **early grape harvesting**, and **premature fruit dropping**. Agrivoltaic pergolas installed in newly planted vineyards in the south-east of the island and in traditional olive groves in the north-west can provide both **microclimate benefits** for crops and **additional income** from **electricity generation**, supporting the continuation of certified PDO production and sustainable farming practices.

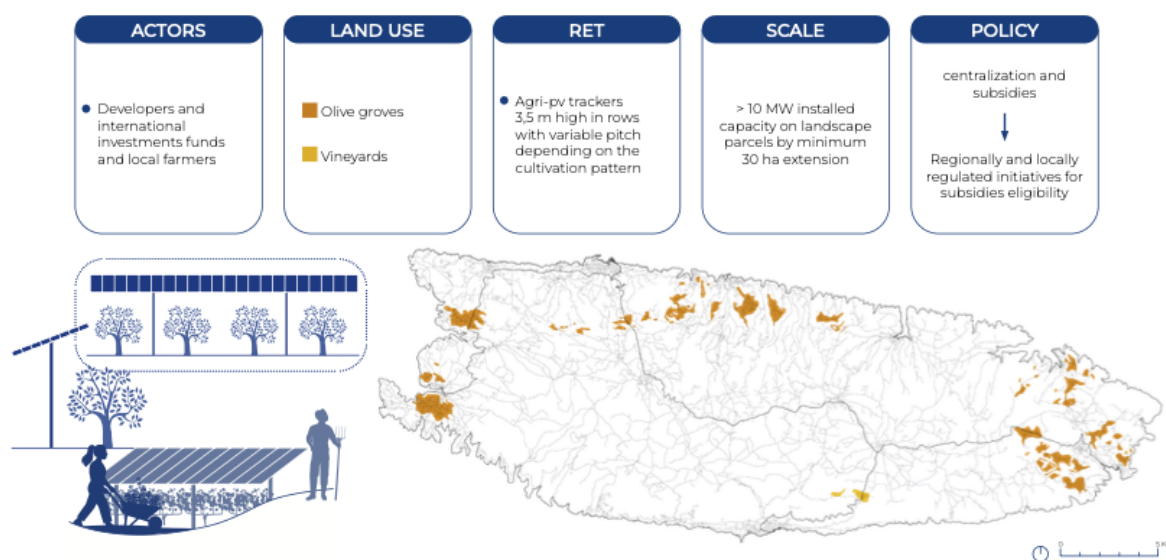


Figure 11: factsheet reporting on scenario main actors, potentially suitable land uses, technology, spatial and investment scale and possible policy sustaining the scenario.

For each scenario, a **design prototype** was developed to translate the proposed configurations into spatially concrete and visually communicable proposals. **Two** prototypes were produced: one for an **agrivoltaic system** on complex **cultivation patterns** land, combining fresh vegetable and grain cultivation with energy community development; and one for a **wind park** on pastureland in an elevated inland location, sized at six turbines with a **total effective capacity of 21.6 MW**. A detailed description of the landscape analysis, scenario development, design prototypes, and stakeholder engagement outcomes is provided in **Annex 1.a**.



Virtual reality

The development of the Brač virtual reality (VR) experience followed a structured pathway, moving from landscape analysis to **full immersive simulation**. Initial spatial studies, carried out by UNIFI, defined the boundaries of the renewable scenarios and identified appropriate locations for agrivoltaic installations and wind turbines, forming the conceptual foundation of the visualisation process. Particular attention was given to **landscape sensitivity**, visibility corridors, agricultural land use, and coastal morphology, ensuring that the proposed scenarios respected the island's **territorial identity**. Building on these analyses, the terrain of Brač was digitally reconstructed within a georeferenced 3D environment integrating Mediterranean vegetation, agricultural patterns, road networks, and atmospheric conditions. The objective was not only technical accuracy but also visual familiarity, as local users needed to recognise their island in the simulation in order to engage meaningfully with the proposed transformations.

The final immersive experience incorporated two main renewable scenarios. The **agrivoltaic** installation was presented as an elevated photovoltaic system allowing agricultural activity underneath, illustrating the concept of dual land use. Users could explore the installation at ground level and subsequently transition to an aerial balloon perspective, gaining a broader understanding of its spatial integration within the landscape (Figure 12, Figure 13). The **wind energy** scenario followed a progressive narrative structure: participants first observed the turbines from distant coastal and village viewpoints before approaching them at close range, a sequence intentionally designed to communicate scale, spatial distribution, and visual impact in a gradual and comprehensible manner. The Brač VR experience therefore constitutes a structured and transferable methodology for immersive territorial visualisation, moving from analytical landscape study and scenario modelling to rendering development and participatory validation during the Lab.



Figure 12: Approaching nearby village with hot air balloon. Labels above villages help observer identify locations.



Figure 13: Visiting Agrivoltaic facility in VR, humans added for scale; with a close-up of lettuce and tomato plants.

Beyond its direct representational function, the Brač VR experience demonstrated a clear capacity to enhance cognitive **engagement** and environmental **awareness** among participants. The immersive format allowed users to move from passive reception of information to **active spatial interpretation**, enabling them to construct their own understanding of scale, distance, and territorial integration. The agrivoltaic scenario proved particularly effective in clarifying how photovoltaic infrastructure can coexist with



agricultural production, transforming the concept of dual land use from a technical abstraction into a visible and intuitive reality, while the progressive approach to wind turbines allowed users to assess their actual visual impact within a contextualised landscape setting. The experience also produced meaningful motivational and **social effects**: participants who completed the VR session frequently remained to discuss what they had seen, and the activity contributed to **intergenerational dialogue** by functioning as a common communication platform across demographic groups. From a participatory governance perspective, making proposed renewable infrastructures visible within an accurate geographical framework reduced uncertainty and enabled citizens to evaluate concrete representations, supporting transparency, trust-building, and constructive engagement around climate-neutral transition.

Financing the transition

Translating the **transition priorities** identified for Brač into concrete actions requires not only technological feasibility and social support, but also the mobilisation of adequate financial resources. Mediterranean islands face specific constraints in this regard — geographic isolation, small-scale energy systems, seasonal economic fluctuations, and limited administrative capacity all tend to increase the cost and complexity of investments — making it necessary to combine complementary instruments rather than relying on a single funding source.

The **financing strategy** for Brač is therefore structured around a **multi-layered approach** that aligns each category of intervention with the most appropriate funding mechanism. **European programmes** such as LIFE Clean Energy Transition, Interreg Italy-Croatia, and Interreg Euro-MED can support renewable energy deployment, sustainable mobility, and pilot experimentation across the energy and transport sectors. The Integrated Territorial Programme 2021–2027 (ITP) and **national instruments** such as the Environmental Protection and Energy Efficiency Fund (FZOEU) and the Renewable Energy Programme 2026–2030 provide the capital required for the large-scale deployment of mature infrastructure, from field-mounted photovoltaic systems to onshore wind installations. For **innovation-oriented solutions** — including smart waste routing and fibre-optic water leak detection — Horizon Europe and the LIFE Circular Economy and Quality of Life sub-programme offer relevant funding pathways, while the Connecting Europe Facility (CEF Energy) can support larger energy infrastructure investments. Beyond public funding, innovative mechanisms — including **community crowdfunding**, **living lab investment** models, and **blended finance platforms** — can attract additional private capital while strengthening local ownership and social legitimacy of transition projects.

A detailed mapping of funding instruments for the specific solutions emerging from the co-design process, the landscape scenarios, and the Open Innovation activities is provided in **Deliverable 2.2.1** (Citizen Survey, Youth Think Tank Report, Financing the Transition: evaluation report).



Elba Transition Roadmap

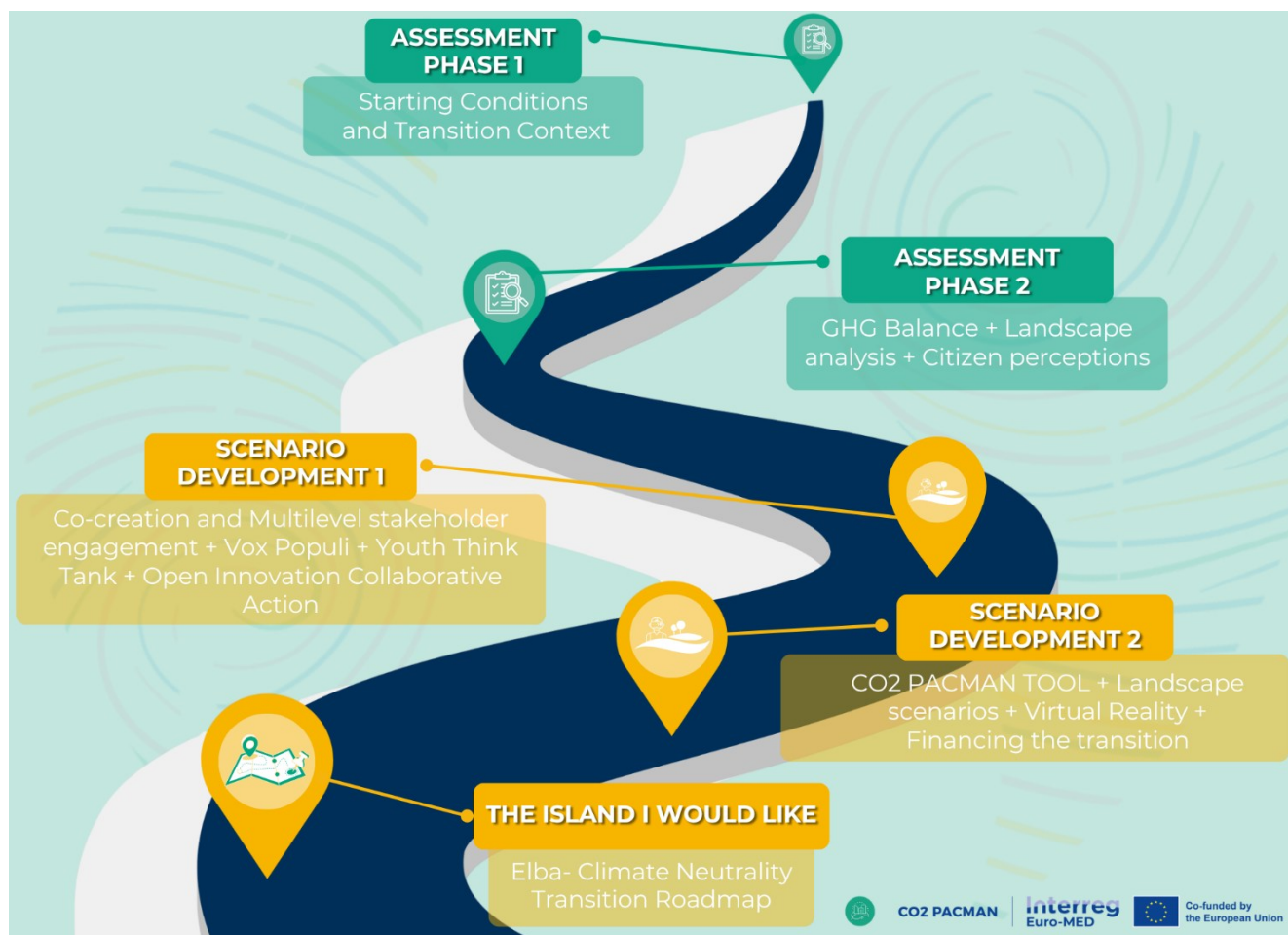


Figure 14: Conceptual pathway guiding the development of the Climate Neutrality Transition Roadmap for Elba.

The **Climate Neutrality Roadmap for Elba** (Figure 14) represents the outcome of an **integrated, participatory**, and **evidence-based process** aimed at supporting the island's transition towards a low-carbon and climate-resilient future. Developed within the framework of the CO2 PACMAN project, the roadmap combines technical analysis, stakeholder engagement, and co-creation activities to define a shared and locally grounded vision for decarbonisation.

The process builds on a comprehensive analysis of the island's greenhouse gas balance, which identifies the **energy sector** as the **primary source of emissions** while also highlighting the **strategic importance** of the **island's natural carbon sinks**. A defining feature of Elba's transition context is the close interconnection between climate neutrality



objectives and the island's **territorial identity**: tourism, agriculture, coastal landscapes, and geo-mining heritage are not peripheral considerations but central dimensions of any viable transition pathway. This requires an approach capable of integrating energy transition goals with landscape sensitivity, local economic resilience, and the preservation of the distinctive environmental and cultural assets that define the island.

A defining feature of the roadmap is its **multi-layered participatory approach**. Through a series of Living Lab activities, a wide range of actors, including public authorities, businesses, SMEs, civil society organisations, students, and citizens, were involved in exploring future scenarios and defining priorities. **Citizen engagement** was fostered through vox populi interviews and interactive exhibition areas, while **co-design** sessions and simulations using the **CO2 PACMAN Tool** enabled stakeholders to test policy options and assess their impacts on emissions. In parallel, the roadmap integrates additional dimensions essential for a comprehensive transition strategy, including the **involvement of SMEs** through open innovation activities, **landscape scenario analysis** supported by immersive virtual reality tools, and a dedicated focus on financing the transition, recognising the importance of aligning decarbonisation pathways with available resources and investment capacity.

The roadmap is therefore not conceived as a purely technical document, but as a **shared strategic framework** that integrates quantitative evidence with qualitative insights. It highlights a transition model built on renewable energy deployment, energy efficiency, sustainable mobility, and the preservation and enhancement of natural and agricultural ecosystems, while connecting these technical objectives to the specific territorial conditions and community values of Elba. At the same time, it acknowledges **key challenges**, including the **social acceptability** of large-scale infrastructure, the need to balance energy transition with landscape protection, and the importance of aligning local actions with broader governance and investment frameworks.

Overall, the Elba Climate Neutrality Roadmap provides a coherent and actionable foundation for guiding future planning and policy development. By linking data-driven analysis with participatory decision-making, it supports the development of a transition pathway that is not only environmentally effective, but also inclusive, context-specific, and broadly supported by the local community.

The Island I Would Like lab

"The Island I Would Like" Lab took place in over three days in Elba, structured as an **open**, place-based and **participatory experience** combining immersive exploration, co-design sessions, and institutional dialogue. The first day unfolded through an **immersive walk** within the former mining landscape of Capoliveri, involving **80** participants including citizens, local stakeholders, and public authorities. The second day shifted towards structured **co-design** and scenario simulation using the CO2 PACMAN Tool, while the third day consolidated outcomes into a shared roadmap, connecting locally generated visions



with broader **governance frameworks** and **European climate targets**. As the second phase of the CO2 PACMAN Living Lab process, the Lab functioned as a **bridge** between **knowledge** and **action**: shifting from assessment towards co-creation, it served as a structured space for translating technical evidence into **shared visions**, testing decarbonisation solutions, and building social consensus around locally grounded **transition pathways**. Participants spanned a broad range of stakeholder categories, including local and regional public authorities, enterprises and SMEs, NGOs and interest groups, higher education and research organisations, infrastructure providers, and business support organisations (Figure 15).

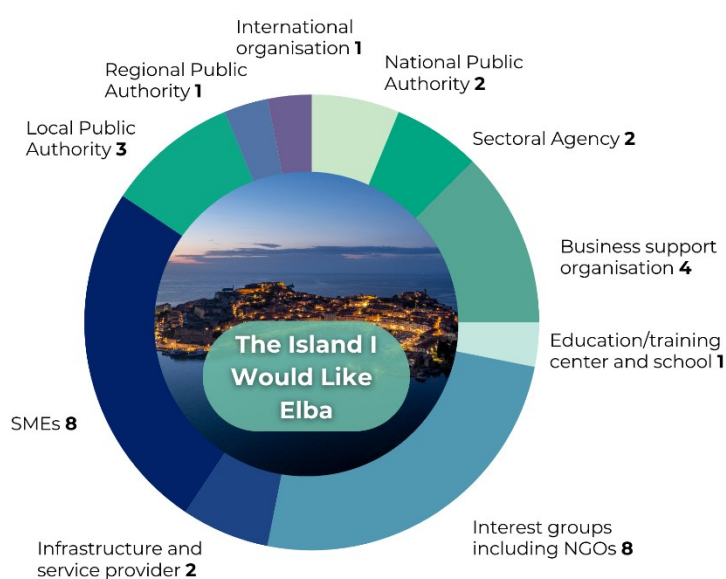


Figure 15: Stakeholders engaged in the Elba The Island I Would Like Lab, categorized by stakeholder typology rather than absolute number of participants.

Vox populi

The **Vox Populi** interviews conducted on Elba reveal a generally **positive** and **forward-looking attitude** towards the energy transition and climate-related actions. Participants frequently described the survey results as “accurate” and representative of an increasing **environmental awareness** among local communities, highlighting a growing **sensitivity** towards renewable energy and climate change issues. Several respondents also emphasised the importance of **active citizen involvement** in addressing environmental challenges, underlining that both institutional initiatives and individual participation are necessary to support the transition process. In this sense, climate action is not perceived solely as a technical or political matter, but as a **collective responsibility** that directly concerns the future development of the island.



The issue of **renewable energy** installations generated reflections that balanced **environmental protection** with the **need for change**. While some participants acknowledged that new infrastructures may inevitably **alter the landscape**, most responses suggested that such impacts could be **acceptable** if implemented **carefully** and in a “soft” or **integrated** manner. The idea that renewable energy deployment is necessary to preserve the environment in the long term emerged strongly across the interviews, indicating a relatively high degree of **social acceptance**, provided that interventions remain compatible with the island's natural and visual identity. Some respondents also pointed out that the availability of unused or sparsely vegetated land could facilitate the integration of renewable energy systems while minimising environmental disruption. When describing **the island they would like to live on**, interviewees consistently referred to a vision centred on **harmony** between **human** activities and **nature**. The **preservation of green landscapes** and **environmental quality** emerged as a central aspiration, together with the desire for a fully “**green**” island powered by renewable energy. At the same time, respondents stressed the importance of improving mobility systems, particularly through more extensive and **electrified public transport**, as well as strengthening infrastructure and welfare services for both residents and tourists. These perspectives suggest that sustainability is understood not only in environmental terms, but also as a broader concept encompassing quality of life, accessibility, and social well-being.

Overall, the interviews portray a community that is broadly **supportive** of sustainability-oriented transformations while remaining attentive to the need for balanced and context-sensitive implementation strategies. The responses highlight the importance of ensuring that renewable energy development and decarbonisation pathways are designed in a way that preserves Elba's ecological and **cultural identity**, while simultaneously improving local services and living conditions. From a policy perspective, the Vox Populi findings underline the value of participatory approaches capable of integrating citizens' expectations, environmental concerns, and long-term development objectives within the island's transition process.

Youth Think Tank

On Elba, the **Youth Think Tank** pathway was developed with students from **ISIS Raffaello Foresi** in Portoferraio through a structured multi-phase process, progressing from awareness-building and participatory learning to scenario simulation and the co-design of concrete transition proposals. Initial phases revealed that a large majority of students were **unfamiliar** with the concept of climate neutrality, while emotional responses to the climate crisis were predominantly characterised by **worry** and **anxiety**. Through interactive presentations, live questionnaires, and game-based learning activities — including the Fish Game and the COOL Game — students progressively developed a clearer understanding of the relationship between resource use, ecosystem dynamics, and emissions, with over **72%** reporting **increased awareness** of sustainability following the experiential sessions.



The subsequent phases strengthened the analytical and participatory dimension of the process. The introduction of the **CO2 PACMAN Tool** enabled students to work in groups on **scenario-building exercises**, testing different mitigation measures and assessing their combined effects on the island's emissions balance. Transport emerged as a central concern, alongside renewable energy deployment, forest expansion, and maritime electrification, with students also reflecting on the trade-offs between **energy infrastructure**, **landscape sensitivity**, and **tourism compatibility** — dimensions particularly relevant to Elba's territorial identity.

The most significant contribution of the Youth Think Tank emerged during the final **co-design phase**, where students translated their accumulated learning into three original project **proposals** presented at the Lab. **THALASSAEA** addressed the reduction of emissions from maritime transport through **ferry electrification** and alternative propulsion solutions. **FOUR B-System** proposed a modular **carbon capture system** for port areas, based on active carbon filters installed under piers. **PENELOPE** focused on the restoration and sustainable management of **Posidonia oceanica** meadows, integrating coastal protection, CO₂ sequestration, and circular economy approaches.

Overall, the Youth Think Tank on Elba demonstrates the added value of integrating young people into co-design processes through a structured, multi-phase pathway. By combining progressive knowledge-building with hands-on tools and creative design exercises, students contributed proposals that are both technically grounded and locally embedded. Their involvement not only enriched the content of the roadmap, but also reinforced its social dimension, highlighting the role of younger generations as active contributors to the island's long-term transition towards climate neutrality.

Further methodological details and a comprehensive analysis of activities and results are provided in **Deliverable 2.2.1** (Citizen Survey, Youth Think Tank Report, Financing the Transition: evaluation report).

Open Innovation Collaborative Action

The second “The Island I Would Like” lab, held from 22nd to 24th March 2026 on Elba, represented a further step in the continuous process connecting **challenge identification**, **solution development**, and **territorial implementation**. Building on the exchanges initiated during the Valencia Business Forum, the Lab provided the opportunity to move from the presentation of solutions to a more **direct** and substantive **dialogue between challengers and solvers**, situated within the island's own decarbonisation context.

The Open Innovation action was integrated into the Lab's programme from the outset, with the challenges and selected solutions presented as part of the **interactive exhibition areas** on the first two days, alongside the greenhouse gas inventory, landscape scenarios, and other project activities. This approach ensured that the innovation dimension was



visible not only to technical actors but also to the broader public, reinforcing the connection between local challenges and the wider ecosystem of available solutions.

The core moment of the Open Innovation process took place during the session dedicated to the island's decarbonisation roadmap, where **challengers** and **solvers engaged** in a structured **roundtable** discussion. The **challengers** were Norman La Rocca (**Fondazione Acqua dell'Elba**), Claudio Della Lucia (**CER Elba**) and Antonio Arrighi (**Azienda Agricola Arrighi**). On the **solver** side, the programme included Mar Domínguez (**Bluease**), Josep Pijuan Parra (**EURECAT**) and Davide Barbaresi (**ENERECO**), that could not attend to this meeting but sent a statement to the challenger in order to renew the contact and following up the conversations (Figure 16). The format was designed to go beyond technical presentation, encouraging both sides to **reflect** on the **motivations** behind their participation, the practical **obstacles** encountered, and the **potential** for the proposed solutions to evolve beyond the project's timeframe. The Lab also enabled **direct bilateral exchanges** between challengers and solvers, creating space for more focused, challenge-specific conversations that allowed proposals to be tested against concrete operational needs and local conditions.

Overall, the Elba Lab confirmed the value of embedding open innovation within a structured territorial process. Its contribution lay in raising the profile of the selected solutions within the island community, creating conditions for direct and meaningful contact between demand and supply, and positioning the proposed innovations within a locally grounded and publicly discussed decarbonisation roadmap. The next phase should build on these foundations by maintaining the connections established during the Lab and monitoring whether the emerging alignments continue to develop into concrete implementation pathways.



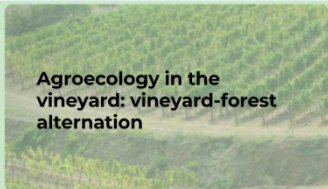
ELBA CHALLENGE	SOLVERS		
 Agroecology in the vineyard: vineyard-forest alternation	Durham University		5
	Eurecat		
	Integra Estrategia y Tecnología		
	Legal Pythia		
	Porto Protocol		
 Sustainable Events: A Roadmap to Carbon Neutrality for the Island of Elba	AIMPLAS		7
	Bluease		
	Ecopulse		
	ELBA NEST		
	Green Living Projects		
	LIS Data Solutions		
	Sea the Change		
 Sun, Sea & Hydrogen	Bailardi Boutique Engineering		8
	David de Haro Malo de Molina		
	Enerco		
	Equitus Engineering		
	European Marine Energy Centre		
	GreenShift Elba		
	Muhammad Waheed Azam		
	University of Central Lancashire		

Figure 16: Open Innovation Collaborative Action in Elba: challenges (on the left), solutions received (in the middle), categorized by nationality of the solvers and the number (on the right). The selected solvers are highlighted in green.

CO2 PACMAN Tool

The **simulation** activity carried out on Elba Island was designed as a participatory exercise aimed at **exploring** different **perspectives** on decarbonisation pathways through the use of the **CO2 PACMAN Tool**. Unlike the approach adopted in other pilot cases, **participants** were not organised into mixed stakeholder groups but were instead **divided** into **homogeneous groups**, each composed of **actors sharing similar backgrounds** and roles. In particular, six simulation sessions were conducted with **high school students**, while two additional sessions involved **local decision-makers** and **technical stakeholders**, including mayors, public administration representatives, local organisations (such as the National Park authority and energy communities), and experts in key sectors such as mobility, energy, and waste management.

This methodological choice was intended to **capture** distinct **viewpoints** and enable a structured comparison between different stakeholder categories. By allowing each group



to develop decarbonisation scenarios independently, the exercise made it possible to **highlight** how **priorities**, perceived **constraints**, and levels of **technical awareness influence policy selection**. The results were therefore analysed comparatively, with a specific focus on differences in ambition, policy preferences, and alignment between perceived and actual effectiveness of the measures.

High school students

The results obtained from the **student** groups of **I.S.I.S. Foresi** (Portoferraio, Elba) show a heterogeneous but overall **proactive approach**. As illustrated in Figure 17, three out of six groups successfully achieved **carbon neutrality**, while the remaining groups, although not reaching full compensation of emissions, still delivered significant emission reductions. This indicates a generally high level of engagement and an ability to identify impactful mitigation strategies, even when a fully balanced scenario was not achieved. It is also worth noting that one group significantly exceeded the carbon neutrality threshold, achieving a markedly higher level of emissions compensation compared to the others. This outcome can be interpreted as the result of a particularly ambitious and exploratory approach, in which participants maximised the deployment of high-impact mitigation measures within the simulation framework. While this may reflect a degree of optimism in the perceived feasibility of certain interventions, it also highlights the capacity of the tool to **encourage forward-looking** and **transformative thinking** among younger participants.

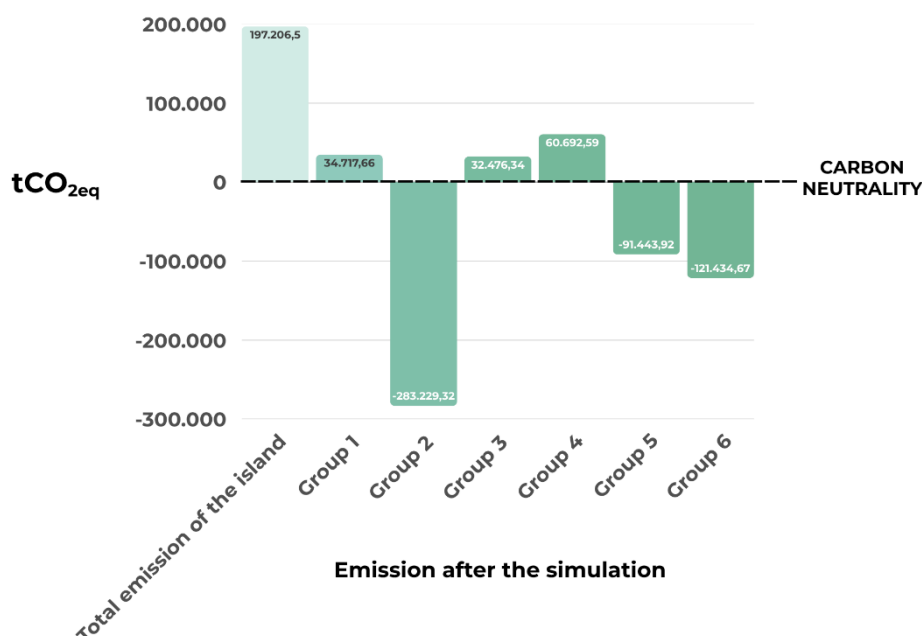


Figure 17: Result of the simulation – achieving the carbon neutrality



From the perspective of policy selection, a total of **nine policies** (out of the 28 available) were **excluded at least once** across the six student simulations. The distribution of these exclusions are presented in Figure 18. Large-scale wind solutions—both 6MW turbines and 2MW onshore installations—emerge as the most frequently excluded measures (4 out of 6 groups), followed by microwind systems and field-mounted photovoltaic installations (3 out of 6). Other measures, such as tree plantation and offshore wind, were excluded less frequently, while policies related to industrial optimisation and shared mobility were only marginally excluded. Overall, this pattern suggests a relative **reluctance** towards large-scale or infrastructure-intensive **renewable energy** solutions, particularly those **perceived** as having a **higher territorial** or **landscape impact**.

At the same time, the analysis of the most selected policies reveals a preference for a diversified and balanced portfolio of interventions. Students consistently **prioritised** measures related to conservation **agriculture**, **marine energy** technologies (both oscillating water column systems and near-shore converters), electrification of heating through heat pumps, **waste reduction**, and **photovoltaic** renewable energy generation. This pattern indicates a tendency to combine behavioural, nature-based, and technological solutions, reflecting an integrated vision of the energy transition.

However, when examining the policies identified as most effective in terms of CO₂ emissions reduction, a more concentrated pattern emerges. **The most impactful measures** are predominantly associated with **large-scale renewable energy** generation and **transport electrification**, with near-shore wave energy, field-mounted photovoltaic systems, and offshore wind technologies appearing most frequently among the top-performing options. This highlights a **partial misalignment** between **perceived priorities** and **actual mitigation potential**, as some of the most effective measures are not always those most strongly selected by participants.

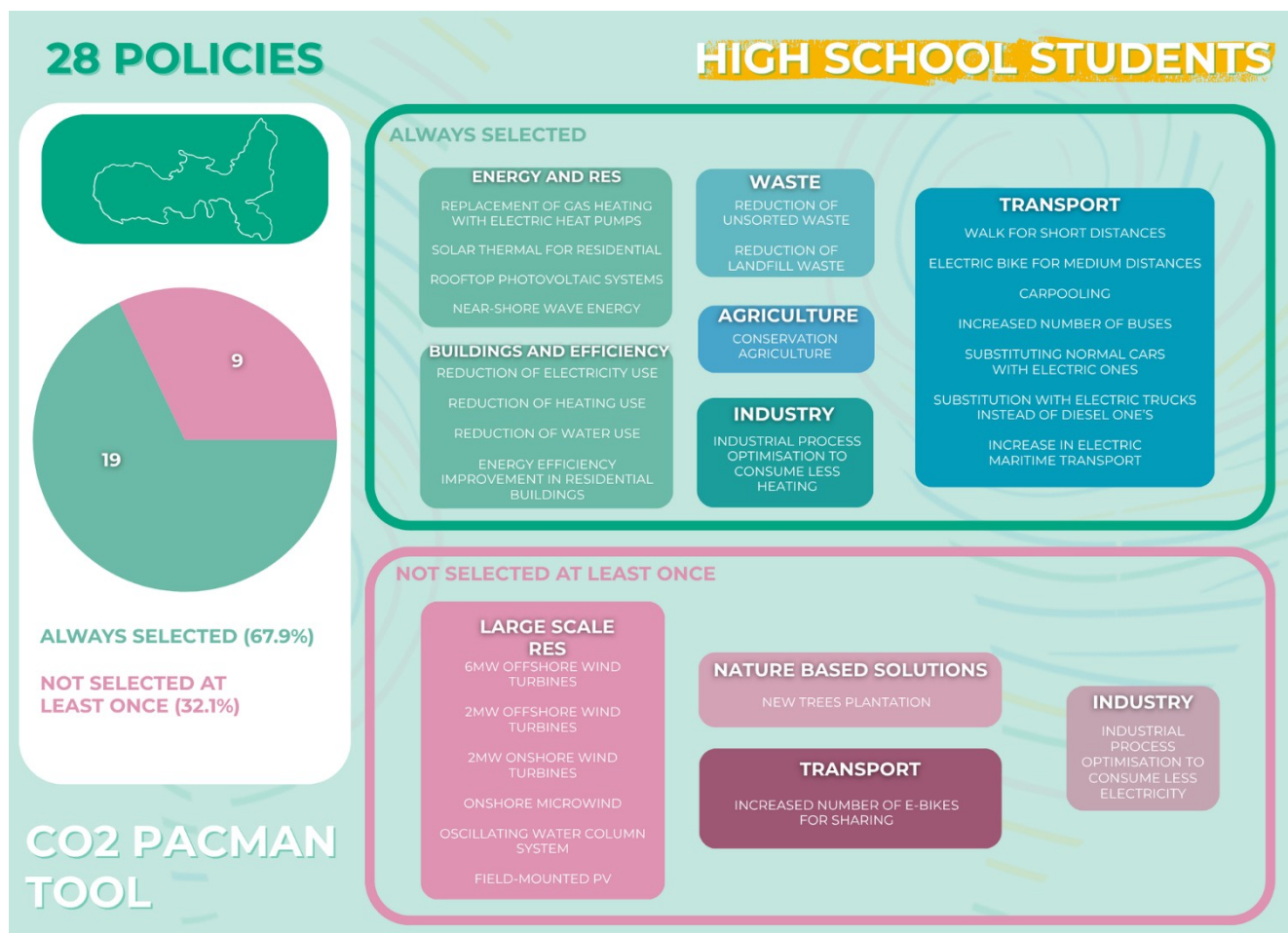


Figure 18: Policy prioritisation emerging from the Island I Would Like Lab, highlighting measures consistently selected by stakeholders, options excluded at least once during the simulations, and the single policy never selected.

Public administration and technical stakeholders

A **first simulation** session involving public administrations and local stakeholders did not achieve carbon neutrality (Figure 19), reflecting a relatively **cautious** and **selective approach** to policy design. As illustrated in Figure 20, a wide range of policy options was **excluded (9 out of 28)**, including measures related to industrial process optimisation, building energy efficiency, conservation agriculture, multiple wind energy technologies (both small-scale and large-scale), marine energy solutions, and nature-based interventions such as tree plantation. This extensive set of exclusions suggests a **strong filtering process**, likely **influenced by** perceived **feasibility constraints**, implementation **barriers**, and **risk aversion**. Despite this, the policies identified as **most effective** within the selected portfolio were **transport electrification** (both private vehicles and freight),



offshore wind deployment, and large-scale **photovoltaic** systems—indicate an awareness of the key high-impact levers for emissions reduction, even within a more conservative scenario.

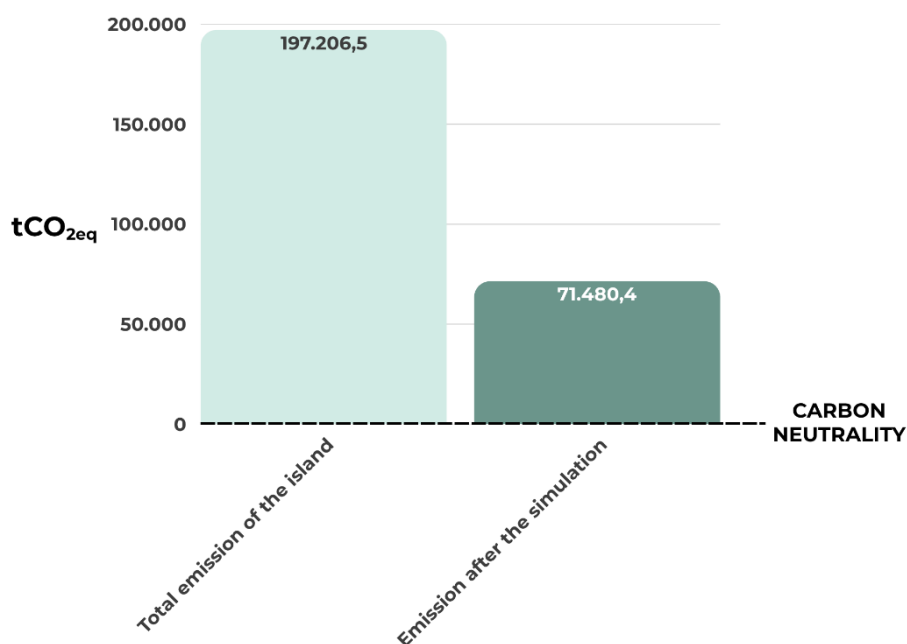


Figure 19: Result of the simulation - achieving the carbon neutrality

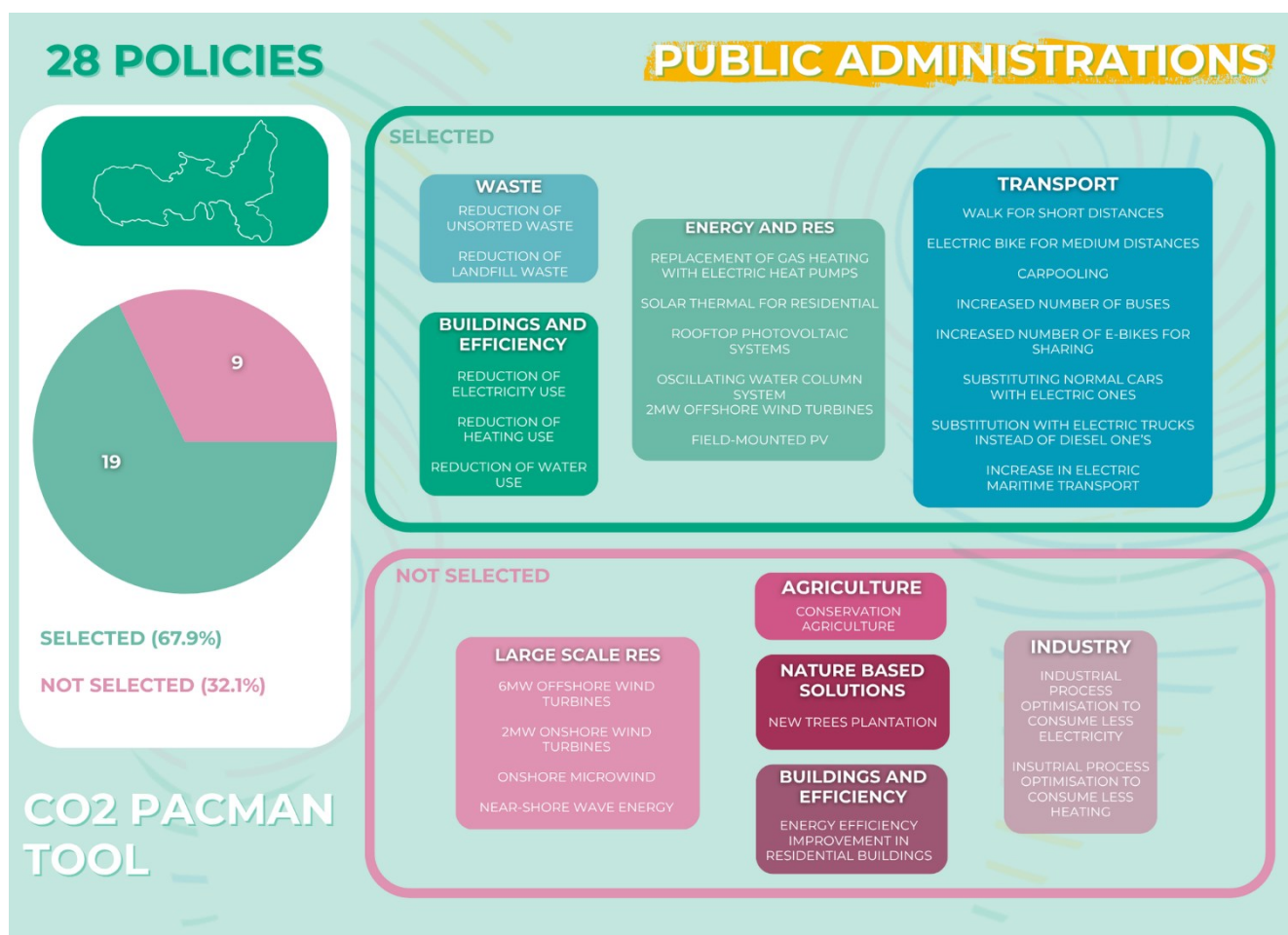


Figure 20: Policy prioritisation emerging from the Island I Would Like Lab, highlighting measures consistently selected by stakeholders, options excluded at least once during the simulations, and the single policy never selected.

A **second simulation** session, conducted several months later and involving **public administrations alongside** a broader range of **technical experts** from different sectors, resulted in a markedly different outcome. In this case, the group **successfully achieved carbon neutrality** (Figure 21), adopting a more comprehensive and **balanced policy mix**. As shown in Figure 22, the number of **excluded** policies was significantly lower (**3 out of 28**), with only a limited set of measures—primarily related to onshore wind and tree plantation—being set aside. This shift suggests a more **open** and **integrative approach** to the available policy options. The set of **most effective** measures identified in this session largely confirms those highlighted in the previous simulation, including **transport electrification**, **offshore wind**, and **photovoltaic systems**, while also incorporating additional solutions such as **microwind** technologies.

The contrast between the two sessions highlights a notable **evolution in perspective**.



While the first group adopted a more restrictive approach, the second demonstrates a greater **alignment** between **ambition** and **feasibility**, resulting in the achievement of carbon neutrality. This shift can be partly attributed to the different **composition** of participants, with the presence of sectoral experts contributing to a **more informed assessment** of technical and implementation aspects. In addition, the time gap between the two sessions may have played a relevant role. Over this period, the project advanced in the development and **dissemination of analytical results and local insights**, which may have supported a **more mature and confident approach** to policy selection. From a process perspective, this evolution highlights the importance of **iterative engagement** and **knowledge-building** activities in **strengthening local capacity** to design effective and achievable decarbonisation pathways.

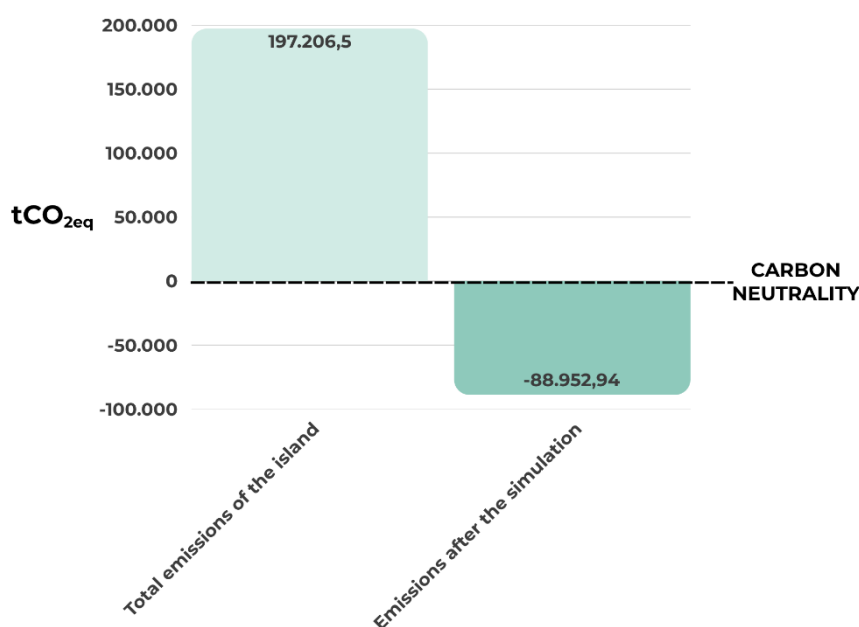


Figure 21: Result of the simulation - achieving the carbon neutrality.

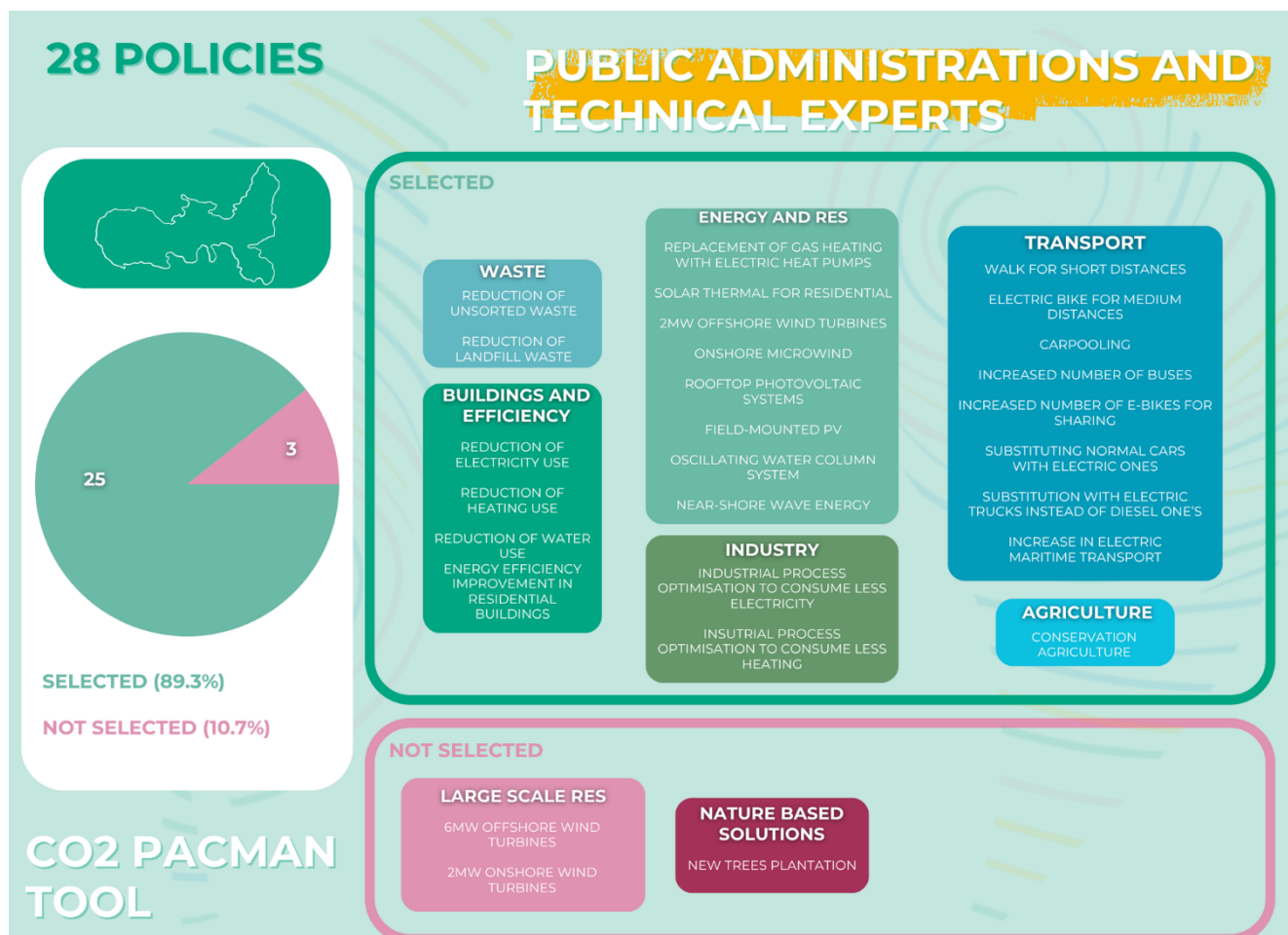


Figure 22: Figure 20: Policy prioritisation emerging from the Island I Would Like Lab, highlighting measures consistently selected by stakeholders, options excluded at least once during the simulations, and the single policy never selected.

The **comparison** between **students** and **institutional** stakeholders highlights two complementary approaches to the design of decarbonisation pathways. On the one hand, **students** tend to explore a broader and **more diversified** set of solutions, combining different types of interventions and showing **openness** towards innovative or emerging technologies. On the other hand, **public administrations** and **technical actors** adopt a more selective and **strategic approach**, prioritising measures that are perceived as more **feasible**, **scalable**, and immediately implementable, while excluding a wider range of options.

These differences reflect not only varying levels of **technical expertise** but also different **perceptions** of **economic**, **regulatory**, and **territorial constraints**. From a roadmap development perspective, the integration of these perspectives represents a key added value. While the exploratory approach of younger participants contributes to expanding the range of possible solutions, the more pragmatic orientation of institutional stakeholders helps to ground the transition pathway in realistic implementation conditions. Together, these perspectives provide a more comprehensive basis for the



development of robust, feasible, and socially informed decarbonisation strategies.

Landscape scenarios

The landscape-based approach to the energy transition roadmap for Elba was developed grounded in the principle that every landscape **embodies renewable natural energies** and that a sustainable transition can be planned by **designing** with regard to the **specific features** of each territory. In this framework, landscape is treated not only as a technical parameter but also as a **medium for public involvement**, offering citizens and stakeholders an accessible and spatially grounded entry point into climate neutrality discussions.

The technical process began with the **quantification** of the **energy target**: achieving carbon neutrality requires installing approximately **22.5 MW** of **additional renewable energy** capacity on Elba, representing a substantial increase in local production. Building on this objective, a **landscape suitability** and **capability analysis** was conducted, **combining** solar and wind energy **potential maps** with a **land-use assessment** to identify where the installation of renewable energy technologies could generate co-benefits beyond decarbonisation — including support for agriculture, water management, and ecosystem restoration. The analysis confirmed a **strong solar energy potential** across the island, while wind energy showed more limited prospects inland, with greater opportunities along the western offshore areas.

On this basis, **three landscape-based scenarios** for the energy transition were developed, framed not as mutually exclusive alternatives but as **complementary perspectives** through which different transition pathways could be explored and discussed.

Scenario 01 – Offshore Wind Development

The first scenario explores concentrating the entirety of renewable energy production in an **offshore wind farm** (Figure 23), thereby **avoiding** the distribution of **installations across the inland** landscape. From a technical standpoint, certain marine areas around Elba are compatible with floating offshore wind development **without causing** significant **impacts** on **natural habitats** or existing marine uses. The scenario also carries a place-making dimension: turbines generating clean energy visible from the coast could become part of the **island's sustainable identity** and **tourism offer**, as has occurred in other European contexts. However, floating offshore wind remains the **most expensive** renewable technology currently available, with estimated costs of approximately **€4.85 million per MW installed** — four to five times higher than ground-mounted photovoltaic or agrivoltaic systems. Combined with the island's relatively limited offshore wind capacity, this scenario is envisaged as viable primarily through community-led investment supported by substantial public subsidies, rather than conventional private financing.

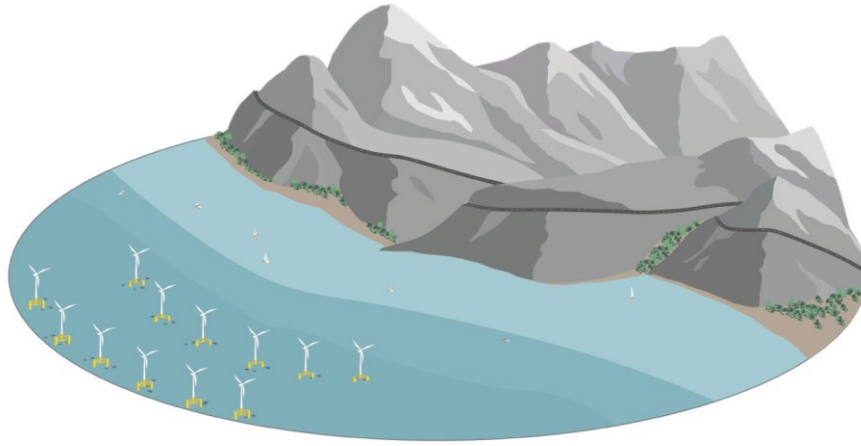


Figure 23: landscape composition for scenario 1.

Scenario 02 – Solar Energy and Landscape Regeneration

The second scenario responds to a **specific territorial challenge** that is unique to Elba: the legacy of centuries of **iron mining activity**, which ceased in 1981 but **left behind contaminated landscapes** where sulphide-bearing materials continue to generate acid waters with high heavy metal content, particularly in the area of Rio Marina. The scenario proposes **integrating ground-mounted photovoltaic** arrays with **interrow planting of native species** (Figure 24) — including *Lavandula stoechas*, *Cistus salvifolius*, and *Dittrichia viscosa* — capable of phyto-stabilising metal and metalloid contaminants, as demonstrated by research conducted at the University of Pisa. In this configuration, solar energy revenue self-funds the **phytoremediation process**, the planted strips limit water runoff and support contaminant capture, and the flowering character of the species makes the system suitable for integration into the geo-mining park as a publicly accessible and visually engaging space. This scenario is therefore distinctive in that it **combines decarbonisation** with **ecological restoration** and **cultural heritage valorisation** within a single intervention.

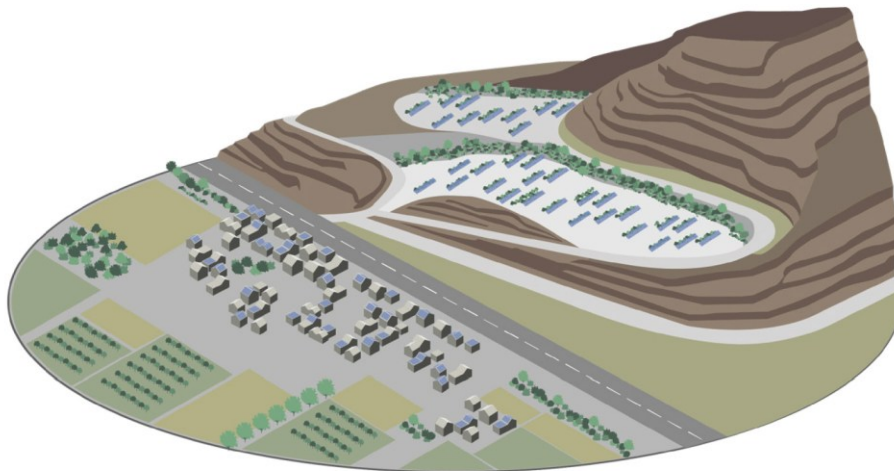


Figure 24: landscape composition for scenario 2

Scenario 03 – Agrivoltaics and Local Production Systems

The third scenario focuses on the **island's alluvial plains**, where **fertile agricultural land** has been progressively **abandoned** in recent decades, and **connects** the **energy transition** directly with Elba's **agro-biodiversity** heritage. The island hosts a rich collection of traditional fruit and vegetable cultivars, recently recovered and stored in the Tuscan Archipelago National Park Germplasm Bank, but the financial resources required to continue their cultivation remain scarce. The scenario proposes **agrivoltaic systems** (Figure 25) — elevated photovoltaic structures allowing agricultural activity underneath — on parcels of abandoned land, **generating renewable energy** while simultaneously providing **farms** with additional income, **mitigating** the **effects** of **climate change** on crops, and supporting the **recovery of traditional varieties** such as the peach cultivars Angelica and Sanguigno, the onion cultivar Petera, and the tomato cultivar d'Appiccà. The production would be valorised through local food networks, including **Slow Food initiatives**, creating a direct link between the energy transition and the strengthening of local food systems and short supply chains.



Figure 25: landscape composition for scenario 3

For each scenario, a **design prototype** was developed to translate the proposed configurations into spatially concrete and visually communicable proposals, supporting dialogue across diverse stakeholder groups. No single scenario was identified as the definitive pathway; rather, the process allowed stakeholders to assess how different configurations could contribute to the island's renewable energy objectives and to reflect on their compatibility with local conditions, landscape quality, and socio-economic context. A detailed description of the landscape analysis, scenario development, design prototypes, and stakeholder engagement outcomes is provided in **Annex 1.b**.



Virtual reality

The development of the Elba **virtual reality** (VR) experience followed a **structured pathway**, beginning with **spatial analysis** of the island's distinctive **landscape contexts** and evolving into a **fully immersive storytelling environment**. In contrast to conventional representations such as maps or static renderings, the VR application allows participants to experience renewable energy transformation scenarios at human scale and through carefully designed viewpoints, **fostering a deeper understanding** of both the environmental context and the proposed energy systems. A particular added value of the Elba experience lies in its **narrative dimension**: the simulation situates future scenarios within the historical evolution of the landscape, framing the energy transition as a process of transformation and adaptive reuse rather than disruption.

The immersive experience was structured around **two main renewable energy scenarios**. The first focused on the Valle Giove former open-pit **mining site** near Rio Marina, where a **photovoltaic installation** is proposed as part of a broader process of post-industrial landscape regeneration. Users begin from an aerial perspective above the eastern coast, observing the amphitheatre-like geometry of the former mine while receiving contextual information about its history of iron extraction and closure in 1980. As the experience progresses, participants are guided toward the site, allowing them to observe how the photovoltaic system is integrated into the terrain and to compare existing and proposed installations side by side. The final stage brings users into close proximity with the installation, where panel structures, vegetation, and ground conditions can be explored in detail, illustrating how renewable infrastructure interacts with a reclaimed and historically significant landscape (Figure 26, Figure 27).



Figure 26: Narration screenshots, Past(mine), present(PV park) and future(extended PV park) of the landscape are explained using audio and subtitles.



Figure 27: Aerial view of Valle Giove quarry (above – left), Viewpoint showing the Photovoltaic formation and vegetation and observation bridge (above – right) and Close-up of photovoltaic panels and vegetation (below).



The second scenario presented a **nearshore wind farm** composed of **14 turbines**, structured as a **circular** and exploratory journey. Users begin from the shoreline, observing the turbines within the coastal horizon, before transitioning to the top of a turbine to gain a direct sense of height and scale, and finally to an aerial hot-air balloon perspective providing a comprehensive overview of the entire installation in relation to the coastline. Distance indicators on each turbine further supported spatial comprehension (Figure 28).

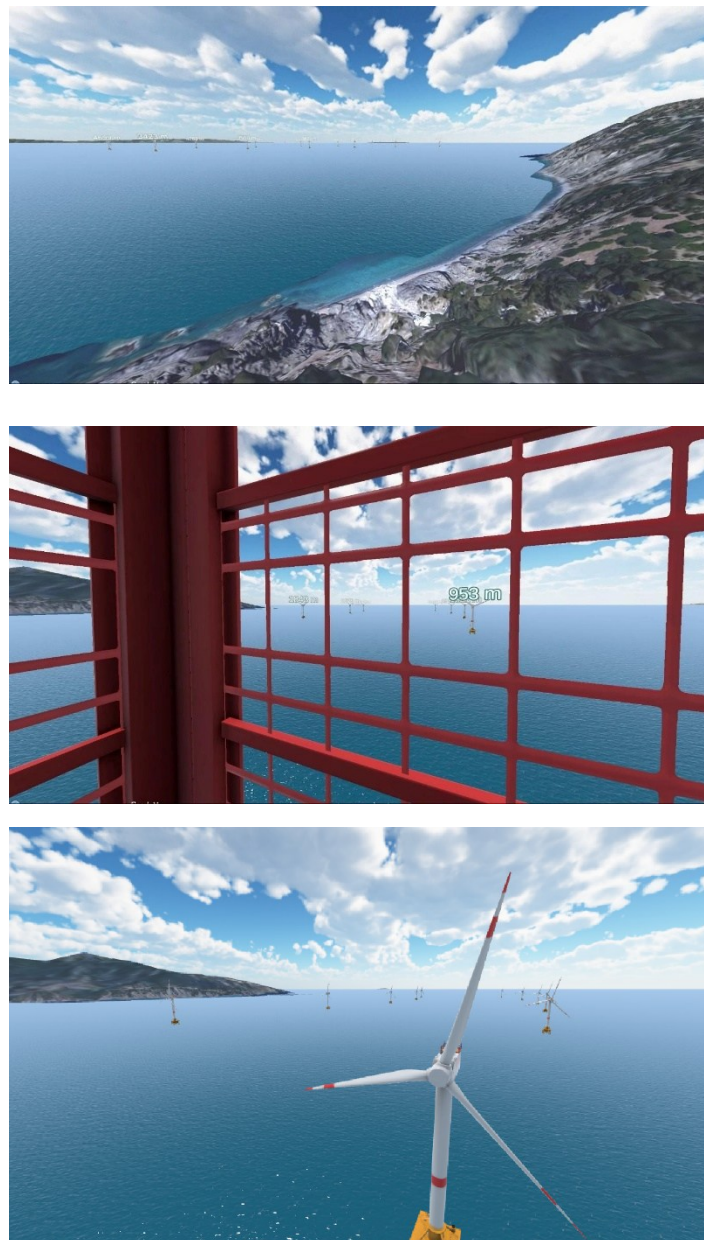


Figure 28: Wind turbines from shoreline perspective, with distance indicators (above), view from turbine top (middle) and aerial overview of wind farm (below).



The evaluation of the Elba VR experience confirmed its effectiveness across a diverse range of participant profiles, including citizens, students, professionals, educators, and institutional partners. Scores were exceptionally high, with the majority of participants assigning the maximum rating, and no significant usability issues reported. The **interaction flow** — combining guided narration with free exploration — was perceived as **intuitive** and **accessible** even by users with no prior experience of virtual reality environments. Participants reported predominantly **positive emotional responses**, including enthusiasm, excitement, and inspiration, consistent across different age groups and stakeholder categories. Beyond emotional engagement, the experience also generated **meaningful cognitive outcomes**: the realistic representation of the landscape was frequently highlighted as a key factor in supporting understanding and trust, while the photovoltaic scenario within the mining area was particularly valued for illustrating the potential of post-industrial land reuse. Several participants explicitly reflected on the broader applicability of similar approaches, indicating a level of knowledge transfer that goes beyond the specific scenario presented. The ability to navigate freely and transition between viewpoints — especially through the balloon and turbine-level perspectives — emerged as one of the most appreciated elements, reinforcing spatial comprehension and sustaining engagement across the full duration of the experience.

Financing the transition

Translating the transition priorities identified for Elba into concrete actions requires not only technological feasibility and social support, but also the mobilisation of adequate financial resources. The island's transition is distinctive in this regard, as climate neutrality is closely intertwined with the **transformation of sectors** that are central to **Elba's territorial identity and economy** — **tourism, mobility, agriculture**, and **environmental management** — making it necessary to combine instruments capable of supporting infrastructure investment, environmental protection, innovation, and local economic development simultaneously.

Elba's financing strategy is characterised by a strong connection to the Tuscany Region and the Italy-France Maritime cooperation framework, reflecting the synergy between the green and blue economies that underpins the island's transition pathway.

The **financing strategy** for Elba therefore reflects a **multi-layered approach** that aligns each category of intervention with the most appropriate funding mechanism. For large-scale renewable energy deployment — including offshore wind, ground-mounted photovoltaic systems, agrivoltaic pergolas, and microwind installations — the primary **national instruments** are **Transition 5.0** and **Conto Termico 3.0**, complemented by the **LIFE** Clean Energy Transition sub-programme, **regional funding** through the Tuscany POR FESR 2021–2027, and, for offshore infrastructure, the Innovation Fund for Large-Scale Decarbonisation and the **Connecting Europe Facility** (CEF Energy). **Renewable Energy Communities** (CER) provide an additional mechanism for solar energy deployment at



community scale. For blue energy systems, **Horizon Europe** — Mission Oceans and Waves and the Sustainable Blue Economy Partnership (SBEP) offer relevant research and innovation pathways. For agro-ecological innovations emerging from the Open Innovation activities, the **European Agricultural Fund for Rural Development** (EAFRD) and the **AGRIP programme** represent the most targeted instruments for nutrient and water management in semi-arid viticulture contexts. Circular tourism initiatives and digital tools for sustainable event management can be supported through SMP-COSME PowerUp NetZero, the MIMIT Piano Nazionale Transizione 4.0, and the FESR 2021–2027 regional programme, while the ETS2 mechanism offers an additional avenue for buildings and road transport decarbonisation.

Beyond public funding, **innovative financial mechanisms** — including **blue bonds** and **community investment structures** — can help attract private capital while strengthening local ownership of transition projects, particularly for investments that combine renewable energy objectives with marine environmental stewardship.

A detailed mapping of funding instruments for the specific solutions emerging from the co-design process, the landscape scenarios, and the Open Innovation activities is provided in **Deliverable 2.2.1** (Citizen Survey, Youth Think Tank Report, Financing the Transition: evaluation report).



Crete Transition Roadmap

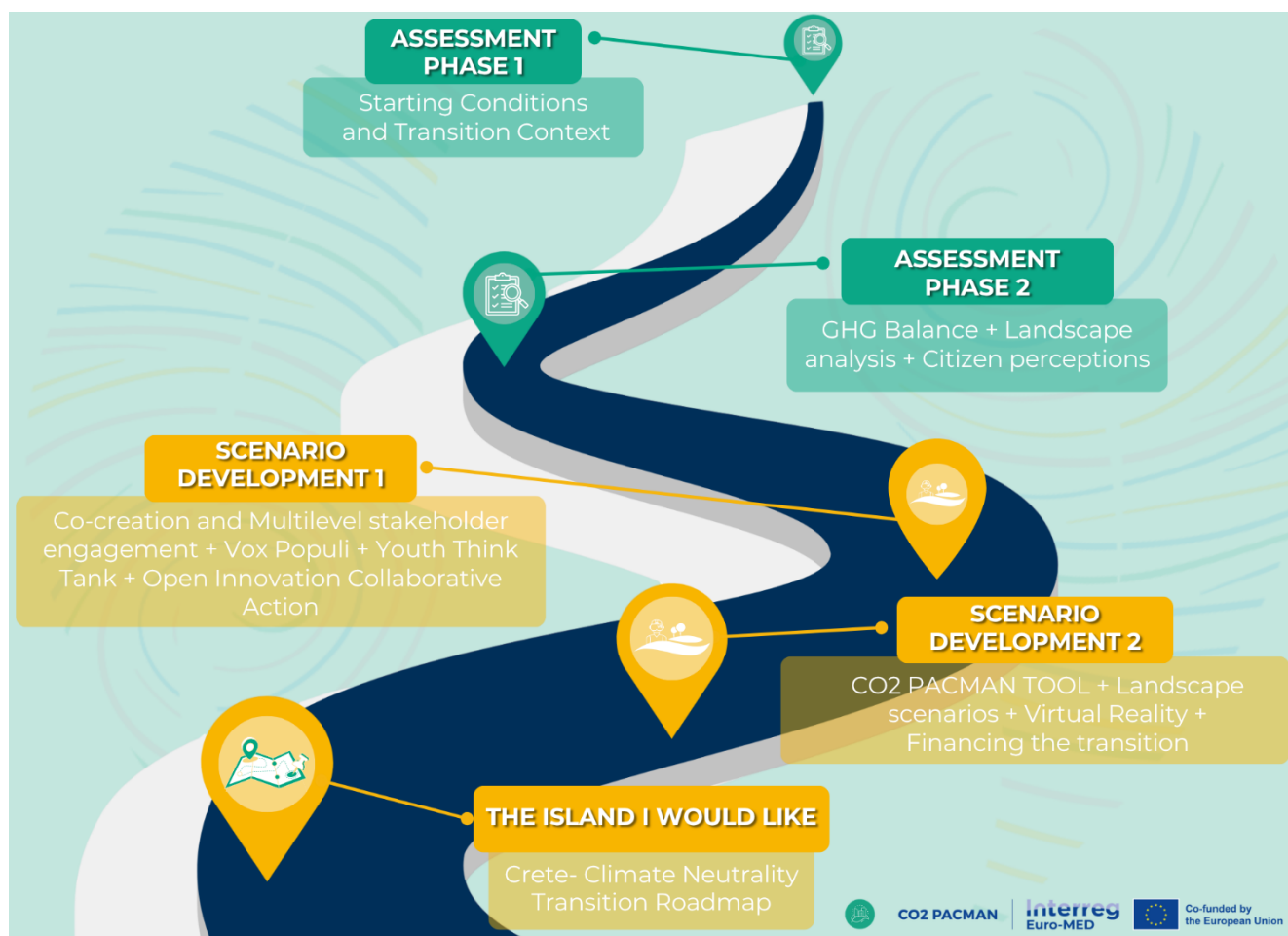


Figure 29: Conceptual pathway guiding the development of the Climate Neutrality Transition Roadmap for Crete.

The **Climate Neutrality Roadmap for Crete** (Figure 29) represents the outcome of an **extensive, integrated, and highly participatory process** aimed at supporting the island's transition towards a climate-neutral, resilient, and sustainable future. Developed within the framework of the CO2 PACMAN project, the roadmap combines rigorous scientific analysis, territorial assessment, stakeholder engagement, youth participation, and multi-level governance dialogue to define a shared vision for long-term decarbonisation.

The process builds on a comprehensive analysis of Crete's greenhouse gas profile, which identifies the **energy sector** as the **dominant source of emissions**, accounting for approximately two-thirds of total greenhouse gas emissions, followed by agriculture, forestry and land use, and waste management. At the same time, substantial **natural**



carbon sinks offset a significant share of gross emissions, highlighting the strategic importance of ecosystem conservation and nature-based solutions alongside emission reduction measures. A defining feature of Crete's transition context is the scale and diversity of its territory: as the largest and most populous Greek island, Crete combines a **tourism-driven economy**, a **strong agricultural sector**, **valuable natural ecosystems**, and **growing urban centres**, while **facing** increasing **climate-related pressures** including rising temperatures, water scarcity, biodiversity loss, and seasonal peaks in energy and resource demand associated with tourism. These interconnected challenges require integrated solutions addressing environmental, social, economic, and territorial dimensions simultaneously.

A defining feature of the roadmap is its **multi-layered participatory approach**, supported by one of the most comprehensive **engagement processes** undertaken within the CO2 PACMAN project. Through Living Lab activities, roundtable discussions, co-design workshops, public events, and targeted consultation processes, a broad range of actors, including regional and local authorities, businesses, SMEs, academic and research institutions, civil society organisations, infrastructure providers, and citizens, actively contributed to the identification of priorities, challenges, and opportunities. Special emphasis was placed on **youth participation** through the Youth Think Tank, which engaged students from different educational levels in envisioning and co-designing a climate-neutral future for Crete, empowering them as Climate Neutrality Ambassadors and active contributors to the island's long-term vision. A particularly innovative dimension of the roadmap is the integration of landscape as a unifying framework for climate neutrality planning, connecting energy transition objectives with spatial planning, ecosystem protection, local development, and community values.

The roadmap is therefore not conceived as a purely technical document, but as a **shared strategic framework** that integrates quantitative evidence with qualitative insights and community aspirations. Rather than prescribing a single pathway, it establishes a flexible framework supporting informed decision-making, combining renewable energy deployment, energy efficiency, sustainable mobility, circular resource management, ecosystem protection, and community-led initiatives. At the same time, it acknowledges key challenges, including water scarcity, tourism-related seasonal pressures, governance complexity, and concerns regarding the social acceptability of large-scale renewable energy developments.

Overall, the Crete Climate Neutrality Roadmap provides a coherent and actionable foundation for guiding future planning and policy development. By placing landscapes, communities, and local development priorities at the centre of decision-making, it supports the development of a transition pathway that is not only environmentally effective, but also inclusive, context-specific, and broadly supported by the local community, offering at the same time a transferable model for Mediterranean islands seeking to accelerate decarbonisation and strengthen climate resilience.



The Island I Would Like lab

The Crete "The Island I Would Like" Lab took place over three days in Rethymno in April 2026, endorsed by the Region of Crete and the Municipality of Rethymno. Conceived as an **integrated platform** for dialogue, learning, **co-design**, and **collaborative decision-making**, the Lab combined scientific expertise, territorial knowledge, participatory planning, and visualisation technologies within a single **co-creation framework**, bringing together a particularly broad range of stakeholders across governance levels and sectors, including local and regional authorities, researchers, technical experts, businesses, tourism actors, urban planners, infrastructure providers, civil society representatives, and citizens (Figure 30). A distinctive feature of the Crete Lab was the exceptional breadth of **institutional engagement**: the Municipality of Rethymno and the Region of Crete were both represented at senior level across multiple policy domains, spanning energy, mobility, tourism, environment, digital governance, and regional development, creating conditions where all dimensions of the **Quintuple Helix innovation model** were represented, enabling meaningful **cross-sectoral dialogue** and coordination. As the second phase of the CO2 PACMAN Living Lab process, the Lab functioned as a **bridge between knowledge and action**: shifting from assessment towards **co-creation**, it served as a structured space for translating technical evidence into **shared visions**, testing decarbonisation solutions, and building **social consensus** around locally grounded **transition pathways**. Through landscape scenarios, interactive exhibitions, the CO2 PACMAN Tool, and virtual reality experiences, participants visualised **alternative futures** and assessed the implications of different transition choices, with advanced visualisation tools making complex climate and energy concepts accessible to non-specialists and enabling more **transparent** and **inclusive dialogue**.

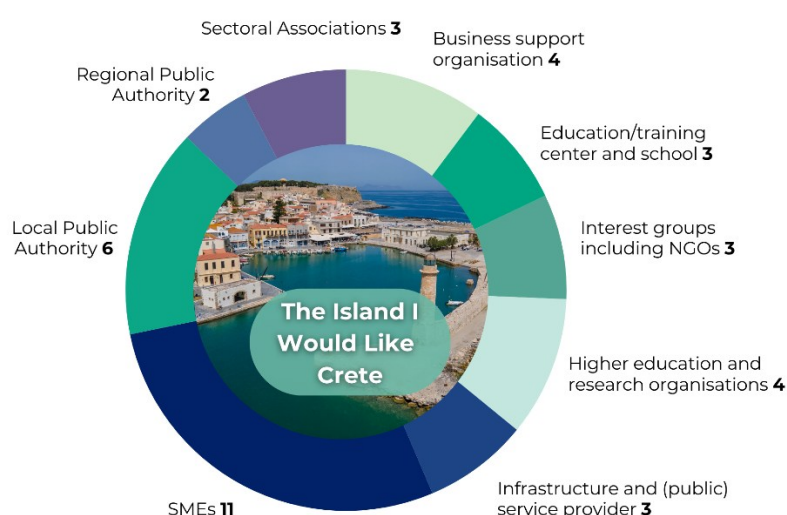


Figure 30: Stakeholders engaged in the Crete The Island I Would Like Lab, categorized by stakeholder typology rather than absolute number of participants.



The round table discussions that took place during the Lab confirmed that Crete's pathway towards climate neutrality must be built around an **integrated** and **territorially sensitive transition model** going beyond the deployment of renewable energy technologies alone. Participants consistently emphasised the need for **differentiated strategies** reflecting the diversity of Crete's territories: urban areas were identified as priority spaces for **sustainable mobility**, building renovation, and **climate-resilient planning**, while rural and mountainous areas require solutions focused on **water security**, sustainable agriculture, small-scale renewable energy, and the preservation of **productive landscapes**. The strategic importance of linking renewable energy deployment to **direct community benefits**, through **energy communities**, citizen participation schemes, and incentive mechanisms, was widely recognised as essential for building **social acceptance** and generating **local economic value**. Governance capacity, **institutional coordination**, and **public participation** emerged as critical enabling conditions, with administrative complexity and fragmented decision-making identified as major **barriers to implementation**. Stakeholders also highlighted the need for a transition towards more **circular** and **resource-efficient tourism models**, based on water reuse, waste valorisation, and local supply chains, a dimension particularly relevant given tourism's central role in Crete's economy. Overall, participants reinforced a vision of a **climate-neutral Crete** combining renewable energy integration, sustainable mobility, **circular economy** principles, **ecosystem stewardship**, and **active citizen participation**, a balanced transition pathway that connects **environmental ambition** with **territorial cohesion** and **long-term community well-being**.

Vox populi

The **interviews** conducted with residents of Crete reveal a generally **positive attitude** towards climate **awareness** and **sustainability**-oriented change, broadly consistent with the **survey results** presented during the workshop (more detailed are provided in **Deliverable 2.2.1** (Citizen Survey, Youth Think Tank Report, Financing the Transition: evaluation report)). Several respondents confirmed that the findings were **realistic** and **representative** of local perceptions, expressing **positive surprise** at the level of environmental awareness among the island's population. At the same time, some participants noted that awareness remains uneven and that a larger share of the population could still be **better informed** about the **urgency** and **implications** of climate change, suggesting that the gap between general sensitivity and deeper knowledge of specific solutions has not yet been fully closed.

The question of renewable energy installations and their potential impact on the landscape elicited nuanced and, in some cases, **ambivalent responses**. While several participants acknowledged that new infrastructure would inevitably bring **changes** to the **island's visual** and **natural environment**, most expressed the view that such impacts could be **positive** overall, or at least **acceptable**, provided that projects are carefully designed and spatially sensitive. A recurring **concern** was the **perception**, held by part of the local



population, that renewable energy deployment might come at the expense of the island's green character — a sensitivity that underlines the importance of **landscape-integrated approaches** and **transparent communication** about the nature and scale of proposed interventions. One respondent, a young engineer, explicitly framed the transition as a professional and civic aspiration, expressing a desire to inspire local authorities towards sustainable solutions not only in Rethymno but across Crete more broadly.

When invited to describe their ideal island, respondents articulated a **vision** centred on the **preservation** and **enhancement** of **natural beauty**, combining **abundant green spaces**, forests, and **clean beaches** with a **reduction** in **emissions**, **waste**, and **private car use**. Recurring themes included the desire for an island that is clean in all respects, powered by **renewable energy**, and **accessible** to all its inhabitants. Several interviewees emphasised the importance of **community engagement** and **collective responsibility**, expressing a wish for both younger and older generations to feel more connected to and invested in the places they live. The vision that emerged most consistently is one of **harmony** between **human activity** and the **natural environment** — a transition perceived not as a disruption of the island's identity but as an opportunity to strengthen and safeguard it.

Overall, the vox populi results highlight a population that is broadly **open** to sustainability-oriented transformation while remaining **attentive** to the quality of implementation and the preservation of the island's distinctive landscape and environmental character. From a policy perspective, these insights underline the importance of combining technical planning with participatory communication strategies capable of building trust, addressing landscape concerns, and mobilising the collective engagement that residents themselves identify as essential to a successful transition.

Youth Think Tank

On Crete, the Youth Think Tank was developed and implemented as one of the most extensive youth engagement processes within the CO2 PACMAN project, involving more than 100 students across **multiple school levels**: junior and senior high school students and university engineering students, as well as teachers, school directors, and secondary education authorities. Launched during the Rooting Lab in 2024 and extending until April 2026, the initiative was conceived not as a stand-alone awareness campaign but as a structured **multi-phase learning and empowerment pathway**, progressively guiding young people from climate awareness and critical thinking towards participatory research, scenario development, and co-design.

The initial phases focused on **building climate literacy** and **critical thinking** through **participatory laboratories**, open-air **events**, interactive exhibitions, and classroom **workshops**. Students explored climate change, carbon footprints, and the concept of climate neutrality while developing the ability to connect global climate challenges with local realities across key sectors including energy, transport, tourism, food systems, waste, and water management. The subsequent phases introduced **experiential learning**



through the **CO2 PACMAN Tool**, **landscape scenarios**, and **immersive visualisation technologies**, enabling students to explore alternative transition pathways, evaluate trade-offs, and understand the territorial implications of climate-neutrality interventions.

The **co-design** phase represented the most significant contribution of the Crete Youth Think Tank. Junior and senior high school students worked under the common vision of "The Island I Would Like", investigating local sustainability challenges through surveys, participatory research, and collaborative workshops, and producing a **diverse portfolio of outputs including posters, videos, podcasts, comics, digital applications, physical models**, and **awareness campaigns**. University engineering students complemented this work by developing and evaluating evidence-based **decarbonisation pathways** for Crete using recognised planning methodologies, local datasets, and the CO2 PACMAN Tool, gaining practical experience in addressing the technical, environmental, economic, and governance dimensions of climate-neutrality transitions.

A particularly significant outcome of the process was the establishment of a network of more than 80 **Climate Neutrality Ambassadors**, officially recognised during a dedicated **award ceremony** held at the Lab. These students became **active promoters of sustainability** and **climate action** within their schools, households, and communities, representing a lasting legacy of the initiative beyond the project's formal duration. Overall, the Crete Youth Think Tank demonstrates how youth engagement can evolve from awareness-raising into a structured process of empowerment, innovation, and climate-neutrality planning, enriching the roadmap with the perspectives of younger generations and reinforcing its social dimension.

Further methodological details and a comprehensive analysis of activities and results are provided in **Deliverable 2.2.1** (Citizen Survey, Youth Think Tank Report, Financing the Transition: evaluation report).

Open Innovation Collaborative Action

The Crete "The Island I Would Like" Lab, held in Rethymno from 28 to 30 April 2026, represented a further step in the continuous process connecting **challenge identification**, **solution development**, and **territorial implementation**. Building on the exchanges initiated during the Valencia Business Forum, the Lab provided the opportunity to reinsert the selected solutions into the island's own decarbonisation context and to maintain the continuity of the Open Innovation process within the local climate-neutrality debate. The Open Innovation action was integrated into the Lab's programme through both a **dedicated exhibition station**, which ensured the innovation strand remained visible throughout the event, and a **structured round table session** focused on entrepreneurship and innovation in Crete's transition to climate neutrality. The session was designed to **explore** how open innovation could help **accelerate the transition** to sustainable, climate-neutral communities, framing innovation not as a goal in itself but as a means through which local challenges might find responses beyond the island while remaining tied to



territorial realities.

The core moment of the Open Innovation process took place during the dedicated round table session, where the three Cretan **challenges** and their selected **solutions** were presented and discussed. The **challenges** addressed the substitution of peat with circular organic alternatives (challenger: Intermunicipal Solid Waste Management Company — **DEDISA**; solver: **SILVIBIO**), smart small-scale organic waste treatment for the hospitality sector (challenger: **Rethymno Hoteliers Association**; solver: **EFFIWASTE**), and the design of a smart data collection system for sustainable urban mobility analysis (challenger: **Rethymno Municipality** in collaboration with TUC-ReSEL; solver: **LIS Data Solutions** — SmartMove Analytics) (Figure 31).

The Crete Lab presented a **distinctive organisational challenge: budgetary constraints** prevented the selected solvers from attending in person. Rather than allowing this limitation to erase the innovation component from the event, the project adapted its format. Two of the three selected solution **providers** submitted **video presentations** that were screened during the session, while the third solution was presented by the project moderator on the basis of information previously submitted by the solver. This organisational resilience — maintaining the visibility and relevance of all three solutions despite the constraints — should be considered one of the practical strengths of the CO2 PACMAN Open Innovation process. The discussion was anchored by **two local representatives** directly linked to the challenge context, ensuring that the session retained a meaningful territorial connection to municipal planning, European programmes, and the tourism and hospitality sector.

Overall, the Crete Lab confirmed the **value** of maintaining the **challenge-solution relationship** visible and active within the island community, even where the format of interaction is necessarily mediated. Its contribution lay in **continuity**: the selected solutions remained present and legible within the local debate, the challenge-side perspective remained engaged, and the broader project logic linking island needs to an ecosystem of external solutions was preserved. The next phase should build on this by maintaining active contact between challengers and solvers, monitoring whether the conversations initiated during the Lab continue to develop, and using the Open Innovation catalogue and repository as a bridge between territorial needs and the wider set of Mediterranean innovation proposals.



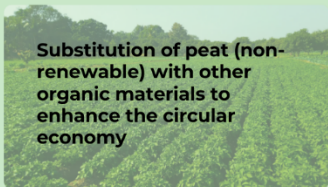
CRETE CHALLENGE	SOLVERS		
	Cardiff Metropolitan University		5
	Durham University		
	Porto Protocol		
	SilviBio Ltd		
	Veganic		
	AbonoKm0		6
	D-organic		
	Effiwaste		
	Legal-Pythia		
	Miogas		
	Sustainable Food Science and Technologies		6
	Equitus		
	Findspo		
	Legal-Pythia		
	LIS Data Solutions		
	Raiven		
	Urban Life		

Figure 31: Open Innovation Collaborative Action in Crete: challenges (on the left), solutions received (in the middle), categorized by nationality of the solvers and the number (on the right). The selected solvers are highlighted in green.

CO2 PACMAN Tool

The **simulation** activity carried out on Crete was designed as a participatory and educational exercise aimed at **exploring decarbonisation pathways** through the use of the CO2 PACMAN Tool. Unlike the approach adopted in the other pilot islands, where sessions involved mixed stakeholder groups including public administration representatives, technical experts, and local enterprises, the Cretan simulations focused exclusively on **high school students**, developed within the framework of the **Youth Think Tank**. This methodological choice reflected a deliberate decision to prioritise the engagement of younger generations in climate-neutrality processes, **fostering awareness, participation**, and a **future-oriented vision** of the **energy transition**.

Seven simulation sessions were conducted with student groups, each working independently to design a decarbonisation scenario for the island by selecting and combining policy measures across key sectors. The results revealed a remarkably **proactive**



and **optimistic approach**: **six out of seven** groups successfully **achieved carbon neutrality**, often **exceeding** the neutrality threshold by a significant margin, while the remaining group still achieved substantial emission reductions through the deployment of multiple mitigation measures (Figure 32). This strong overall performance suggests a high level of engagement and an ability to identify impactful transition strategies, with one group in particular adopting a markedly ambitious approach that maximised the deployment of high-impact measures across all available sectors.

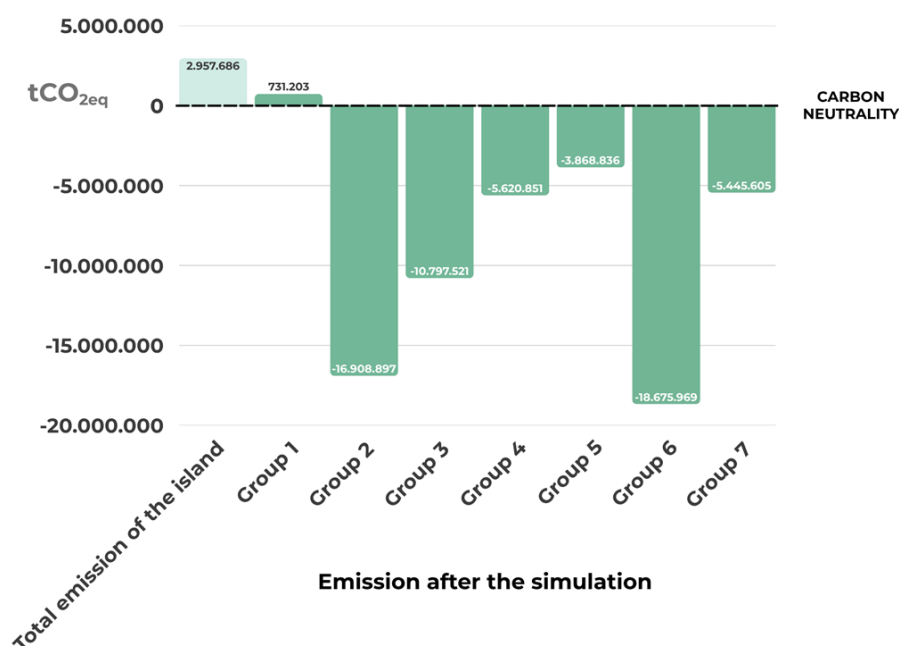


Figure 32: Result of the simulation – achieving the carbon neutrality

The collective evaluation of policy options revealed an exceptionally high level of acceptance of the mitigation portfolio proposed within the simulation framework. Out of the **28 policies available**, **25 were selected** by all groups (**89.3%**), with **only three measures excluded at least once** across the simulations (Figure 33): rooftop photovoltaic systems, the replacement of gas heating with electric heat pumps, and the increase in the number of buses. Student groups displayed a **consistently positive attitude towards renewable energy technologies** across all categories — including offshore and onshore wind turbines, field-mounted photovoltaics, and marine energy solutions such as oscillating water column systems and near-shore wave energy — with **limited evidence of NIMBY dynamics**. The exclusion of rooftop photovoltaics and heat pumps, both distributed and building-scale solutions, may reflect a perception of these measures as less impactful or less visible compared to larger-scale infrastructure, rather than resistance to the energy transition as such. Similarly, the exclusion of increased bus services may indicate a **preference** for **more innovative** or **individual mobility solutions** — such as electric bikes, carpooling, and electric vehicles — over conventional public transport expansion.



Overall, the Cretan experience demonstrates how **participatory simulation tools** can **support** the **development** of **climate awareness** and encourage younger generations to engage actively with territorial transition processes. Beyond the quantitative outcomes achieved within the simulations, the activities highlighted the **potential of co-design** methodologies to **stimulate** ambitious **thinking**, strengthen understanding of decarbonisation challenges, and foster a solution-oriented vision of the energy transition. From a comparative perspective, the results also contribute to a **richer understanding** of how different stakeholder groups approach the design of decarbonisation pathways: the openness and ambition shown by Cretan students complements the more selective and pragmatic approaches observed among institutional actors in the other pilot islands, enriching the evidence base from which the CO2 PACMAN roadmaps have been developed.

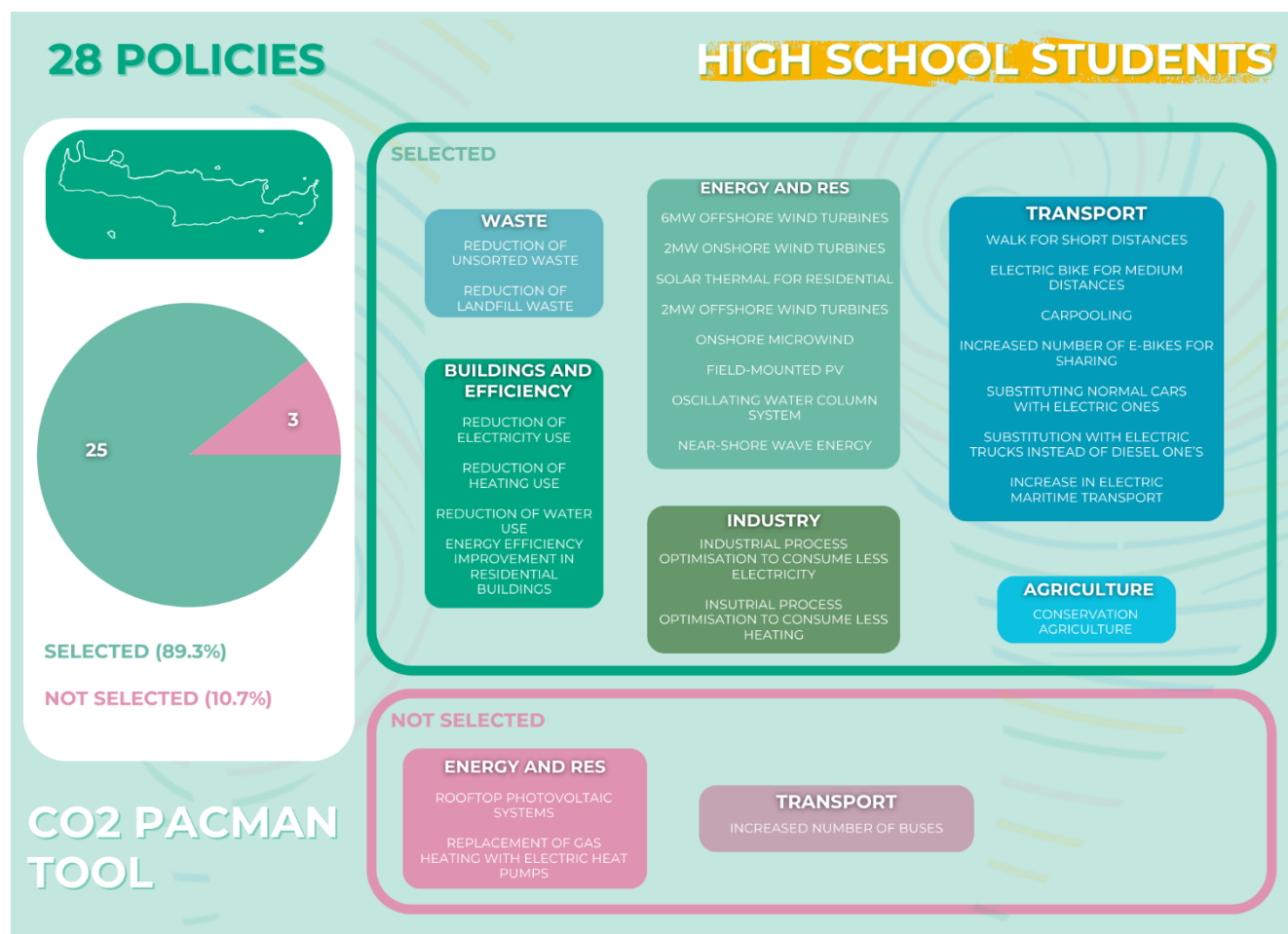


Figure 33: Policy prioritisation emerging from the Island I Would Like Lab, highlighting measures consistently selected by stakeholders, options excluded at least once during the simulations, and the single policy never selected.



In Crete, the simulation activities were complemented by a set of additional **interactive visualisation instruments** and **mobile applications** used to **foster** climate consciousness and **facilitate** informed reflection on lifestyle choices and their environmental impacts. These tools, including a **participatory city map of green transition interventions** in Rethymno, an **interactive carbon footprint prioritisation board** covering key sectors such as energy, transport, waste, water, tourism, and food, and two mobile applications translating everyday mobility and driving habits into carbon emission data (**Green Your Ride** and **Green Your Drive**, developed by TUC-ReSEL), served as accessible entry points into climate-neutrality discussions, allowing participants to experiment freely and connect personal experiences to the more structured scenario work carried out through the CO2 PACMAN Tool.

Landscape scenarios

The landscape-based approach to the energy transition roadmap for Crete focused on the Rethymno Regional Unit, applying the same CO2 PACMAN methodological framework used for Brač and Elba. The analysis addressed a substantially **larger territorial scale**, reflecting Crete's size and the **complexity** of its **energy transition challenge**: achieving carbon neutrality for the island requires generating an **additional 2,953,926 MWh of renewable energy**, to which the Rethymno Regional Unit can contribute through a combination of solar, wind, and thermal energy systems.

The landscape suitability and capability analysis combined Corine Land Cover data, slope conditions, and protected area designations, excluding Natura 2000 sites to preserve sensitive ecosystems. The results highlight that the majority of **suitable areas** fall within **agricultural land categories**, while **most forest** and **semi-natural areas** are **protected**. **Solar** energy **potential** is **very high** across the island, particularly on south-facing mountain slopes, while offshore **wind potential** is **strong along the southern coast**. In contrast, onshore wind development faces significant constraints due to the mountainous geomorphology of much of the territory. A distinctive finding of the Crete analysis is the high **potential of agrivoltaic** greenhouse systems for **tomato** and **pepper cultivation**, which could replace existing plastic tunnel structures near the coastline, simultaneously reducing plastic use, generating renewable energy, and supporting the gradual redistribution of agricultural activity towards inland areas.

Three landscape-based scenarios were developed as **complementary perspectives** for the energy transition.

Scenario 01 – Urban and Coastal Energy Integration

The first scenario proposes **photovoltaic pergolas integrated** with **new vegetation** in large **urban parking areas** in Rethymno, **combined** with the conversion of **coastal plastic tunnels** into **agrivoltaic greenhouses** and the deployment of building-integrated



photovoltaics and geothermal heat pumps in tourism structures along the coastline (Figure 34).

ACTORS	LAND USE	RET	SCALE	POLICY
- Municipality - Energy Communities - Small and medium-sized enterprises, single or in partnership	- Continuous and Discontinuous Urban Fabrics, industrial and commercial units - Port areas IN LARGER CITIES	- PV pergolas on Port area - Agrivoltaic greenhouses, 30% shading on tomatoes and peppers; - Photovoltaic modules on green roofs and facades - Building-scale closed heat-cold pumps and storage	< 1 MW installed capacity units in network	Strong Public Subsidies for Energy Communities and to farmers to switch from plastic tunnels to closed agrivoltaics (<40% contribution to the sustained costs and < 1, 2 euros/kWh electricity price)



Figure 34: factsheet reports on scenario main actors, potentially suitable land uses, technology, spatial and investment scale and possible supporting policies.

Scenario 02 – Renewable Energy and Ecological Coexistence

The second scenario explores the potential of **inland water bodies** and **offshore areas** to host **floating photovoltaic systems** and **offshore wind turbines**, designed to simultaneously enhance aquatic and marine habitats through floating vegetated islands and **artificial reef structures** integrated into turbine platforms (Figure 35).

ACTORS	LAND USE - WIND	RET	SCALE	POLICY
Industry, Developers and Investment Funds in co-ownership with locals	Sea of Crete Sweet water bodies	- Floating PV systems covering up to 5% to the water surface - Wind turbines by 10 MW each nominal power on floating basements	>10 MW for floating PV systems >100 MW for off-shore wind farms	Strong regulations for project quality standards and co-ownership

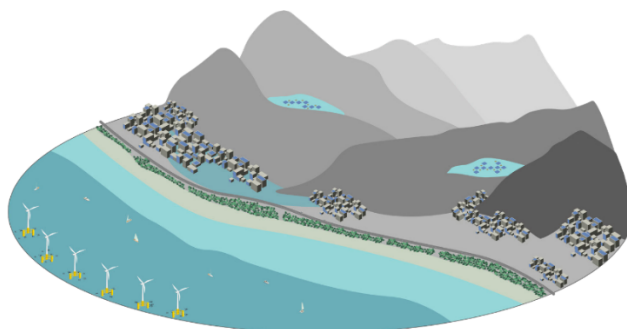


Figure 35: factsheet reports on scenario main actors, potentially suitable land uses, technology, spatial and investment scale and possible supporting policies.



Scenario 03 – Agrivoltaics and Rural Resilience

The third scenario focuses on the **regeneration** of **inland non-irrigated agricultural areas** through **agrivoltaic systems**, supporting the transition from low-productivity farming towards more competitive irrigated cultivation and the recovery of tomato and pepper production currently concentrated in coastal plastic tunnels (Figure 36).

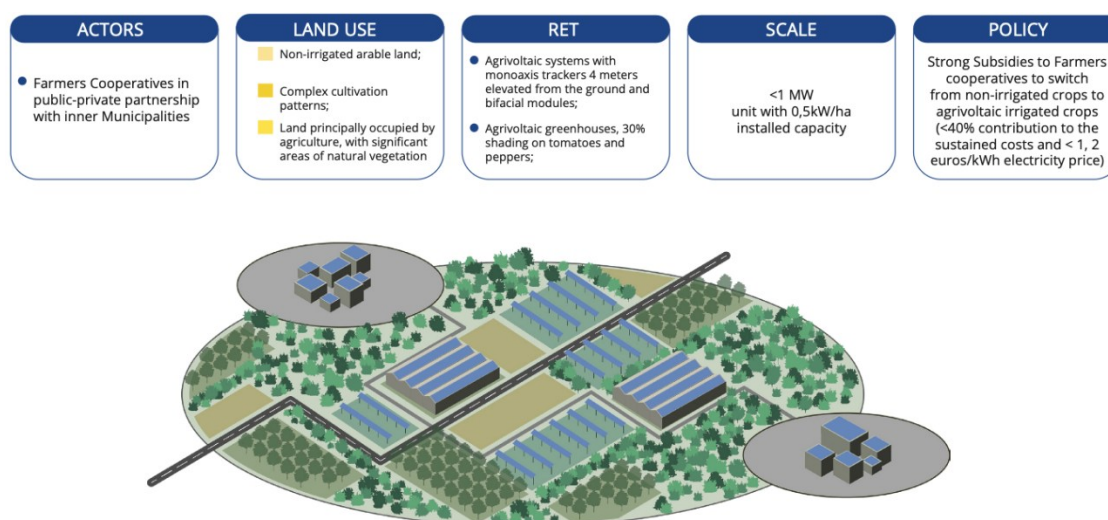


Figure 36: factsheet reports on scenario main actors, potentially suitable land uses, technology, spatial and investment scale and possible supporting policies.

For each scenario, a **design prototype** was developed. For **Scenario 1**, a **photovoltaic pergola** system was designed for the Rethymno harbour parking area, combining solar generation with vegetation and improved public space quality. For **Scenario 2**, **two prototypes** were produced: a **floating photovoltaic system** with integrated natural habitat islands at the Amari Dam, and an **offshore wind park** — named "The Πέα wind park" in tribute to the Titan Mother of Zeus — composed of 12 floating turbines with a total effective capacity of 38 MW, positioned in the Gulf of Mesara with high visual visibility from both the Timbaki waterfront and Mount Ida. A detailed description of the landscape analysis, scenario development, design prototypes, and stakeholder engagement outcomes is provided in **Annex 1.c**.



Virtual reality

The development of the Crete **virtual reality** (VR) experience followed a **structured pathway**, beginning with **spatial analysis** of the island's distinctive urban and natural **landscape contexts** and evolving into a **fully immersive storytelling environment**. In contrast to conventional representations such as maps or static renderings, the VR application allowed participants to experience renewable energy transformation scenarios at human scale and through carefully designed viewpoints, **fostering a deeper understanding** of both the environmental context and the proposed energy systems. A particular added value of the Crete experience lies in its **dual focus**: rather than concentrating solely on energy production, the scenarios emphasised the **coexistence of renewable infrastructure** with **ecological enhancement** and **urban climate adaptation**, reflecting the specific territorial challenges of the island.

The immersive experience was structured around **two** main **renewable energy scenarios**. The first focused on a **floating photovoltaic installation** at the Potamon Dam in Amari, presented not only as an energy-generating infrastructure but also as an ecological intervention incorporating floating vegetation islands designed to support biodiversity and habitat creation. Users began from a boat perspective within the reservoir, receiving narrated information about the installation's energy capacity and ecological strategy, before transitioning through an interactive boat ride that gradually approached the floating structures. A subsequent stage placed participants directly onto one of the floating vegetation islands, allowing close observation of the photovoltaic systems, vegetation, and water conditions simultaneously. The experience concluded with an aerial hot-air balloon journey providing a panoramic overview of the entire dam and the proposed intervention as it would appear from the roadside viewpoint familiar to local visitors (Figure 37).

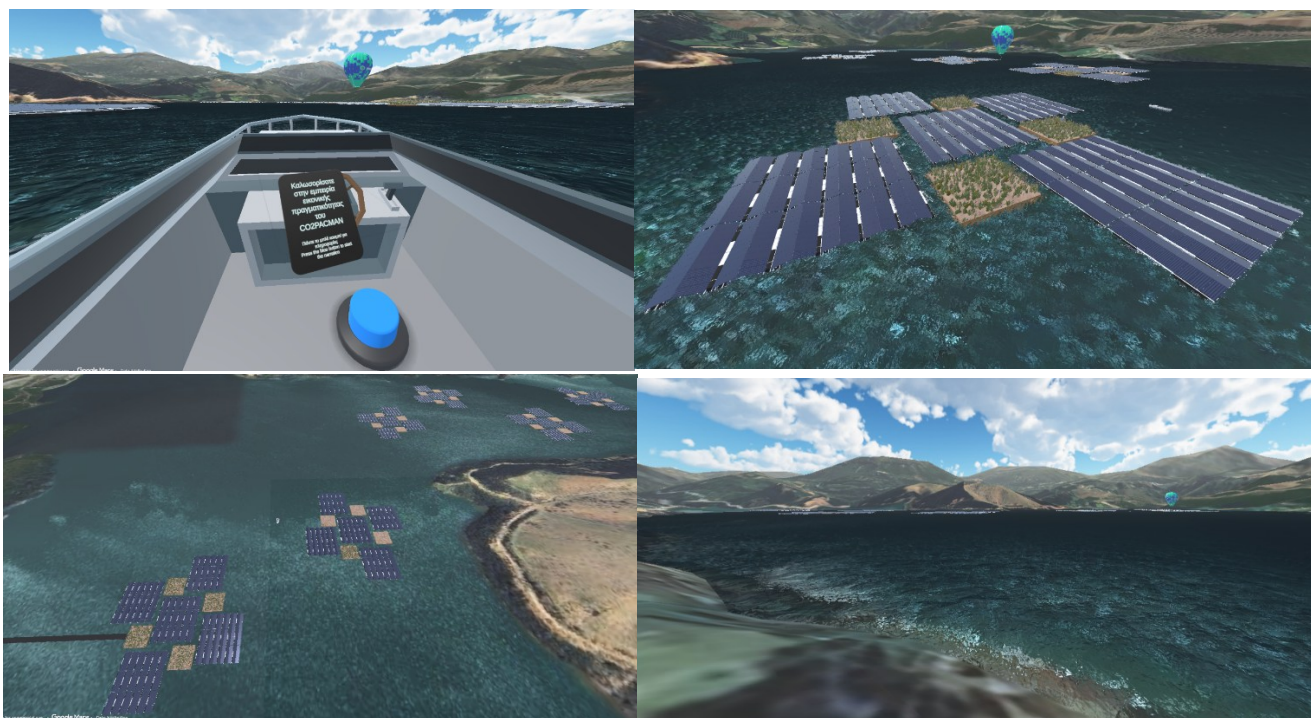


Figure 37: Initial boat perspective within the reservoir (above -left), Floating vegetation islands and photovoltaic structures (above – right), Aerial hot-air balloon overview of Potamon Da (below – left), Final roadside viewpoint of the intervention (below – right).

The second scenario focused on a **photovoltaic parking** intervention at the Port of Rethymno, illustrating how urban infrastructure can simultaneously contribute to renewable energy generation, thermal comfort, and public space improvement. Users began from an elevated aerial perspective above the port and old city, then transitioned into a vehicle moving through the redesigned parking area beneath the photovoltaic pergolas, and finally arrived at pedestrian level along the waterfront promenade, where animated elements and vegetation contributed to conveying the social and microclimate dimensions of the intervention (Figure 38).



Figure 38: Aerial overview of Rethymno port and old city (first), Driving beneath photovoltaic pergolas (second), Pedestrian-level view with vegetation and public space (third), Urban microclimate and shading intervention (fourth).



The evaluation of the Crete VR experience confirmed its effectiveness across a diverse range of participant profiles, including local stakeholders, public authorities, planners and citizens. The overall **reception** was **strongly positive**, with participants highlighting the **accessibility**, **realism**, and **interactive** nature of the experience. The hot-air balloon sequence emerged as one of the most appreciated elements, particularly in the Potamon Dam scenario, where the aerial overview enabled users to understand the full spatial relationship between the floating installation and the surrounding landscape. Beyond emotional engagement, the experience generated **meaningful cognitive** and **participatory outcomes**: the **multi-scale approach**, combining close-up interaction with panoramic perspectives, helped participants understand how proposed interventions integrate into both natural and urban environments, facilitating a more informed assessment of their potential benefits and impacts. The **visualisation process** provided a common reference point for different stakeholder groups, enabling citizens, technical experts, urban planners, and policy-makers to discuss future developments on the basis of a shared understanding of the landscape and the proposed interventions. The demonstrations attracted representatives from multiple governance levels, including mayors, regional officials, and urban planners, many of whom highlighted the value of experiencing proposed interventions before implementation. Notably, the discussion sessions following the demonstrations produced **constructive critical observations**, including concerns about vegetation survival in the coastal port environment and the visual impact of the floating photovoltaic installation on the natural character of the reservoir. These reactions demonstrate that the VR experience functioned not only as a tool for awareness-raising and acceptance but also as a platform for informed reflection and open dialogue, supporting more **transparent** and **inclusive conversations** around future environmental interventions on the island.

Financing the transition

Translating the transition priorities identified for Crete into concrete actions requires not only technological feasibility and social support, but also the mobilisation of adequate **financial resources**. The island's transition is distinctive in this regard, as climate neutrality is closely intertwined with the transformation of sectors that are central to Crete's territorial economy and environmental management — circular economy, waste valorisation, smart mobility, and digital innovation — making it necessary to **combine instruments** capable of **supporting infrastructure** investment, **innovation**, and **local economic development** simultaneously.

The financing strategy for Crete therefore reflects a multi-layered approach that aligns each category of intervention with the most appropriate funding mechanism. For general environmental and climate-neutrality initiatives, the **ESPA/NSRF 2021–2027 Regional Programme for Crete** represents the primary territorial instrument, complemented by the



Greek Recovery and Resilience Facility and the **Green Fund** for circular economy and organic waste valorisation solutions, including those emerging from the Open Innovation activities. The **LIFE Programme** — through both its Circular Economy and Quality of Life and its Nature and Biodiversity sub-programmes — offers relevant pathways for waste management innovations and nature-based solutions, while **Interreg Euro-MED** under the Greener MED priority supports cooperation-based circular economy initiatives across the Mediterranean. For renewable energy infrastructure — including floating photovoltaic systems, photovoltaic pergolas in port and agricultural areas, and blue energy technologies — Horizon Europe Cluster 5 (Climate, Energy and Mobility), the Connecting Europe Facility (CEF Energy), and the National Strategic Reference Framework 2021–2027 provide the primary innovation and deployment funding pathways, while **Horizon Europe EU Mission: Restore our Ocean and Waters** and the Blue Invest Fund offer specific instruments for marine and offshore energy solutions. For transport electrification, including truck fleet decarbonisation, the **Connecting Europe Facility (CEF)**, Horizon Europe Zero Emission Road Transport (2ZERO), and the **Regional Programme Crete 2021–2027** provide complementary funding mechanisms. Beyond public funding, blended finance instruments can help attract additional private capital for larger infrastructure projects, particularly in contexts where investment scale and risk profile require a combination of grant support and loan financing.

Beyond public funds, **private investment** is essential for scaling up building retrofits, sustainable tourism, and circular business models under stable regulatory frameworks. Blended finance, community crowdfunding, and energy cooperatives enable local residents, farmers, and businesses to become active participants, boosting social acceptance and equitable benefit distribution. Ultimately, financing alone is not enough; implementation is a governance challenge that depends on building institutional capacity among municipalities, regional authorities, universities, and businesses to design the mature, bankable projects needed to connect local priorities with external funding.

A detailed mapping of funding instruments for the specific solutions emerging from the co-design process, the landscape scenarios, and the Open Innovation activities is provided in **Deliverable 2.2.1** (Citizen Survey, Youth Think Tank Report, Financing the Transition: evaluation report).



Climate Neutrality Transition Roadmaps for Mediterranean Islands: Strategic Contribution to EU Climate Policy

Addressing the Climate Neutrality Gap for Small and Medium-Sized Islands

The **Climate Neutrality Transition Roadmaps** for the Mediterranean islands of **Elba (Italy)**, **Brač (Croatia)**, and **Crete (Greece)**, designed and implemented under the CO2PACMAN project, aim to contribute to the climate transition of Mediterranean island territories through a structured approach towards **climate neutrality**.

Indeed, the European Union has launched ambitious initiatives for accelerating the climate transition of its territories, such as the **EU Mission on Climate-Neutral and Smart Cities**. However, there is a large number of island territories that are not considered under these new policies and measures. This is because the EU Mission is mainly focused on urban areas with significant population sizes. Thus, the majority of Mediterranean islands, such as Crete, do not meet the criteria for accessing these new policies and measures for accelerating climate transition, as they are not considered large enough for these new EU policies and measures. Thus, there is a need for new approaches and tools for addressing climate change for these island territories.

The CO2PACMAN project is designed to address these gaps for **small and medium-sized islands**, as it puts these island territories at the core of climate transition planning and design. Through the design of Climate Neutrality Transition Roadmaps for these Mediterranean islands for the **2030-2050 timeframe**, it is possible to identify new paths for addressing climate change for these island territories.

The Roadmaps thus support existing initiatives of the European Union regarding climate action by going beyond the scope of urban areas and providing methodological support for the specific conditions of islands. By achieving this, the project also supports the overall goals and objectives of the **European Climate Law (Regulation EU 2021/1119)**, which sets the goal for climate neutrality by 2050 and the reduction of greenhouse gas emissions by at least 55% by 2030, as compared to 1990 levels.

The Roadmaps also support the overall goals and objectives of two of the European Union's major missions: the **EU Mission on Climate-Neutral and Smart Cities**, as it explores the possibilities for developing climate neutrality transition roadmaps for areas not eligible under the mission, and the **EU Mission on Adaptation to Climate Change**, as it considers the climate resilience factors within the transition scenarios developed for the islands and addresses the specific climate-related vulnerabilities of the Mediterranean islands' environments.

The Mediterranean islands face various **climate-related risks** such as extreme heat waves, water scarcity, loss of biodiversity, and coastal erosion. The climate-related risks and



vulnerabilities of the Mediterranean islands require climate action strategies that consider both the **mitigation** and **adaptation** factors. Therefore, the roadmaps also consider the ecosystem and the nature-based factors within the transition roadmaps developed for the islands, ensuring the climate neutrality strategies developed for the islands are sustainable and climate-resilient.

Evidence-Based Climate Transition Planning

One of the major components of the CO2PACMAN methodology is the **greenhouse gas balance** developed for each of the pilot islands. The greenhouse gas balance developed for each of the pilot islands forms the basis for the Climate Neutrality Transition Roadmaps and represents one of the major steps towards the overall understanding of the greenhouse gas profile of the islands.

The GHG balances are prepared following guidelines set out in the **2006 IPCC guidelines for national greenhouse gas inventories** and the 2019 refinement. These balances calculate emissions and removals of greenhouse gases for key sectors such as energy production and consumption, transportation, waste management, agriculture, and carbon sinks. This approach is based on evidence and allows local authorities to identify key areas for reducing greenhouse gas emissions.

The results obtained for Elba, Brač, and Crete give a detailed overview of the **sectoral emission patterns** and the possibilities to be explored in the context of decarbonization. These are the basis on which the development of the **2030 and 2050 transition scenarios** will be conducted, and the Roadmaps will be grounded in reality instead of aspirations.

Based on this foundation, the **CO2PACMAN Tool** provides the link between the greenhouse gas balances and the scenario modelling environment. The users will be able to explore the possibilities that different policy options may have, such as the deployment of renewable energy, improvement of energy efficiency, changes in mobility, land use, and behavioral change.

This will allow the complex emission data to be accessible to policymakers, enabling the development of **evidence-based decision-making** processes and the creation of a coherent climate transition strategy.

Participatory Governance, Technology, and Citizen Engagement

In addition to the various analytical tools, the CO2PACMAN project has focused strongly on **participatory governance** and **citizen engagement**, which are considered to be important factors in the successful development of climate transition processes. A series of participatory initiatives have been created to ensure that the local population and the various stakeholders are included in the development process of the Climate Neutrality Transition Roadmaps. The various initiatives include the development of the so-called **Rooting Labs**, which is considered to be one of the flagship methodological approaches within the context of the CO2PACMAN project.

Further participatory activities, such as the **"Island I Would Like" Labs** and the **Youth Think**



Tanks, offered the opportunity to engage the youth of the island in a dialogue about their vision of their island's future and to feed their ideas into the process of climate transition. The project has also examined the potential of **digital technologies and gamification** to support citizen engagement and make the process of climate transition planning more accessible to all. The integration of scientific analysis with participatory dialogue and digital engagement tools can add to the ownership and democratic legitimacy of climate transition strategies.

Integration with EU Climate and Energy Policy Frameworks

Although the main goal of the Climate Neutrality Transition Roadmaps is to offer a practical approach to island territories, their structure is very much linked to the European Union's overall climate and energy policy. The proposed approach to the transition roadmaps is to use an integrated approach that covers energy, transport, buildings, waste, agriculture, and land use. The systemic approach to the roadmaps is in line with the transformation logic of the **European Green Deal** and can support the implementation of several European Union legislative packages.

The renewable energy scenarios can support the revised **Renewable Energy Directive (RED III)** and the European Union's **REPowerEU Plan**, particularly in terms of decentralized renewable energy and energy communities. The energy efficiency scenarios can support the recast **Energy Efficiency Directive**, particularly in terms of energy efficiency in buildings and in the public sector in terms of energy performance in buildings.

Emission reduction strategies in non-ETS sectors fall in line with the **Effort Sharing Regulation**. Land use-related strategies align with the revised **LULUCF Regulation** and certain elements of the **Common Agricultural Policy**. In the transport sector, the strategies align with the overall EU policy priorities in this sector, as outlined in the **Sustainable and Smart Mobility Strategy**, as well as in the TEN-T policy.

By this approach, the Roadmaps show how European climate and energy policy can be transferred into **territorial planning tools** that are tailored to suit the needs of island territories.

Relevance and Transferability within the Euro-Mediterranean Context

The methodological framework established during the CO2PACMAN project also offers potential relevance for other **Mediterranean island territories** that are confronted with similar structural issues.

Indeed, Mediterranean islands share similar characteristics in terms of high dependency on **imported energy resources, economic seasonality** driven by tourism activities, scarce land availability, and increased vulnerability to the consequences of climate change. The approach developed during the project provides a structured framework that could be useful for supporting the design of a climate transition plan for similar contexts.

The pilot islands of Elba, Brač, and Crete therefore become **"test beds"** for designing a plan for a climate-neutral future on Mediterranean island territories. The results of the project



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also feed into a wider understanding of how European climate policy can be transferred into local policy approaches that are tailored to suit the specific needs of Mediterranean island territories in terms of their unique socio-economic and environmental context.



Conclusions and Strategic Outlook

The **Climate Neutrality Roadmaps** developed within the CO2 PACMAN project for the Mediterranean islands of **Brač** (Croatia), **Elba** (Italy), and **Crete** (Greece) represent a significant step forward in demonstrating how small and medium-sized island territories can **design** structured, participatory, and evidence-based **pathways towards climate neutrality**. By operationalising the **CO2 PACMAN Toolkit** through a combination of **technical analysis**, **co-design activities**, and **innovation-oriented processes**, the project has produced roadmaps that are not only scientifically grounded but also socially supported and locally embedded.

Across all three pilot islands, the process has confirmed several **key findings**. First, the integration of GHG baseline analysis with participatory scenario development proved essential in translating complex emission data into accessible and actionable planning instruments. The **CO2 PACMAN Tool** demonstrated its effectiveness as a **bridge** between **technical evidence** and **public engagement**, enabling diverse stakeholder groups, from students to public administrators and local businesses, to explore decarbonisation options, assess trade-offs, and contribute to the definition of shared priorities. Second, the results of the **co-design** sessions reveal a consistent orientation across the pilot islands towards distributed, community-based, and locally grounded transition strategies. Participants showed a clear preference for energy efficiency, widespread electrification, sustainable mobility, and the preservation of natural ecosystems, while expressing greater caution towards large-scale infrastructural interventions, a pattern that reflects both social acceptability considerations and the specific landscape sensitivities of island contexts. Third, the **complementary dimensions** of the process, landscape scenarios, virtual reality tools, open innovation activities, and financing pathways, proved to be important enablers of a more comprehensive and inclusive approach to transition planning. **Landscape-based scenarios** and **immersive visualisation tools** helped bridge the gap between technical planning and **public perception**, while **open innovation** activities connected local **challenges** with external **solutions**, and **financing analyses** provided a **realistic grounding** for implementation.

At the same time, the process has brought to light a number of **challenges** that the islands will need to address in their transition pathways. **Social acceptance** of renewable energy infrastructure, particularly large-scale wind and offshore technologies, remains a sensitive issue, requiring **careful spatial planning**, **transparent communication**, and **early stakeholder involvement**. The **gap** between **awareness** and **behavioural change**, documented through vox populi activities on the three pilot islands, points to the need for targeted communication strategies and participatory mechanisms capable of translating knowledge into action at the community level. The mobilisation of **adequate financial**



resources also represents a critical condition, requiring the combination of complementary funding instruments and the progressive development of local capacity to access and manage investment opportunities.

From a broader perspective, the CO2 PACMAN experience confirms the potential of a place-based, multi-stakeholder, and iterative approach as a **replicable model** not only for Mediterranean island territories but also for other contexts facing similar structural challenges, geographic isolation, energy dependence, economic seasonality, and heightened climate vulnerability. The methodology developed within the project offers a **structured framework** that can be **adapted** to a wide range of territorial contexts, contributing to the broader European effort to ensure that climate neutrality objectives are pursued not only in major urban areas but also in smaller and more vulnerable territories that are often left outside the scope of mainstream EU climate initiatives. The roadmaps developed for Brač, Elba, and Crete therefore represent not only a deliverable of the CO2 PACMAN project but also a contribution to a wider agenda of equitable, inclusive, and territorially sensitive climate transition planning across the Mediterranean and beyond.



Annex

1.a Landscape scenario - The Energy Transition Roadmap for Brač

The CO2 PACMAN landscape approach was first applied on the island of Brač in connection with the second Lab round. The practical approach was introduced through an **opening poster** presenting the core vision: "Each landscape of your Island is the greatest collective story of the relationships between communities and the places they live in. The landscape is always changing, its story is never-ending."

The **Landscape Vision** underpinning the energy transition work was synthesised in a guiding principle: "Every landscape embodies renewable natural energies, as the sun and the wind. We can imagine a sustainable transition by planning and designing with regard to the specific features of every landscape. It means **expressing the natural power of landscape**." Within this framework, landscape serves not only as a spatial parameter but also as a medium for **public involvement** in policies and actions for carbon neutrality. The energy transition becomes a chance to understand how communities can adapt to live in a way that is respectful of their environment. "Would you like to participate in the energy transition to live on a climate-neutral island?" was the central question the project sought to engage people with throughout the Lab.

The **technical process** produced a series of visions of the island, structured around the following **steps**: the **landscape features**; the **energy target** for carbon neutrality; the **landscape suitability** and **capability** to generate renewable energy; the **landscape scenarios** for the energy transition; and design prototypes.

The landscape features

The landscape features of Brač were summarised through a sampling of the different land uses on the island, based on aerial photogrammetric scanning of different landscape typologies per land use. The analysis illustrates the land use distribution across the island and documents the physical structure of the landscape through orthophotos and schematic landscape mosaic models (Figure 39).

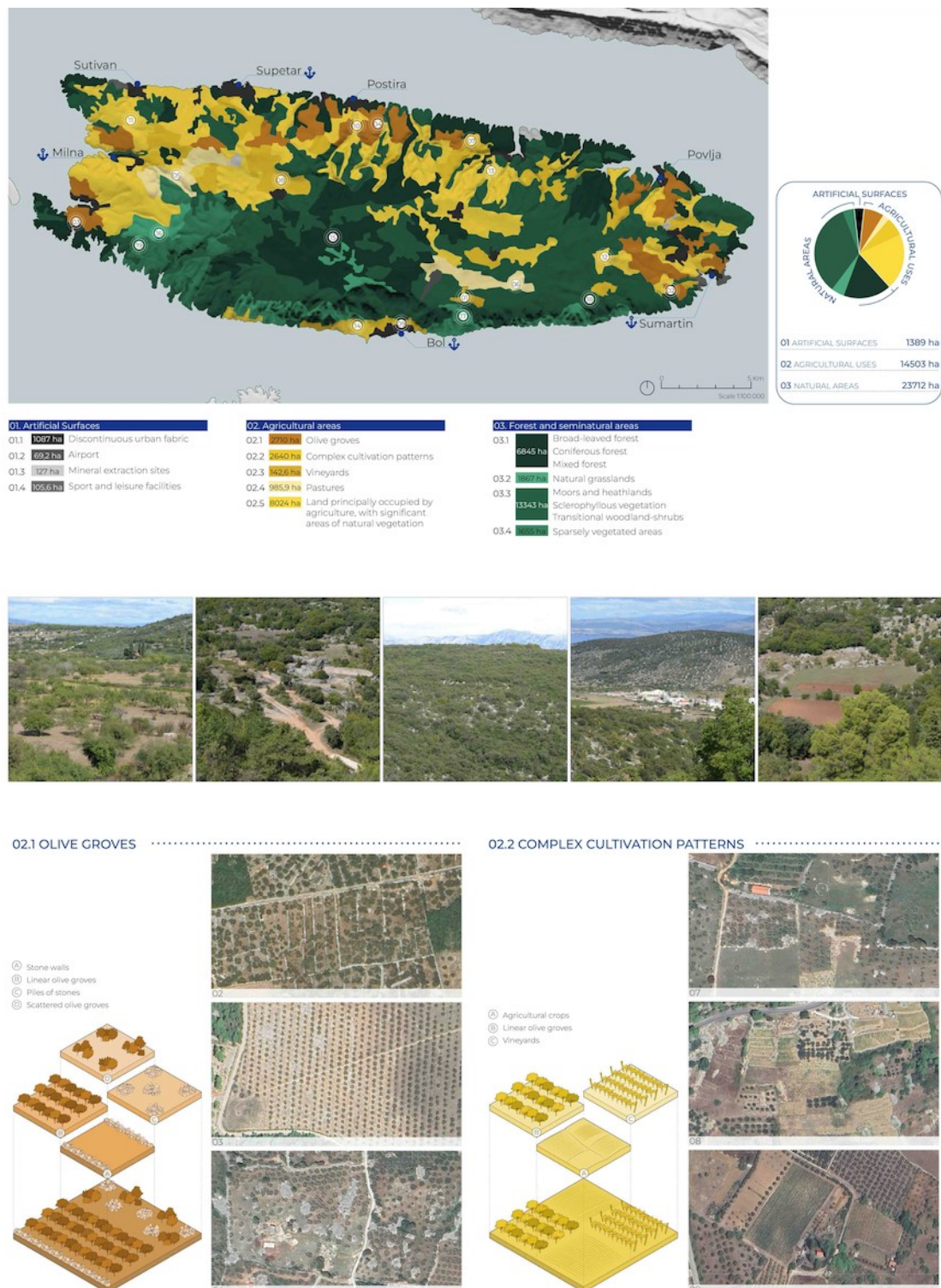


Figure 39: The image shows on top the land use in the Brac island, while below the mapped land uses are exemplified through real landscape orthogonal photos in the island and some abstract models.



The energy target for carbon neutrality

Brač must install a further **8.5 MW** of **renewable energy capacity** in order to close the gap towards carbon neutrality. This objective is equivalent to a defined level of energy production, a corresponding volume of avoided CO₂ emissions, a surface area of equivalent forest in terms of carbon absorption, and the energy demand of an equivalent number of families (Figure 40).

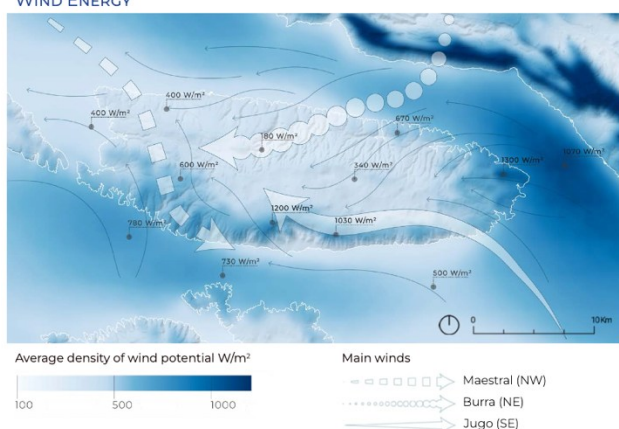


Figure 40: the energy target and equivalent values of the Brač island.

This target must be reached by exploiting the renewable energy sources available both inland and offshore, in synergy with the other ecosystem services that local ecosystems provide. Renewable energy is recognised as an ecosystem service by the European Environment Agency and must therefore be considered as a natural resource in the development of a transition roadmap. The island exhibits a high and relatively homogeneous solar potential across its entire surface, with peak irradiance concentrated in the south-western region. Terrestrial wind potential is comparatively limited across the landmass, with the most significant resources concentrated in the Brački Channel along the eastern coastline (Figure 41). Beyond abstract energy potential maps, however, it is necessary to understand which land uses can play a significant role in the transition and where the installation of renewable energy technologies can generate additional benefits — for agriculture, water storage, and ecosystem services — beyond decarbonisation alone.

THE ENERGY OF LANDSCAPE

WIND ENERGY



SOLAR ENERGY

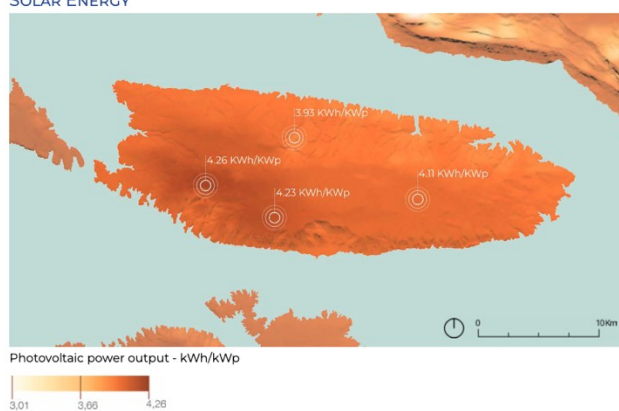


Figure 41: the wind and solar energy potential maps for the Brač island (source Global Wind and Solar Atlas).



Landscape suitability and capability to generate renewable energy

The topographic suitability analysis identified land areas compatible with the installation of renewable energy technologies, specifically slopes below 25% for wind energy systems and below 11% for photovoltaic technologies. Based on these parameters, the island possesses a high territorial vocation for renewable energy development, particularly in the central-southern plain, which presents minimal slope gradients. However, this area simultaneously represents a critical ecological asset due to its rich biocenosis, and any proposed intervention must therefore balance technical suitability with the preservation of vital ecosystem services (Figure 42).

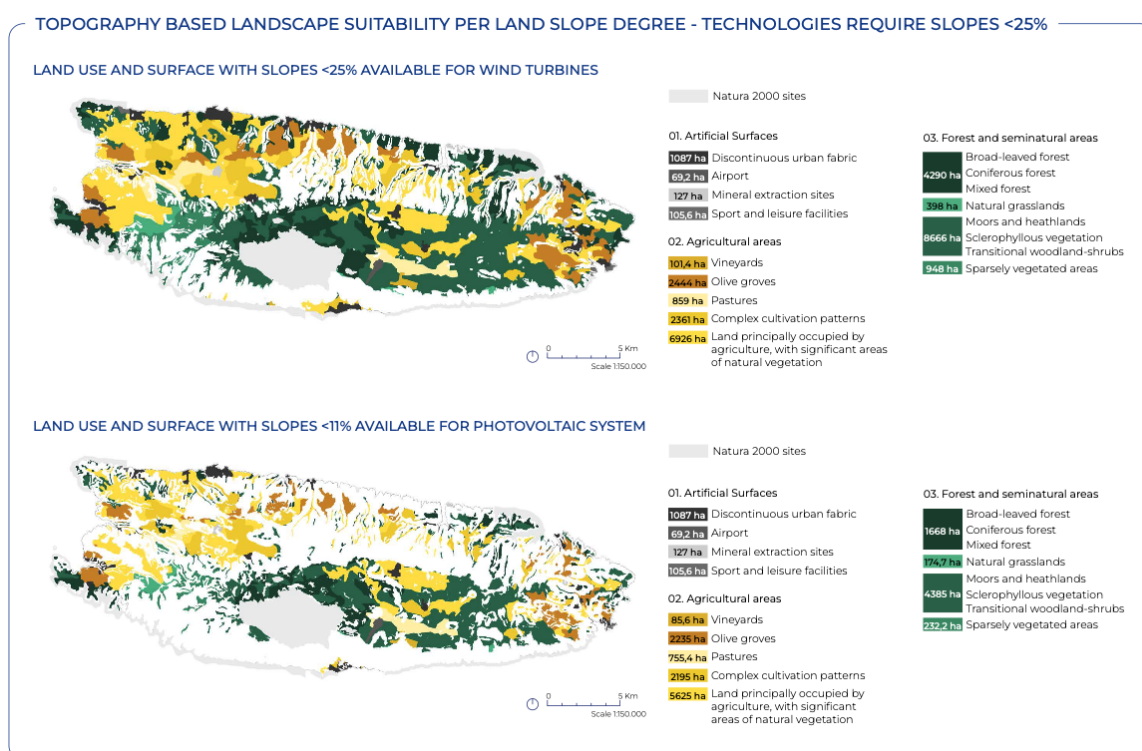


Figure 42: topographic suitability

Building on this suitability assessment, an expert-based evaluation was conducted to identify the opportunity for different land uses to integrate renewable energy technologies (Figure 43). Among the most relevant findings: agrivoltaic systems with elevated bifacial modules and mono-axis trackers represent a high-opportunity option for areas classified as complex cultivation patterns, where agricultural activity interspersed with natural vegetation often suffers from land fragmentation and abandonment. In these contexts, agrivoltaic systems can support the revitalisation of farming practices threatened by rising thermal stress, enable the formation of local energy communities, and help farmers preserve traditional cultivars and indigenous fruit species through improved microclimate conditions and additional income. Ground-mounted photovoltaic systems were identified as a strategic option for degraded landscapes such as former mining sites, where solar infrastructure can be paired with phytoremediation to rehabilitate contaminated soils.



Wind parks offer a viable option in land-use categories such as mineral extraction sites and pastures, with the potential to activate strategic synergies without compromising existing ecological services.

EXPERT BASED LANDSCAPE SUITABILITY PER LAND USE - NATURA 2000 SITES EXCLUDED

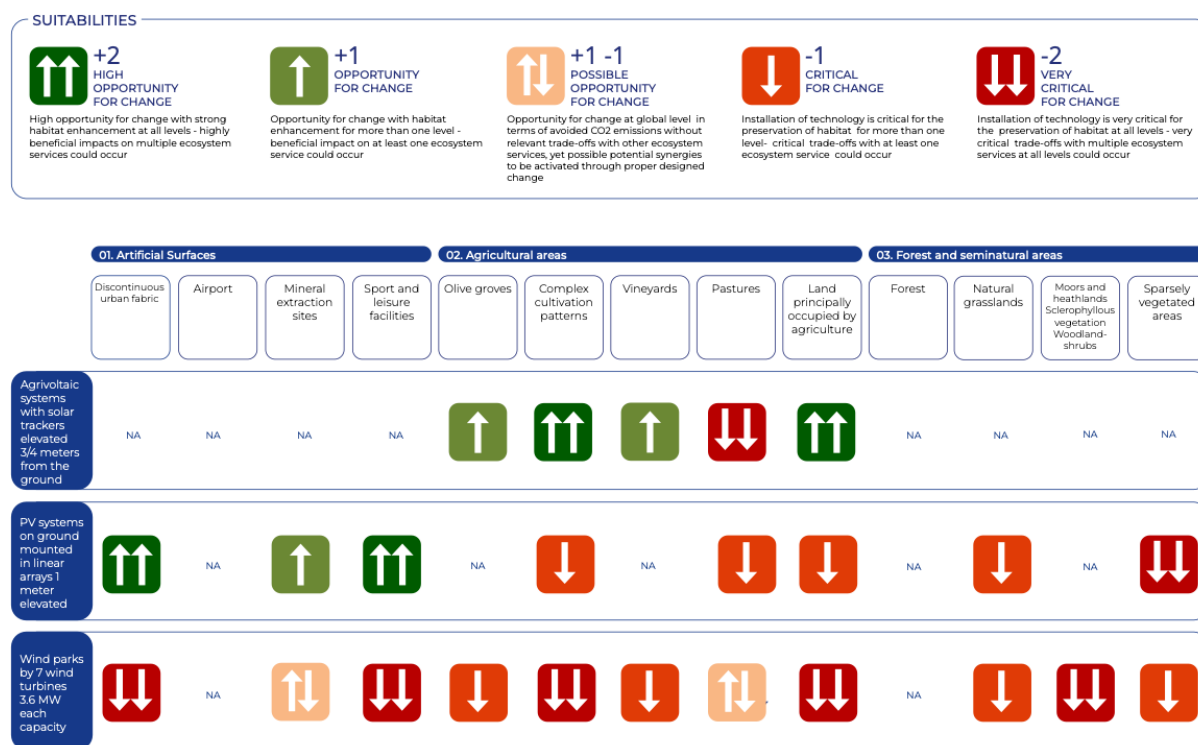


Figure 43: the matrix of the landscape suitability per land use to integrate RET.

The images below show for example the landscape suitability and capability per land uses related to the installation of elevated agrivoltaics systems (Figure 44), photovoltaic systems (Figure 45) and Wind parks (Figure 46).

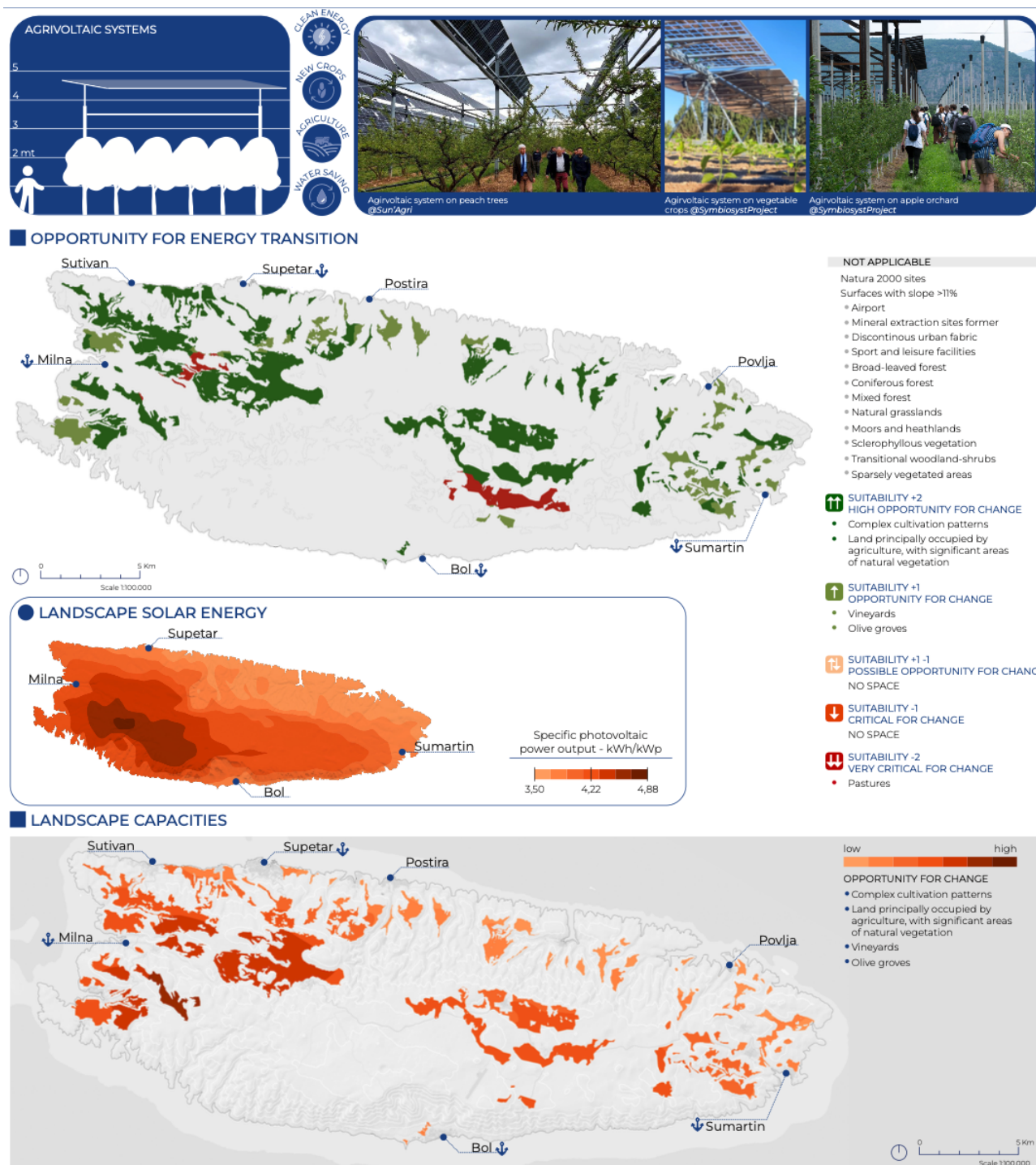


Figure 44: the landscape suitability and capability per land uses related to the installation of elevated agrivoltaics systems.

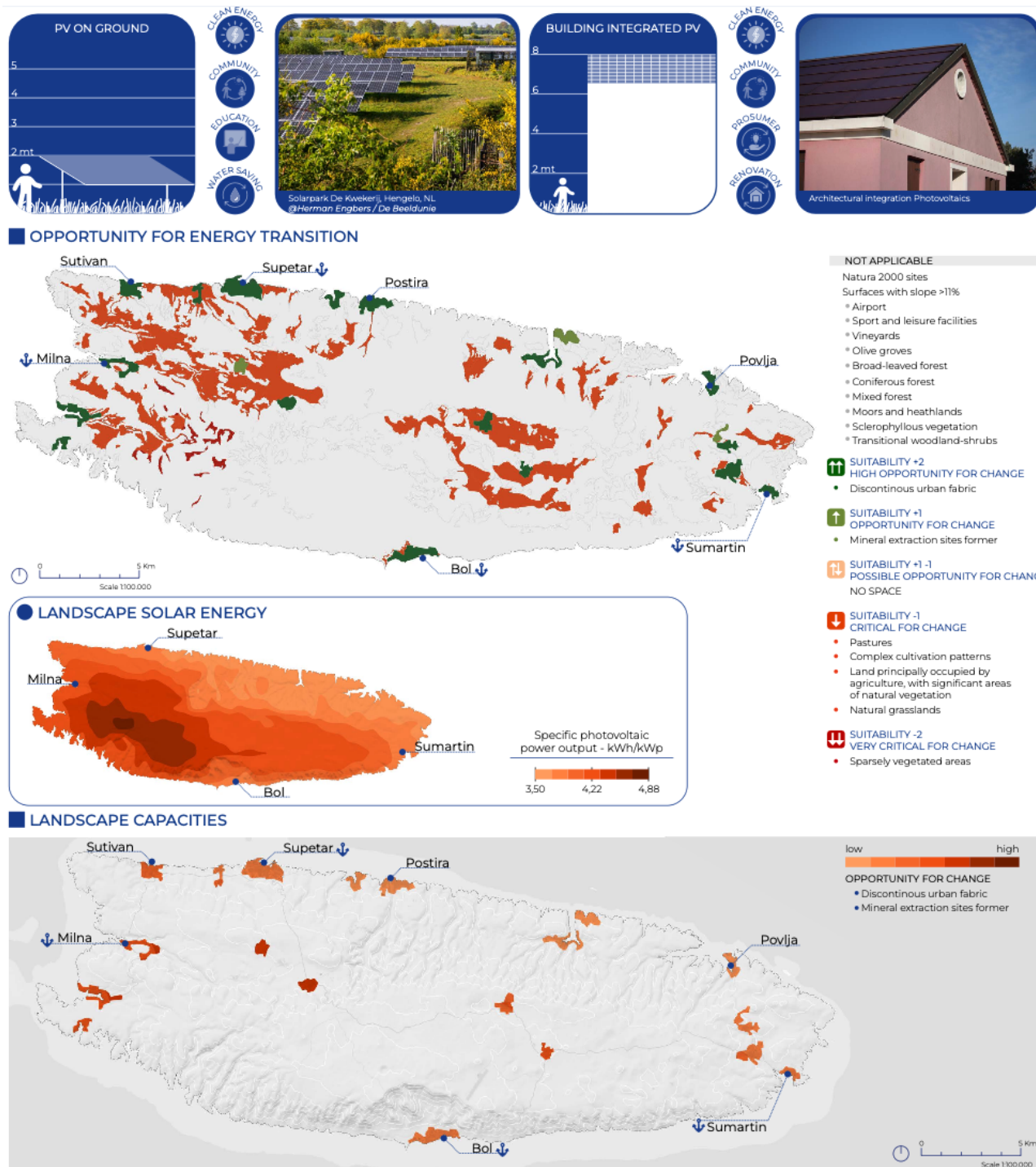


Figure 45: the landscape suitability and capability per land uses related to the installation of PVs on field and on roofs.

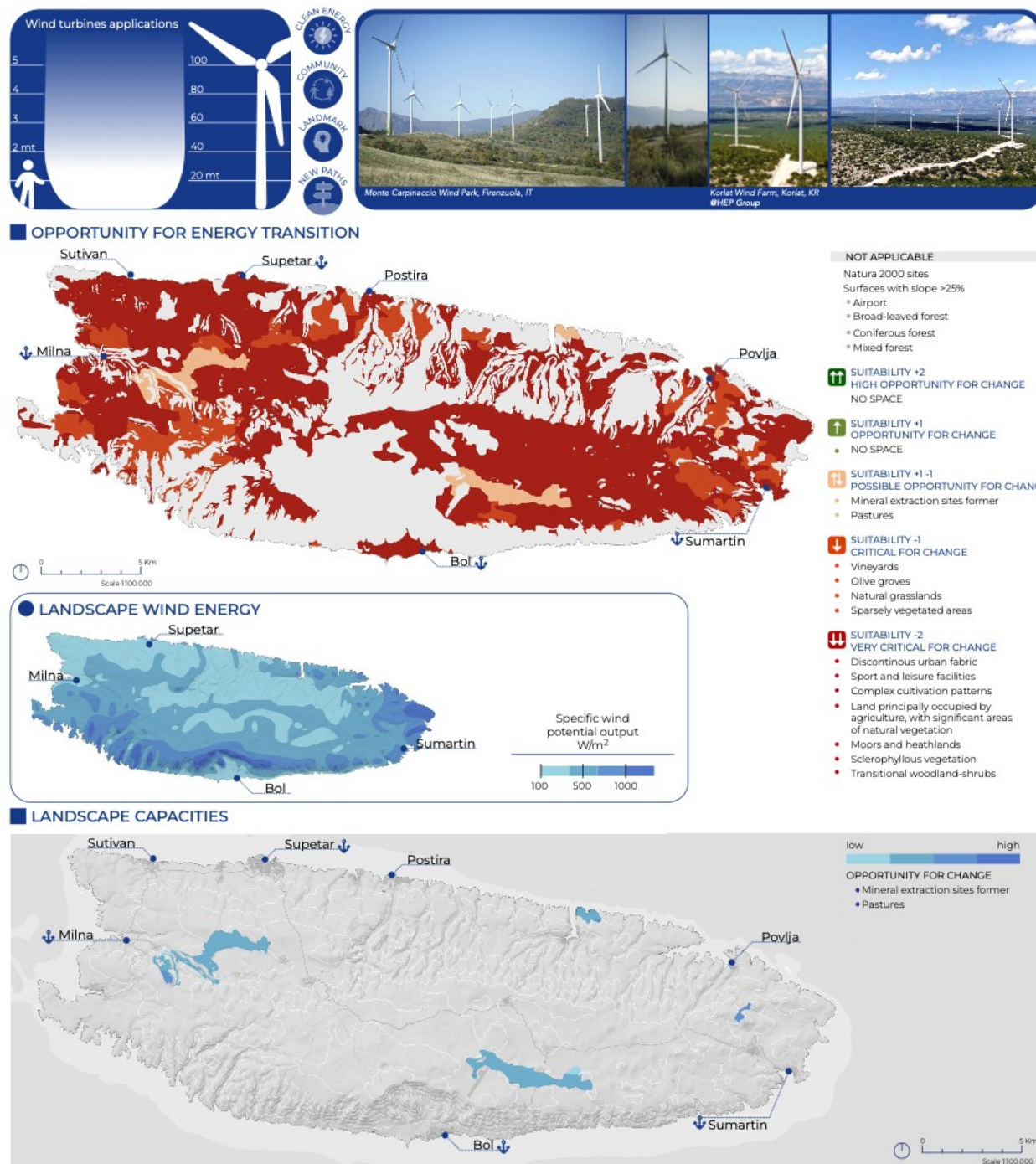


Figure 46: the landscape suitability and capability per land uses related to the installation of on-shore wind farms.



Landscape scenarios for the energy transition

The landscape capacity for agrivoltaic, photovoltaic, and wind energy across different land uses, combined with an assessment of where renewable energy integration presents the greatest opportunity for beneficial change, informed the development of three landscape-based scenarios for Brač's energy transition. These scenarios do not represent univocal pathways but rather different lenses through which the transition can be explored; they are therefore complementary and can be combined.

Scenario 1 — Would you like to maintain the traditional landscape mosaic while self-producing renewable energy?

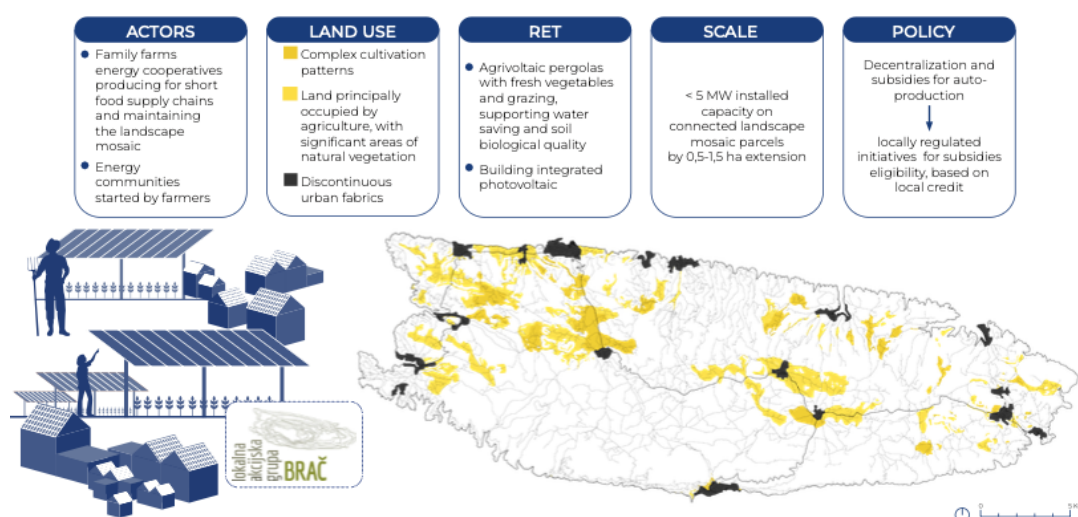


Figure 47: the factsheet reporting on scenario main actors, potentially suitable land uses, technology, spatial and investment scale and possible policy sustaining the scenario.

This scenario, aligned with the objectives of the local action group LAGBrač Smart Action Plan, supports the maintenance of Brač's traditional landscape mosaic (Figure 47). The land uses comprising the mosaic are mostly composed of small vineyards and olive groves, arable land, and grazing areas along valley plains with fertile, moisture-retaining alluvial soils. **Agrivoltaic pergolas** in these contexts can support arable **cultivation of fresh vegetables, grains**, and **grazing**, while advancing water saving and regenerative farming practices. Initiatives can range **from 1 MW** for **single farms** or peri-urban energy communities up **to 5 MW** from **farmers' cooperatives**. The scenario also foresees subsidies for installations on building facades and rooftops framed as contributions to farmer-led energy communities. The scenario is fully capable of satisfying the 8.5 MW target.



Scenario 2 — Would you like companies to develop renewable energy while recovering natural habitat?

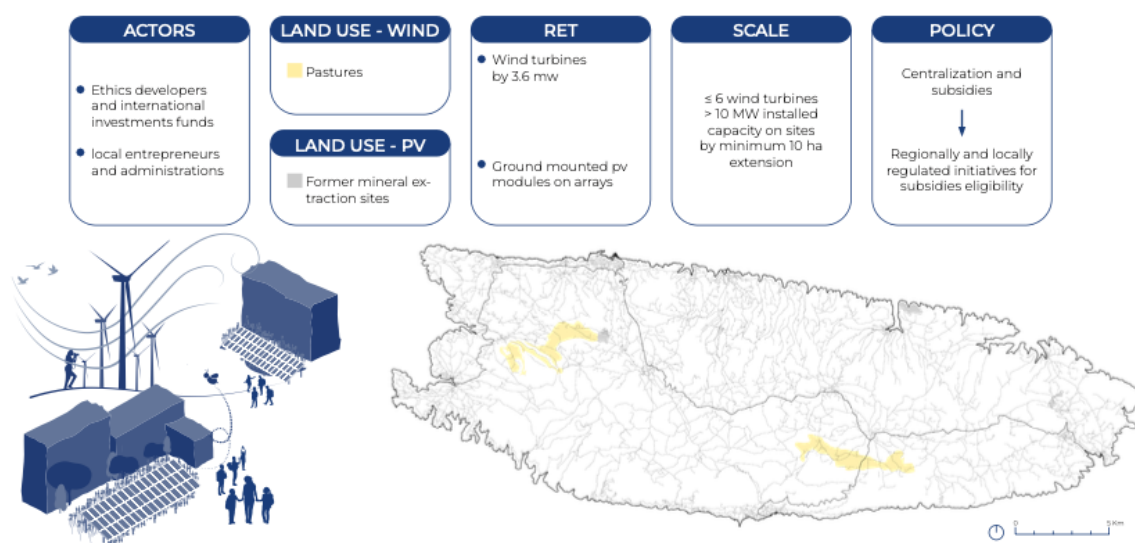


Figure 48: the factsheet reporting on scenario main actors, potentially suitable land uses, technology, spatial and investment scale and possible policy sustaining the scenario.

This scenario combines wind and solar development with the **recovery of natural habitat** and an enhanced landscape experience, following the **touristic vocation** of the island (Figure 48). Pastureland on elevated and windy areas can host wind turbines, and as has occurred in several cases worldwide, the construction and maintenance roads of the wind park can function as ecotourism pathways. **Ground-mounted photovoltaic arrays** can be **integrated** into the regeneration strategy of **former mineral extraction** sites, where scientific evidence shows that the shading provided by photovoltaic modules can benefit and accelerate the regeneration of degraded soil layers, supporting ecological succession from pioneer grassland to sclerophyllous vegetation. Solar exploitation in this context is conceived as temporary, lasting only as long as soil regeneration requires support before nature can fully recover.



Scenario 3 — Would you like to sustain PDO olive oil and wine production while generating renewable energy?

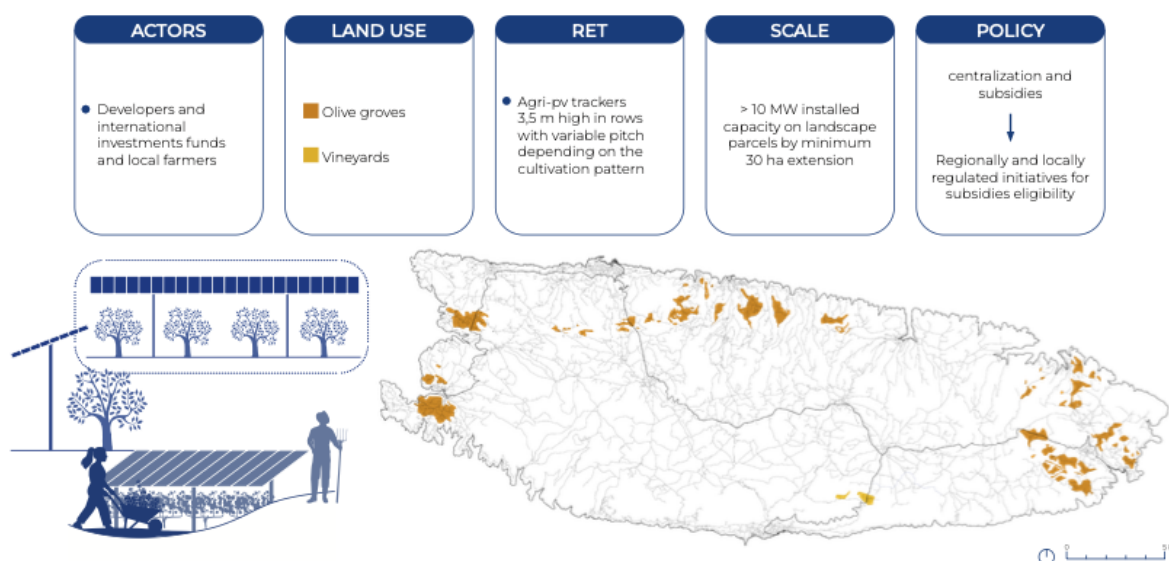


Figure 49: the factsheet reporting on scenario main actors, potentially suitable land uses, technology, spatial and investment scale and possible policy sustaining the scenario.

This scenario proposes **agrivoltaic systems** in **olive groves** and **vineyards** to **support adaptation** to **climate change** — particularly in contexts affected by very negative hydroclimatic balances due to prolonged summer heat waves, resulting in early grape harvesting or premature fruit dropping in olives — and to support the transition towards more sustainable farming practices and **certified PDO productions** (Figure 49). The scenario fits newly planted vineyards on well-drained soils in the south-eastern part of the island, where agrivoltaic pergolas can be installed above vine rows at every other inter-row. It also fits olive groves on the north-western side of the island, where, when the olive pattern is 6×6 metres, tracker rows can be laid out between olive tree rows, every two rows of trees pruned to 3–4 metres height in traditional open-vase form.



Design prototypes

Two design prototypes were developed for Brač: one for an **agrivoltaic system** and one for a **wind park**.

The agrivoltaic prototype targets complex cultivation patterns land use — heterogeneous agricultural landscapes characterised by fragmented, small-scale plots — through the implementation of **agrivoltaic pergola systems** (Table 1, Figure 50). These structures support the cultivation of fresh vegetables and grains alongside managed grazing, while advancing water saving and regenerative farming practices. Given the proximity of these sites to peri-urban areas and small villages, the systems facilitate the development of local energy communities and function as climate adaptation tools, shielding crops from extreme weather events including rising temperatures and late-spring frosts.

Table 1: the Agri-PV system in numbers

Total surface	2,3 ha
PV surface	0,3 ha
Planted surface	1 ha
Installed capacity	0,7 MW
System energy density	300 kW/ha

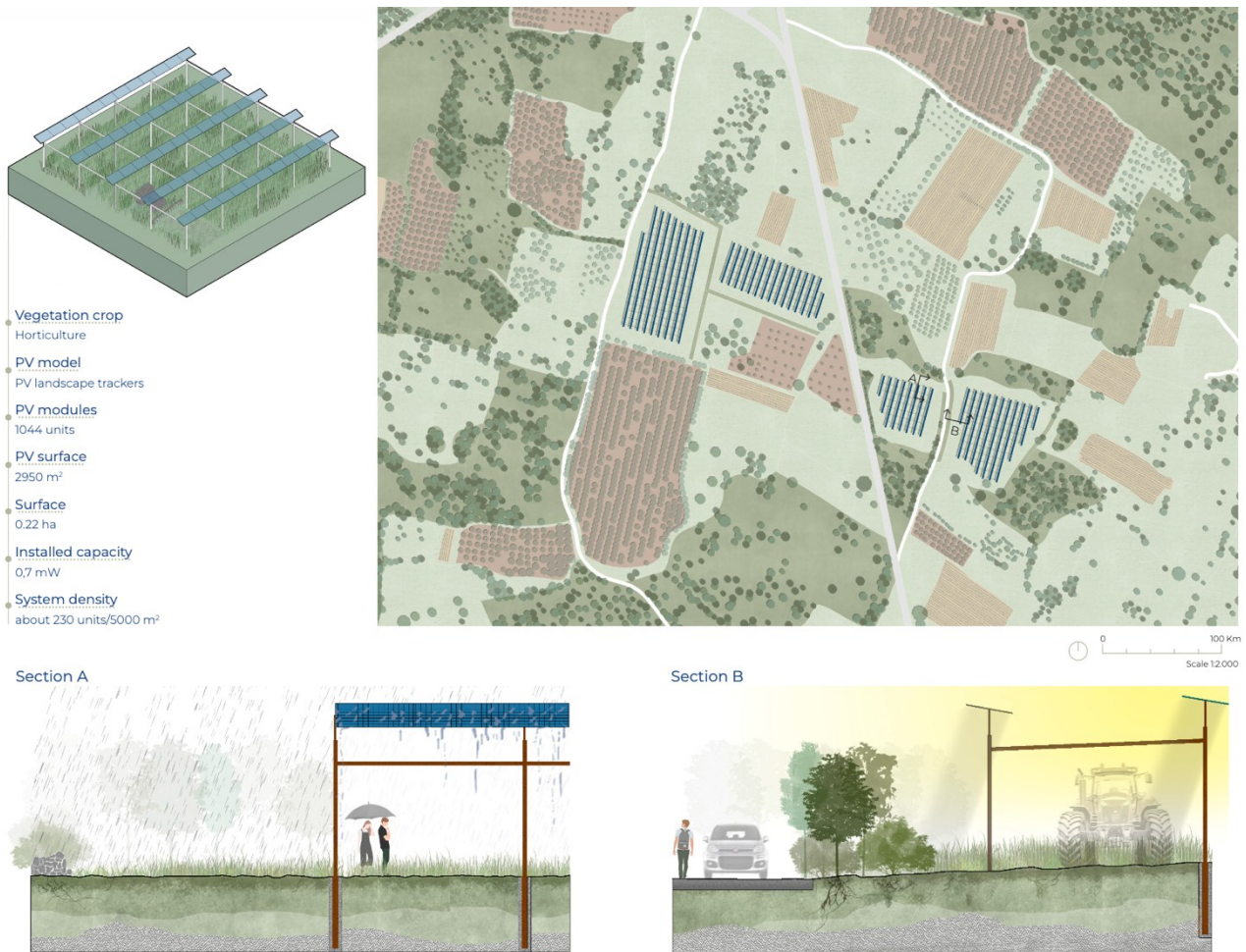


Figure 50: the image shows the details about the Agri-PV system. On the right the general plan that shown how the new Agri-PV pergolas fit in the semiology of the landscape. Below is detailed how this systems work related with agriculture practices and land management.



The **wind park** prototype targets pastureland on inland elevated areas with sufficient wind potential to meet the island's energy target through the installation of **six turbines** (Table 2, Figure 51). The site is predominantly characterised by bare rock, which facilitates construction and minimises ecological impact on native vegetation. The design proposes the integration of new hiking pathways, inviting the public to engage with and explore the wind landscape, reinforcing the connection between renewable energy infrastructure and the island's ecotourism offer.

Table 2: the wind park in numbers

Average annual wind speed in the area	6,5 m/s
Nominal power per unit	3,6 MW
Effective power per unit	1,1 MW
Number of units	6
Total effective power of the wind farm	21,6 MW

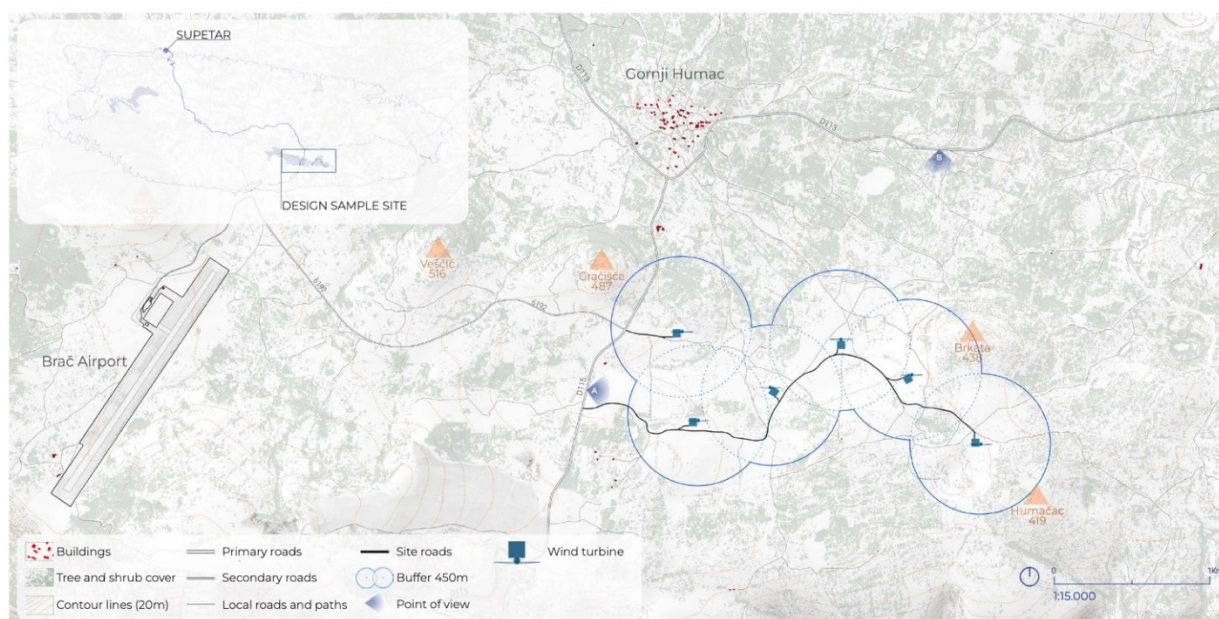


Figure 51: the image shows the exact position of wind turbines with a detailed plan, showing the relation between the Wind Park, the Airport and the nearest small town.



1.b Landscape scenario - The Energy Transition Roadmap for Elba

The CO2 PACMAN landscape approach was applied to Elba Island in connection with the second Lab round, following the same methodological framework previously developed for Brač. The practical approach was introduced through an **opening poster** presenting the core vision: *"Each landscape of your Island is the greatest collective story of the relationships between communities and the places they live in. The landscape is always changing, its story is never-ending."*

The **Landscape Vision** underpinning the energy transition work was synthesised in a guiding principle: *"Every landscape embodies renewable natural energies, as the sun and the wind. We can imagine a sustainable transition by planning and designing with regard to the specific features of every landscape. It means expressing the natural power of landscape."* Within this framework, **landscape** serves not only as a **spatial parameter** but also as a **medium for public involvement** in policies and **actions for carbon neutrality**, offering opportunities to pursue a new aesthetic of sustainability. The energy transition becomes a chance to understand how communities can adapt to live in a way that is respectful of their environment. *"Would you like to participate in the energy transition to live on a climate-neutral island?"* was the central question the project sought to engage people with throughout the Lab.

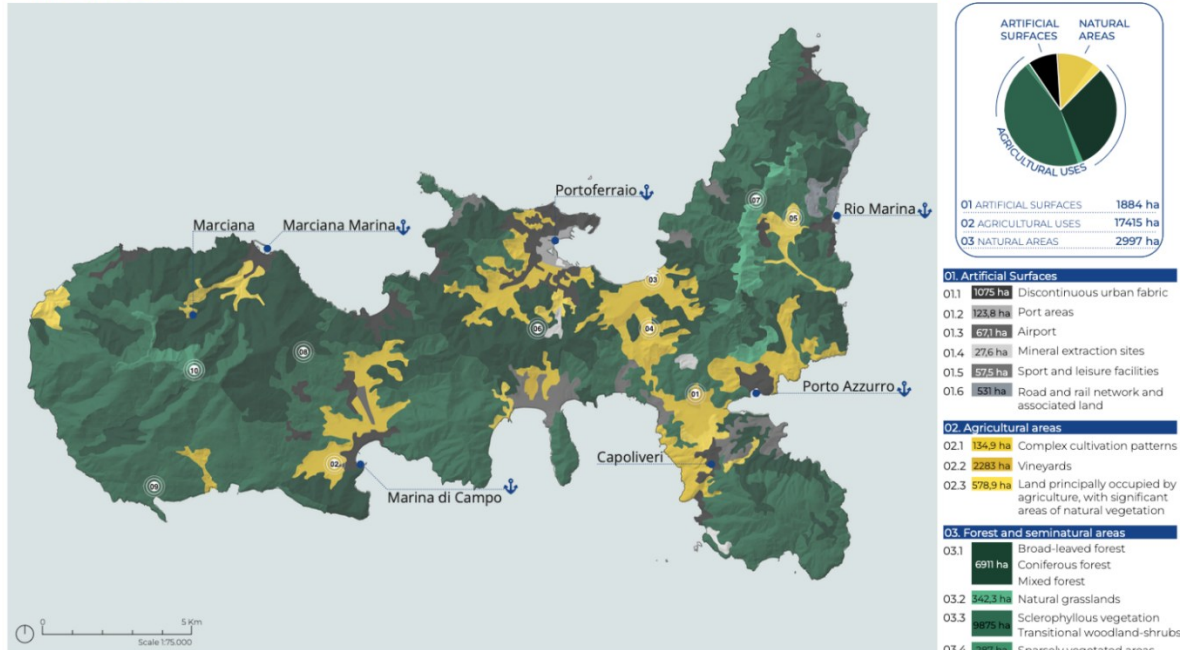
The **technical process** produced a series of visions of the island, structured around the following **steps**: the **energy target** for carbon neutrality; the **landscape suitability** and **capability** to generate renewable energy; the **landscape scenarios** for the energy transition; **design prototypes**; and the **engagement** with stakeholders through those prototypes.

The landscape features

The landscape features have been summarized by providing a sampling of the different land uses in the island. The sampling was based on detecting through an aerial photogrammetric scanning different typologies of landscape features per land use. The image below illustrates a summary of the landscape in the Elba island per land use and sampling of landscape physical structure through orthophoto and landscape mosaic schematic models. The image below (Figure 52) illustrates a summary of the landscape in Elba island per land use and landscape physical structure.

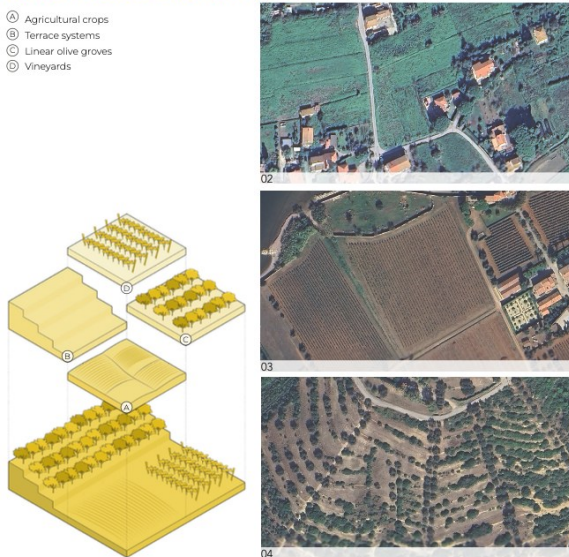


CORINE LAND COVER

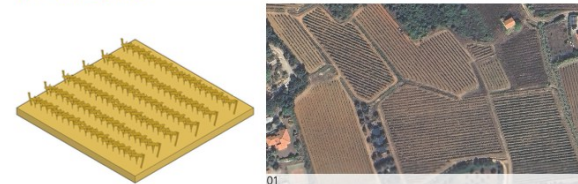


02.1 COMPLEX CULTIVATION PATTERNS

- (A) Agricultural crops
- (B) Terrace systems
- (C) Linear olive groves
- (D) Vineyards



02.2 VINEYARDS



02.3 LAND PRINCIPALLY OCCUPIED BY AGRICULTURE, WITH SIGNIFICANT AREAS OF NATURAL VEGETATION

- (A) Agricultural crops
- (B) Vineyards
- (C) Spontaneous vegetation

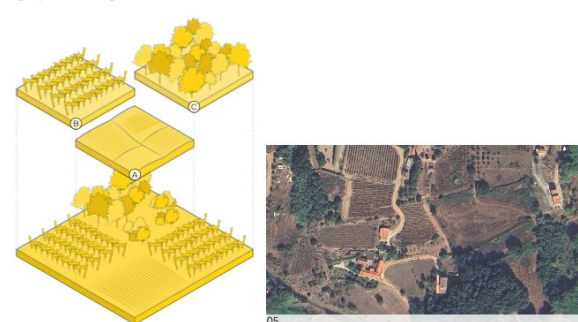


Figure 52: The image shows on top the land use in the Elba island, while below the mapped land uses are exemplified through real landscape orthogonal photos in the island and some abstract models.



The energy target for carbon neutrality

Elba must install a further **22.5 MW** of **renewable energy capacity** in order to close the gap towards carbon neutrality. This objective is equivalent to a defined level of energy production, a corresponding volume of avoided CO₂ emissions, a surface area of equivalent forest in terms of carbon absorption, and the energy demand of an equivalent number of families (Figure 53).



Figure 53: the energy target and equivalent values of the Elba island.

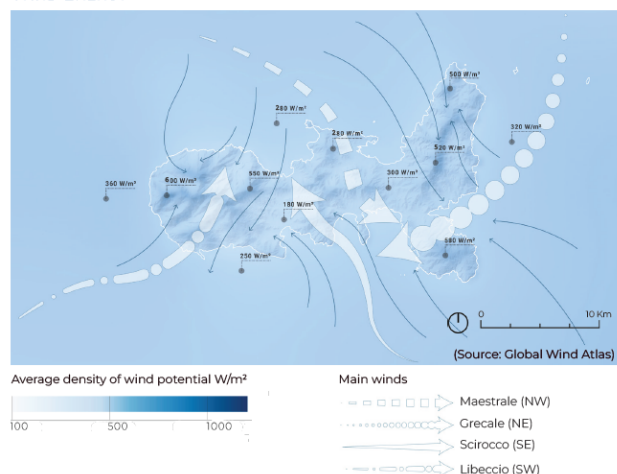
This target must be reached by **exploiting** the **renewable energy** sources available both **inland** and **offshore**, in **synergy** with the other **ecosystem services** that local ecosystems provide. Renewable energy is recognised as an ecosystem service by the European Environment Agency and must therefore be considered as a natural resource in the development of a transition roadmap. **Solar energy potential maps** indicate a very **high potential** across the island, suggesting a central role for solar energy systems in the transition pathway. Wind energy potential, while more limited inland compared to other locations in the Tyrrhenian Sea, presents greater opportunities offshore along the western coast (Figure 54).

Beyond abstract energy potential maps, however, it is necessary to understand which land uses can play a significant role in the transition and where the installation of renewable energy technologies can generate additional benefits — for agriculture, water storage, and ecosystem services — beyond decarbonisation alone.



THE ENERGY OF LANDSCAPE

WIND ENERGY



SOLAR ENERGY



Figure 54: the wind and solar energy potential maps for the Elba island (source Global Wind and Solar Atlas).

Landscape suitability and capability to generate renewable energy

The **topographic suitability analysis** identified the land **areas compatible** with the installation of **renewable energy technologies**, specifically slopes below 25% for wind energy systems and below 11% for photovoltaic technologies, alongside marine areas suitable for offshore wind development. The island's topography significantly constrains the inland land uses available for the transition roadmap, while marine areas present fewer limitations (Figure 55).



TOPOGRAPHIC SUITABILITY- RENEWABLE ENERGY TECHNOLOGIES REQUIRE SLOPES < 25%

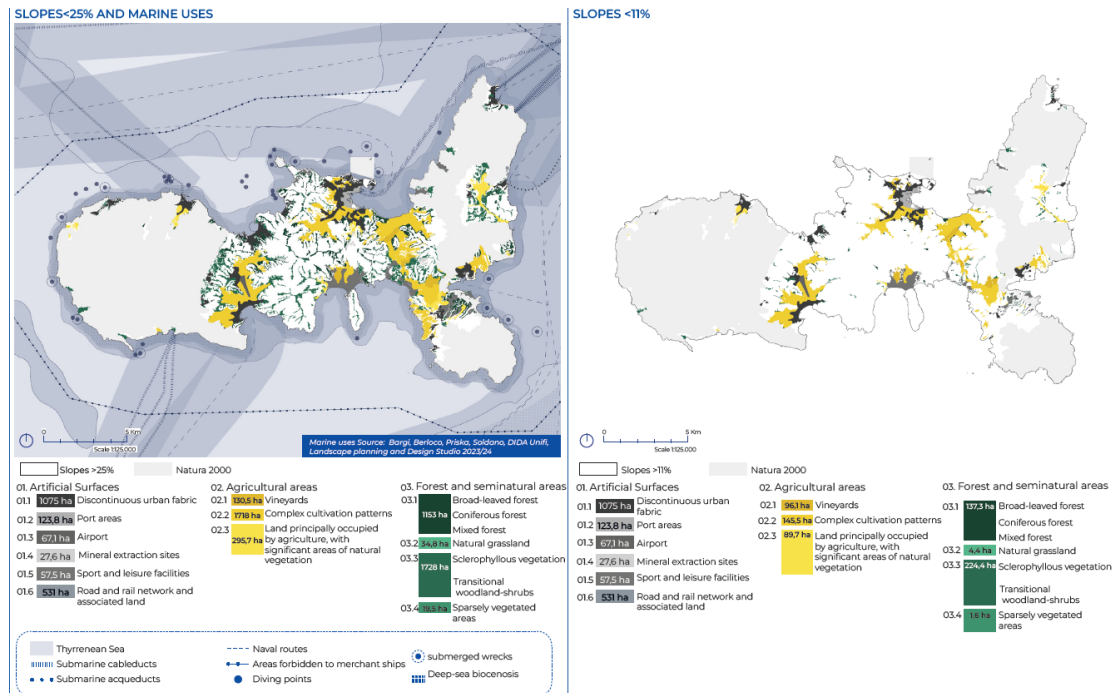


Figure 55: the topographic suitability

Building on this suitability assessment, an **expert-based evaluation** was conducted to identify the opportunity for different land and marine uses to **integrate renewable energy technologies (RET)** (Figure 56). Among the most relevant findings: **agrivoltaic systems** with elevated bifacial modules and mono-axis trackers represent a high-opportunity option for land uses characterised by complex cultivation patterns and agricultural land with significant areas of natural vegetation — contexts where abandoned fields, no longer competitive for conventional agriculture and affected by water scarcity, could benefit from agrivoltaic systems supporting the continuation of traditional local cultivation. **Ground-mounted photovoltaic** systems were identified as a high-opportunity option for former mining areas, where they could support phytoremediation processes on polluted sites. For marine uses, **floating offshore wind farms** were assessed as a high-opportunity option in areas restricted to merchant shipping, given that the sea surface within an offshore wind park is legally interdicted to fishing and can effectively function as a marine habitat nursery.



EXPERT BASED LANDSCAPE SUITABILITY PER LAND USE - NATURA 2000 SITES EXCLUDED

SUITABILITIES

+2
HIGH
OPPORTUNITY
FOR CHANGE

High opportunity for change with strong habitat enhancement at all levels - highly beneficial impacts on multiple ecosystem services could occur

+1
OPPORTUNITY
FOR CHANGE

Opportunity for change with habitat enhancement for more than one level - beneficial impact on at least one ecosystem service could occur

+1 -1
POSSIBLE
OPPORTUNITY
FOR CHANGE

Opportunity for change at global level in terms of avoided CO2 emissions without relevant trade-offs with other ecosystem services, yet possible potential synergies to be activated through proper designed change

-1
CRITICAL
FOR CHANGE

Installation of technology is critical for the preservation of habitat for more than one level- critical trade-offs with at least one ecosystem service could occur

-2
VERY
CRITICAL
FOR CHANGE

Installation of technology is very critical for the preservation of habitat at all levels - very critical trade-offs with multiple ecosystem services at all levels could occur

NOT
COMPATIBLE

Technology installation is not compatible

LAND USES

01

Discontinuous urban fabric

X

X

X

↑↑

↑↑

↑↑

02

Road and rail network and associated land

X

↑↑

↑↑

↑↑

↑

↑

Port areas

X

↑↑

↑↑

↑↑

↑

↑

Airport

X

↑↑

↑↑

↑↑

↑

↑

Mineral extraction sites

X

↑

↑

X

X

X

Sport and leisure facilities

X

↑↓

↑↓

↑↑

X

X

03

Vineyards

↑↓

X

X

X

X

↑↓

Complex cultivation patterns

↑↑

X

X

X

X

X

Land principally occupied by agriculture, with significant areas of natural vegetation

↑↑

X

X

X

X

X

Forests

X

X

X

X

X

X

Natural grassland

X

↑↓

↑↓

X

X

X

Sclerophyllous vegetation
Transitional woodland-shrubs

X

X

X

X

X

X

Sparsely vegetated areas

X

↑↓

↑↓

X

X

↑↓

MARINE USES

Submarine cableducts

X

Submarine aqueducts

X

Naval routes

X

Areas forbidden to merchant ships

↑↑

Diving points

↑↑

submerged wrecks

X

Deep-sea biocenosis

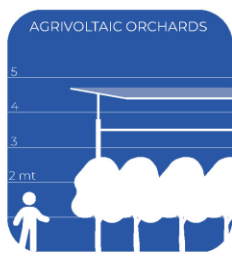
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Off-shore wind park with turbines by 8 MW

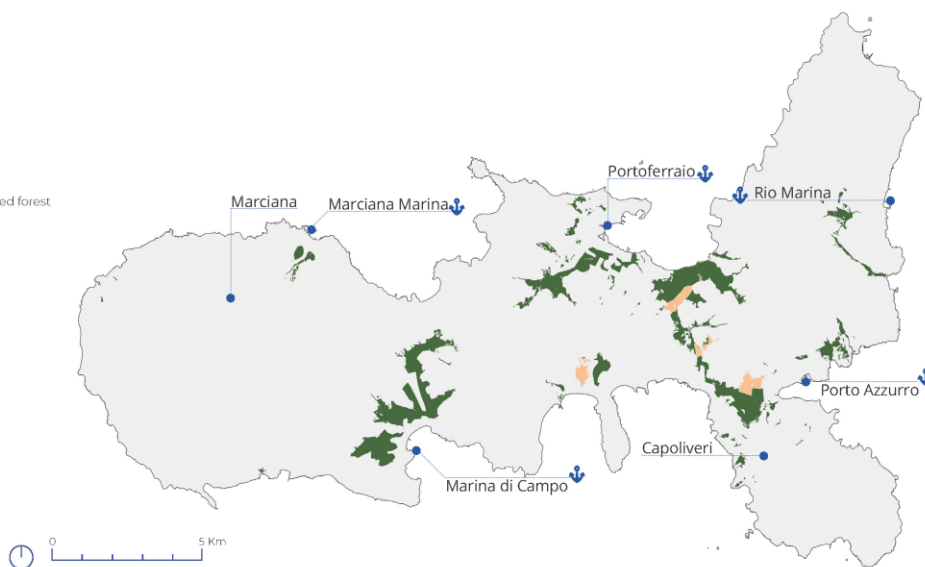
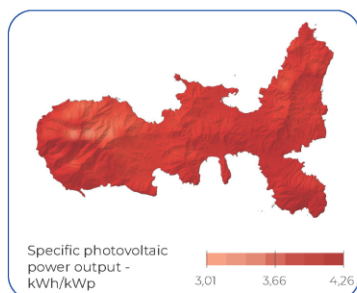
X

Figure 56: the matrix of the landscape suitability per land use to integrate RET.

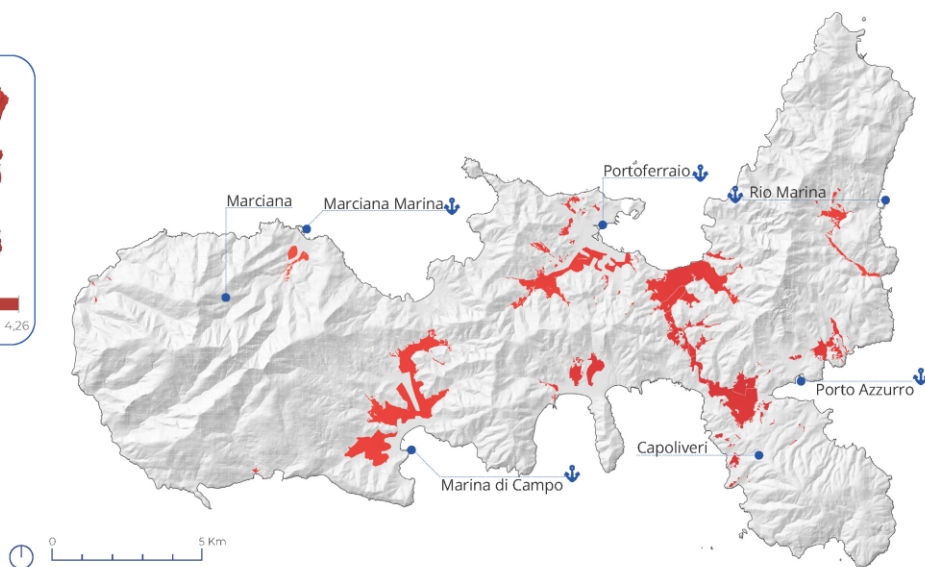
The images below shows for example the **landscape suitability and capability** per land uses related to the installation of elevated agrivoltaics systems (those defined as advanced by Italian regulations (Figure 57) and photovoltaic systems on ground (Figure 58).

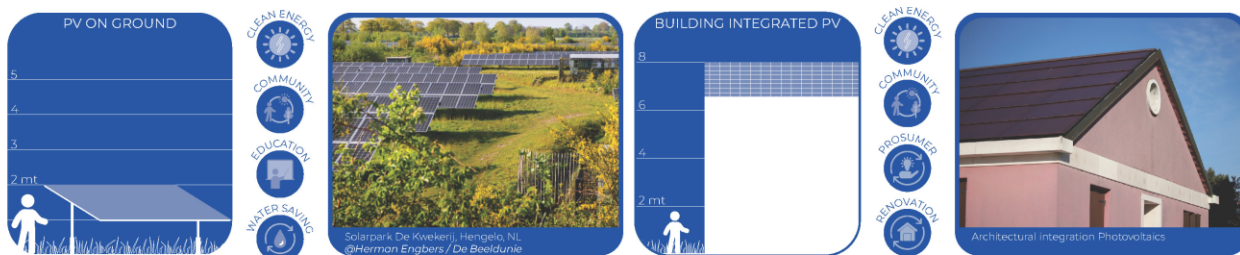
**AGRIVOLTAIC SUITABILITY**

- X NOT COMPATIBLE**
- Natura 2000 sites
 - Surfaces with slope >11%
 - Discontinuous urban fabric
 - Road and rail network and associated land
 - Port areas
 - Airport
 - Mineral extraction sites
 - Sport and leisure facilities
 - Sparsely vegetated areas
 - Broad-leaved forest / Coniferous forest / Mixed forest
 - Natural grasslands
 - Sclerophyllous vegetation / Transitional woodland-shrubs
- ↑↑ SUITABILITY +2**
High opportunity for change
- Complex cultivation patterns
 - Land principally occupied by agriculture, with significant areas of natural vegetation
- ↑ SUITABILITY +1**
Opportunity for change
NO SPACE
- ↑↓ SUITABILITY +1-1**
Possible opportunity for change
- Vineyards
- ↓ SUITABILITY -1**
Critical for change
NO SPACE
- ↓↓ SUITABILITY -2**
Very critical for change
NO SPACE

**AGRIVOLTAIC CAPACITY**

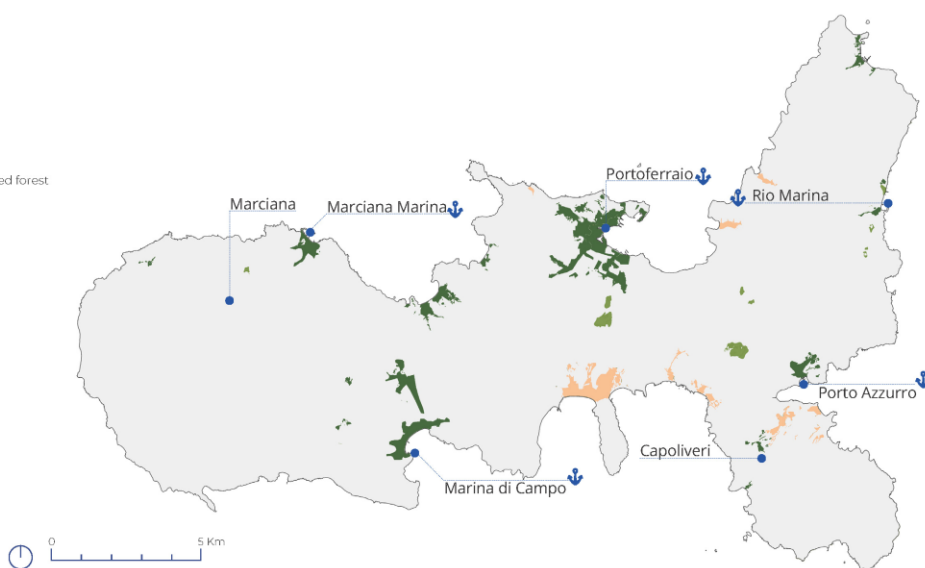
- Opportunity for change
- Complex cultivation patterns
 - Land principally occupied by agriculture, with significant areas of natural vegetation
 - Vineyards

**Figure 57:** landscape suitability and capability for agrivoltaics.

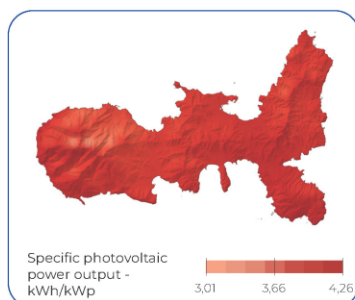


PHOTOVOLTAIC SUITABILITY

- NOT COMPATIBLE**
 - Natura 2000 sites
 - Surfaces with slope >11%
 - Vineyards
 - Complex cultivation patterns
 - Land principally occupied by agriculture, with significant areas of natural vegetation
 - Broad-leaved forest / Coniferous forest / Mixed forest
 - Sclerophyllous vegetation / Transitional woodland-shrubs
- SUITABILITY +2**
 - High opportunity for change
 - Discontinuous urban fabric
 - Road and rail network and associated land
 - Port areas
 - Airport
- SUITABILITY +1**
 - Opportunity for change
 - Mineral extraction sites
- SUITABILITY +1-1**
 - Possible opportunity for change
 - Sport and leisure facilities
 - Sparsely vegetated areas
 - Natural grasslands
- SUITABILITY -1**
 - Critical for change
 - NO SPACE
- SUITABILITY -2**
 - Very critical for change
 - NO SPACE



PHOTOVOLTAIC CAPACITY



- Opportunity for change**
 - Discontinuous urban fabric
 - Road and rail network and associated land
 - Port areas
 - Airport
 - Mineral extraction sites
 - Sport and leisure facilities
 - Sparsely vegetated areas
 - Natural grasslands

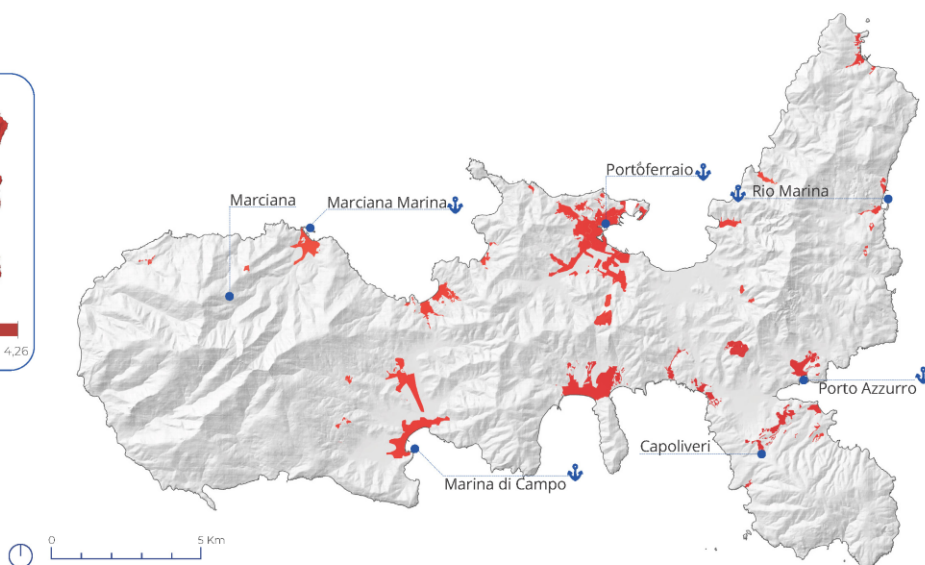


Figure 58: landscape suitability and capability for building integrated photovoltaics and on ground.



Landscape scenarios for the energy transition

The landscape capacity for **agrivoltaic**, **photovoltaic**, and **wind energy** across different land uses, combined with an assessment of where renewable energy integration presents the greatest opportunity for beneficial change, informed the development of **three landscape-based scenarios** for Elba's energy transition. These scenarios do not represent univocal pathways but rather different lenses through which the transition can be explored; they are therefore complementary and can be combined.

Scenario 1 — Would you like to cover the island's energy needs with an offshore wind farm so as not to distribute the necessary production with other technologies on land?

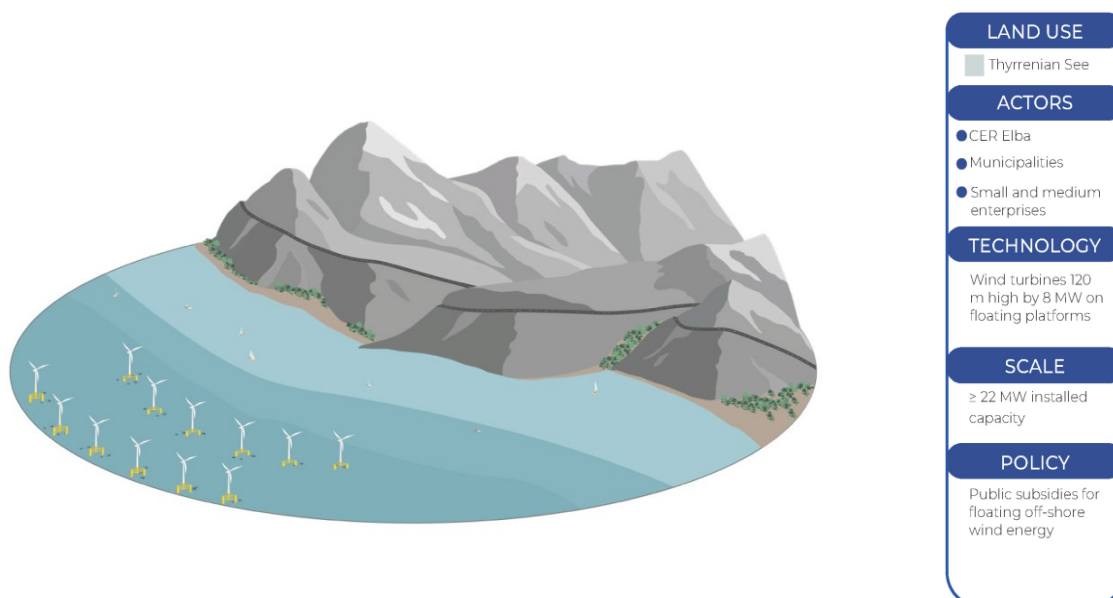


Figure 59: on the left a landscape composition for scenario 1, on the right a factsheet on the scenario reporting on scenario main actors (CER Elba is the Energy Community of Elba, technology, spatial and investment scale and possible policy sustaining the scenario.

This scenario explores the possibility of concentrating renewable energy production in an **offshore wind farm**, reducing the need for onshore installations distributed across the landscape (Figure 59). In some marine areas around Elba, floating offshore wind development is **technically feasible without causing significant impacts on natural habitats or other marine uses**. Observing turbines generating clean energy from the coast could become part of **the island's sustainable identity and tourism offering**, as has occurred in other European contexts. However, floating offshore wind remains currently the **most expensive** renewable energy technology. Based on recent analysis conducted by Sapienza University of Rome and ANEV, a medium-term reference cost of approximately



€4.85 million per MW installed is estimated, approximately four to five times the cost of ground-mounted photovoltaic or advanced agrivoltaic systems. **The island's offshore wind capacity** is also **limited**, with peak wind speeds no higher than **6.4 m/s off the western coast** towards Corsica, making large-scale private investment unattractive under current market conditions. This scenario therefore contemplates the possibility of community-led investment — combining public and private local resources — supported by significant public subsidies, drawing on precedents from the early phase of onshore wind development in Italy.

Scenario 2 — Would you like to protect and enhance geo-mining sites as historical heritage by integrating phytoremediation with ethical solar energy generation at sites subject to water contamination by metals and metalloids?

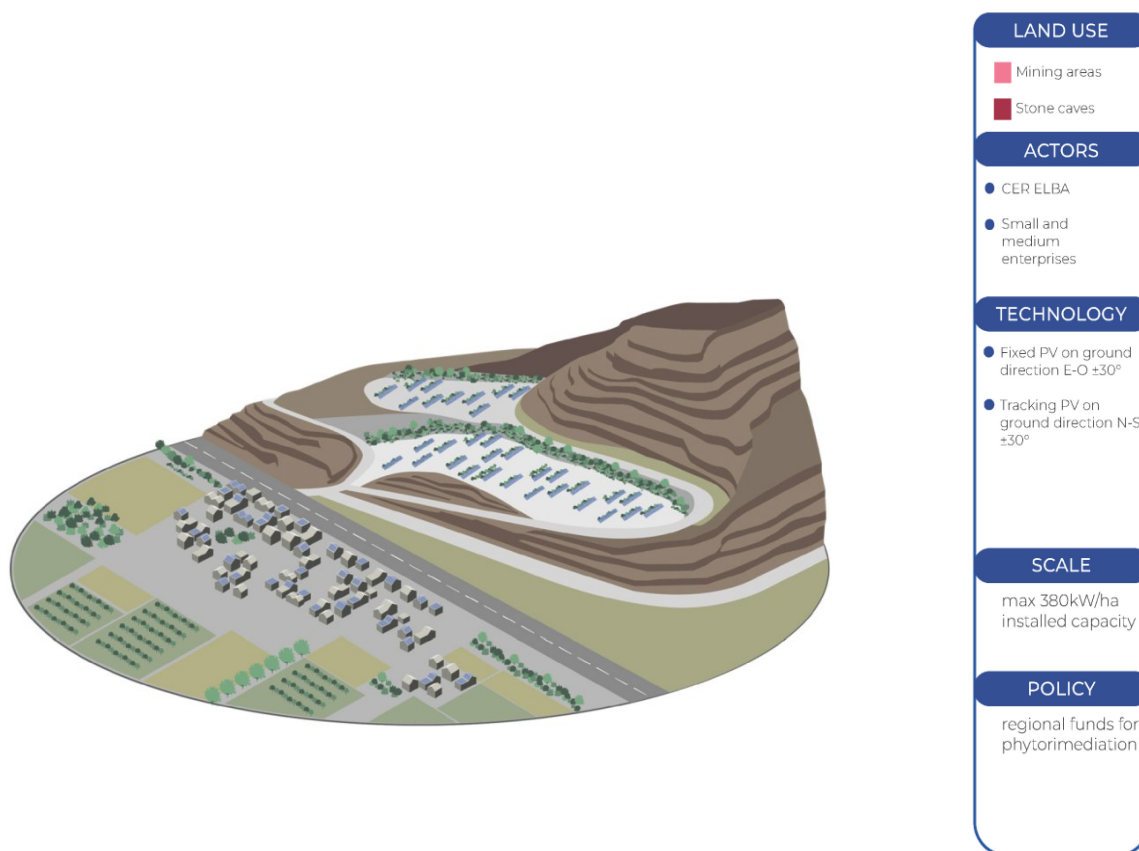


Figure 60: on the left a landscape composition for scenario 2, on the right a factsheet on the scenario reporting on scenario main actors (CER Elba is the Energy Community of Elba), technology, spatial and investment scale and possible policy sustaining the scenario.



Elba has been one of the **most important iron mining areas in Italy** since Etruscan times. Following the cessation of extraction activity in 1981, the accumulation of sulphide-bearing earth materials and their exposure to atmospheric agents has generated **ongoing contamination processes**: acid waters with high heavy metal content affect surface watercourses, particularly in the area behind Rio Marina and along the eastern coast. At the same time, the **geo-mining landscapes** are **recognised as local heritage** — the site of Capoliveri, with its prominent topographic position overlooking the Tyrrhenian Sea, is acknowledged as a location of outstanding landscape value.

Phytoremediation offers an innovative approach to managing polluted soils through the capacity of certain plant species to extract or stabilise metal and metalloid contaminants. Research conducted at Rio Marina and coordinated by the University of Pisa has demonstrated that several species already present in the geo-mining landscapes — including *Dittrichia viscosa*, *Cistus salvifolius*, *Lavandula stoechas*, and *Bituminaria bituminosa* — are capable of storing metals and metalloids in roots, stems, and leaves. This scenario proposes the **integration** of ground-mounted photovoltaic arrays with **interrow phytoremediation planting** (Figure 60), combining solar energy generation with the stabilisation of contaminants and the limitation of water runoff. The flowering character of the planted species — particularly lavender and *Cistus* — means that the system can also function as a publicly accessible and visually engaging space, integrated into the offer of the geo-mining park. Solar energy revenue can self-fund the phytoremediation process, while the energy produced can serve CER Elba, the island's renewable energy community.



Scenario 3 — Given the presence of the Germplasm Bank on the island of Elba, would you like to continue recovering traditional fruits and vegetables by supporting their production along with solar energy?

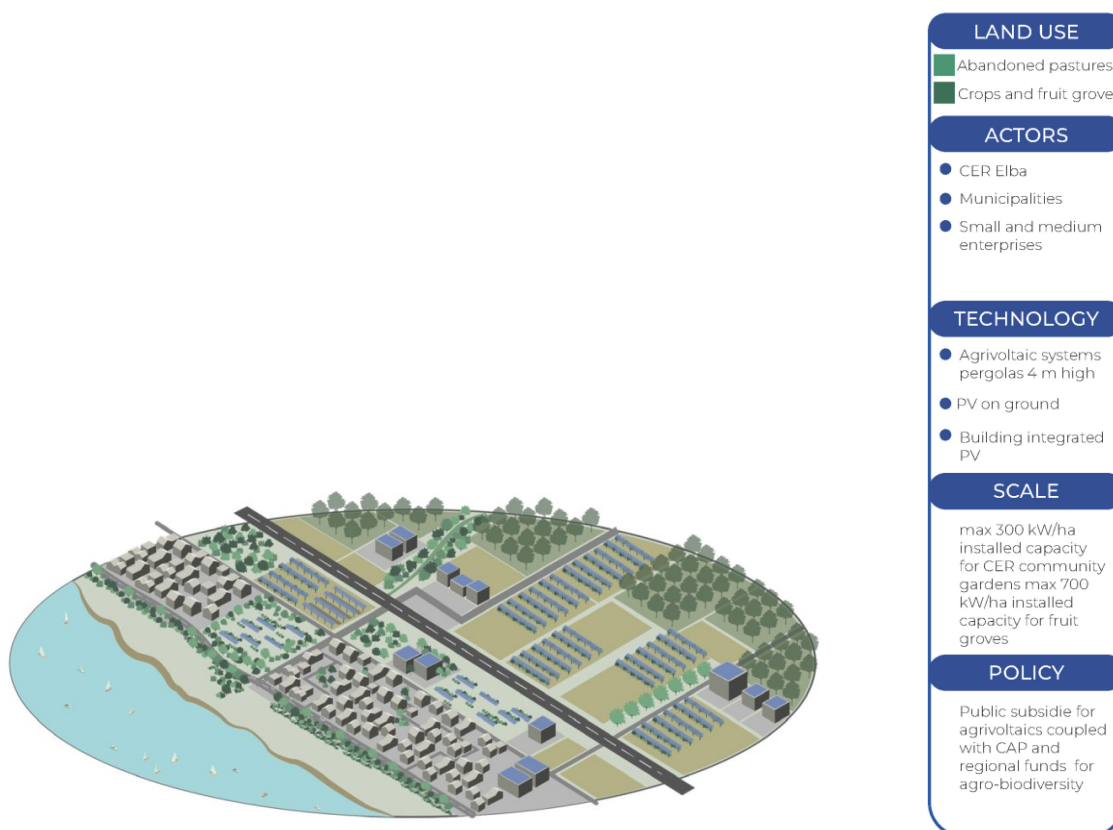


Figure 61: on the left a landscape composition for scenario 3, on the right a factsheet on the scenario reporting on scenario main actors (CER Elba is the Energy Community of Elba), technology, spatial and investment scale and possible policy sustaining the scenario.

The **alluvial plains of Marina di Campo**, Mola, Porto Azzurro, Portoferraio, and Schiopparello represent the **island's most fertile agricultural areas**, yet **land abandonment** has accelerated in recent decades, particularly in proximity to urban settlements. Elba possesses a rich **agro-biodiversity**, with numerous **traditional fruit and vegetable** cultivars recently recovered and stored in the Tuscan Archipelago National Park Germplasm Bank through research conducted by the Sant'Anna Institute in Pisa. However, funds to continue cultivating and recovering these cultivars remain scarce, while climate change — combined with the island's geology-based difficulty in retaining rainwater for agricultural use — is placing additional pressure on farming systems.

Agrivoltaic systems have demonstrated significant potential for supporting fruit and vegetable cultivation under climate stress, while simultaneously providing **farms** with **additional income** through **electricity generation**. This scenario proposes the



development of agrivoltaic systems on parcels of abandoned land in the alluvial plains (Figure 61) — with a maximum size of 3 hectares per parcel, for a **total of approximately 36 hectares** of suitable land — to **support** the **recovery** of **traditional cultivars** and establish **short food supply chains** beneficial to the island. The systems are envisaged both as community gardens on abandoned peri-urban plots, planted with vegetable gardens and fruit orchards and generating solar energy for CER Elba, and as agrivoltaic farm installations cultivating traditional varieties such as the peach cultivars Angelica and Sanguigno, the onion cultivar Petera, and the tomato cultivar d'Appiccà. The agrivoltaic produce can be valorised through local food networks, including initiatives such as Slow Food's Orti in Condotta and the Cuochi dell'Alleanza programme, while the scenario also finds natural synergy with ongoing local initiatives such as AgRio, led by the Municipality of Rio.

Design prototypes

For each scenario, a **design prototype** was produced to **translate** the proposed **configurations** into **spatially concrete** and communicable **proposals**, supporting public engagement and stakeholder dialogue.

For **Scenario 1**, the prototype assumes that, in the future, improved technology and adequate public subsidies would enable the installation of an offshore wind farm on the western sea of the island, where wind capacity is somewhat higher. The design concept aims to **stimulate imagination** and **debate** around the possibility of a future island identity in which wind power is experienced as visually integrated with the wild and windy western coastline. The prototype envisions **14 wind turbines** arising against the backdrop of the Corsican skyline and framing the sunset. The farm would have a **nominal power** of **8 MW per unit** and an **effective power** of **1.7 MW per unit**, for a **total effective capacity of 23 MW**, at an average annual wind speed of **6.5 m/s** in the area (Table 3, Figure 62).

Table 3: the off-shore wind farm in numbers

Average annual wind speed in the area	6,5 m/s
Nominal power per unit	8 MW
Effective power per unit	1,7 MW
Number of units	14
Total effective power of the wind farm	23 MW

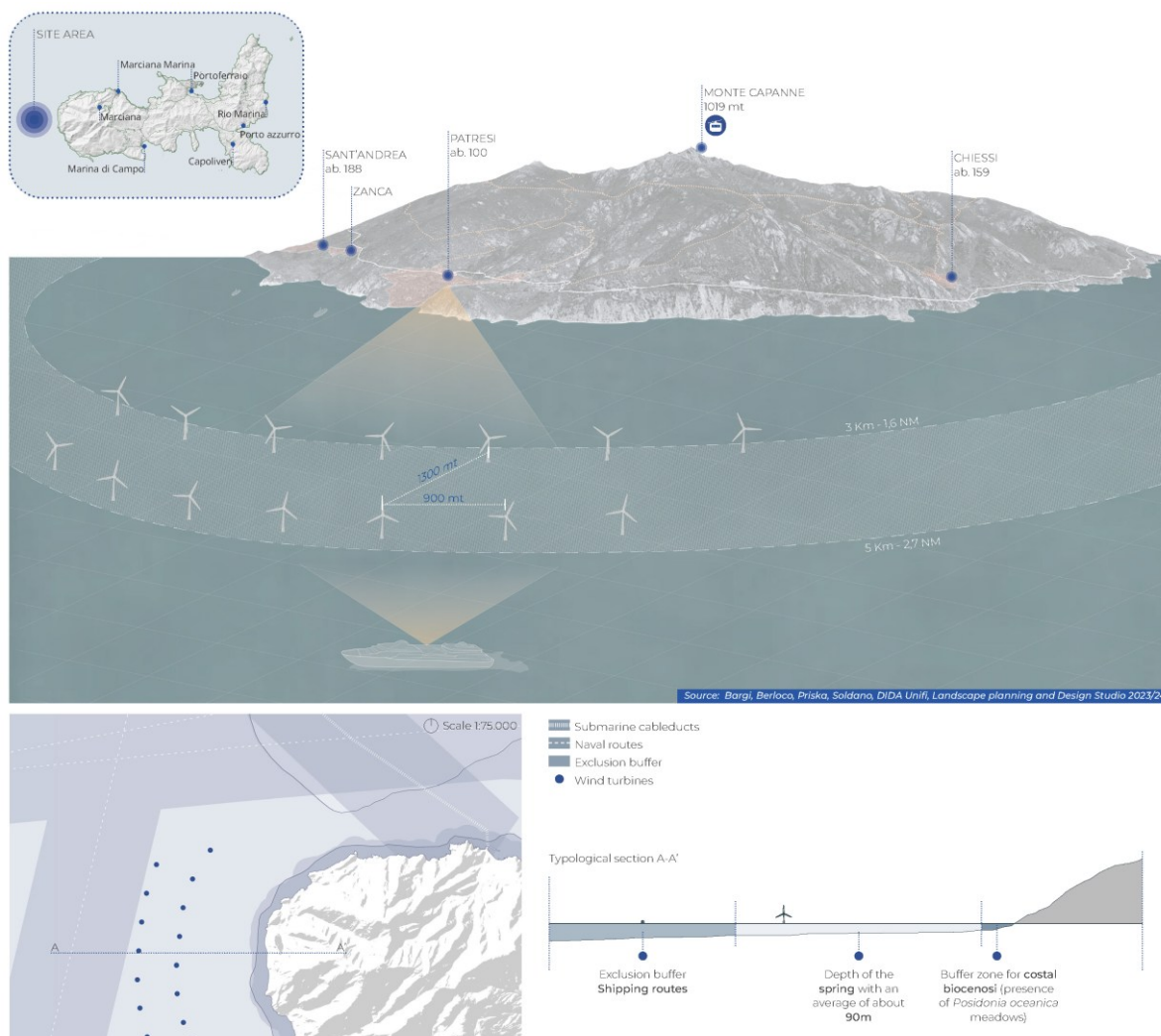


Figure 62: the image shows on top a bird view on the off-shore wind farm design prototype, below left the exact position of wind turbines, and below right a section showing the buffer zone for coastal biocenosis (*Posidonia oceanica*), the buffer zone for the shipping routes and the suitable area for the wind park.

For **Scenario 2**, the prototype was developed for a site within the **geo-mining area of Rio Marina**. It consists of **fixed photovoltaic arrays 50 metres in length**, south-facing with a pitch of 6 metres, with **interrow spaces planted** with *Dittrichia viscosa*, *Cistus salvifolius*, *Lavandula stoechas*, and *Bituminaria bituminosa*. The array structure and planted strips **limit water runoff** and **facilitate metalloid phyto-stabilisation**. The system includes a viewpoint to support public interpretation and is designed to function as part of the geo-mining park's offer.

The prototype covers a **total surface of 2.35 hectares**, of which 0.4 hectares are occupied by photovoltaic surfaces and 1.95 hectares by planted strips, with an **installed capacity of 0.9 MW** and a system energy density of 380 kW/ha (Table 4, Figure 63, Figure 64).



Table 4: the phyto-stabilization PV system prototype in numbers

Total surface	2,35 ha
PV surface	0,4 ha
Planted surface	1,95 ha
Installed capacity	0,9 MW
System energy density	380 kW/ha



Figure 63: the image shows on top right the design prototype location in the Municipality of Rio Marina, tope left a general plan (in blue the PV arrays, and in green the planted strips in the interrow space) and below a bird view.

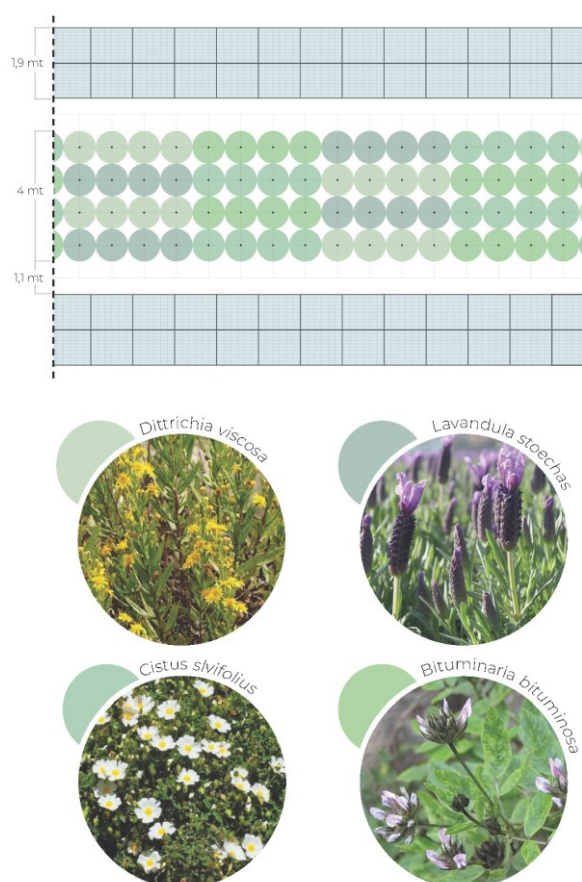


Figure 64: the planting scheme of the phyto-stabilization planted strips.

For **Scenario 3**, the prototype was developed for a site on the **alluvial plain of Marina di Campo**, currently in a **suburban context** but previously cultivated and in proximity to a secondary school. The design proposes a **Community Solar Garden combining ground-mounted photovoltaic systems and agrivoltaic pergolas** with blooming grassland, vegetable gardens, and fruit groves. Rainwater collected from photovoltaic surfaces feeds a natural wetland area, enhancing an existing wet habitat for micro and meso-fauna. Below the agrivoltaic pergolas, **local fruit cultivars and vegetables** are protected and recovered. The garden is also conceived as a public space for recreation and social events. The prototype covers a **total surface of 3.5 hectares**, of which 0.32 hectares are occupied by photovoltaic surfaces and 3.18 hectares by nature and community agriculture, with an **installed capacity of 0.7 MW** and a system energy density of 200 kW/ha (Table 5, Figure 65, Figure 66).



Table 5: the Community Solar Garden design prototype in numbers.

Total surface	3,5 ha
PV surface	0,32 ha
Nature and community agriculture surface	3,18 ha
Installed capacity	0,7 MW
System energy density	200 kW/ha

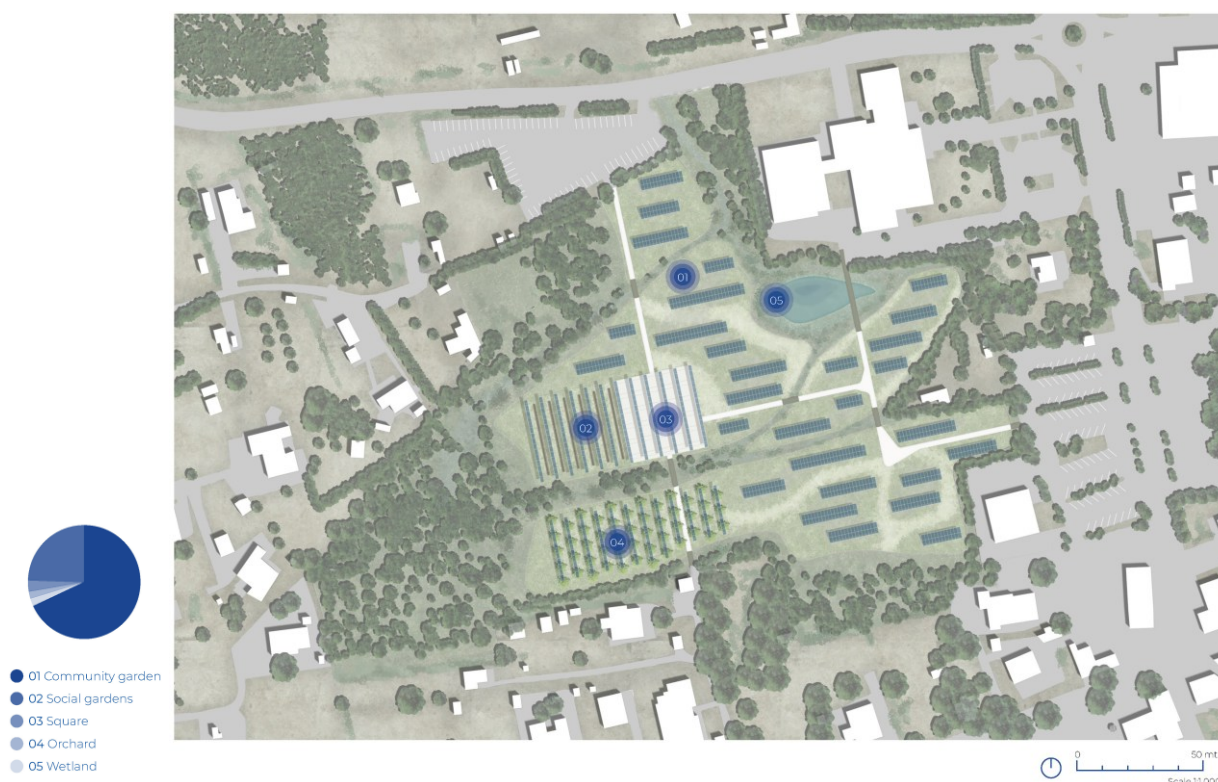
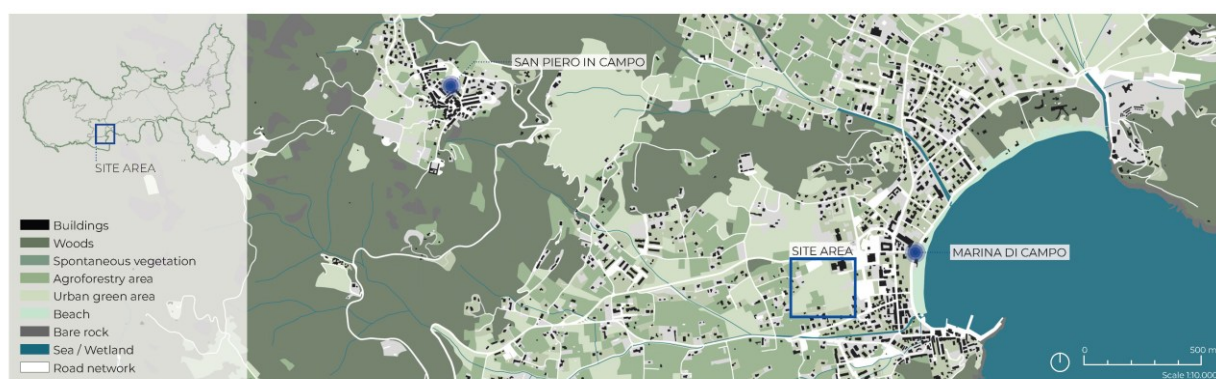


Figure 65: on top the design prototype location, below the general plan of the community solar garden.



01 Community garden



04 Social gardens

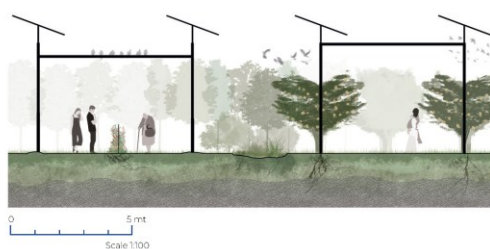


Figure 66: on the left two technical sections of PV on ground (top) and agri-PV pergolas with fruit trees (bottom); on the right a photo impression on the community solar garden with the PV arrays on ground, the wetland and the school in the back.



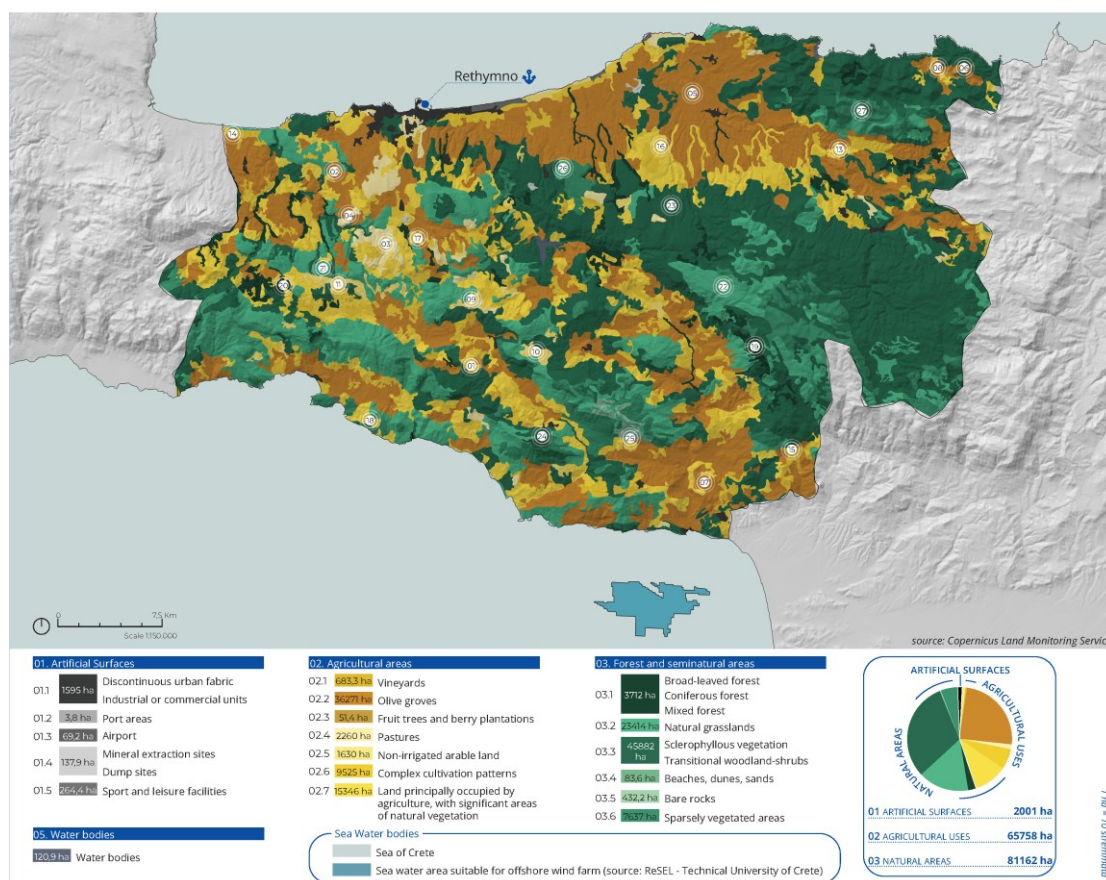
1.c Landscape scenario - The Energy Transition Roadmap for Crete

The CO2 PACMAN landscape approach was applied to Crete — Rethymno Regional Unit in connection with the second Lab round, following the same methodological framework developed for Brač and Elba. The practical approach was introduced through an **opening poster** presenting the core vision shared across all pilot islands: "Each landscape of your Island is the greatest collective story of the relationships between communities and the places they live in. The landscape is always changing, its story is never-ending."

The **technical process** produced a series of **visions of the territory**, structured around the following **steps**: the **landscape features**; the **energy target for carbon neutrality**; the **landscape suitability** and **capability** to generate renewable energy; the **landscape scenarios** for the energy transition; and **design prototypes**.

The landscape features

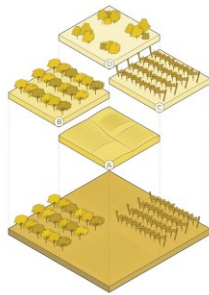
The landscape features of the Rethymno Regional Unit were summarised through a sampling of the different land uses, based on aerial photogrammetric scanning of different landscape typologies per land use. The analysis illustrates the land use distribution across the regional unit and documents the physical structure of the landscape through orthophotos and schematic landscape mosaic models (Figure 67).





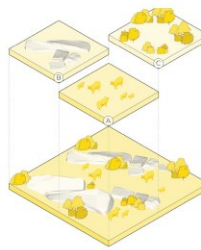
02.1 VINEYARDS

- Ⓐ Agricultural crops
- Ⓑ Linear olive groves
- Ⓒ Vineyards
- Ⓓ Spontaneous vegetation



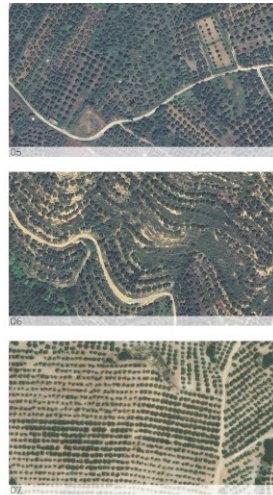
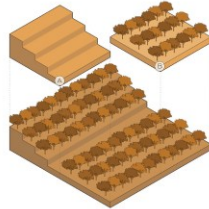
02.4 PASTURES

- Ⓐ Pastures
- Ⓑ Bare rocks
- Ⓒ Spontaneous vegetation



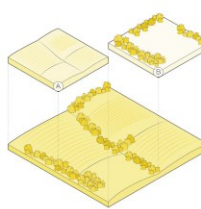
02.2 OLIVE GROVES

- Ⓐ Terrace systems
- Ⓑ Linear olive groves



02.5 NON-IRRIGATED ARABLE LAND

- Ⓐ Agricultural crops
- Ⓑ Perimeter hedges



02.3 FRUIT TREES AND BERRY PLANTATIONS



Figure 67: the image shows on top the land use in the regional unit of Rethymno, while below the mapped land uses are exemplified through real landscape orthogonal photos in the island and some abstract models.



The energy target for carbon neutrality

Achieving carbon neutrality for Crete requires generating a further **2,953,926 MWh of renewable energy**. The landscape of the Rethymno Regional Unit can contribute to this regional energy target through a combination of solar and wind energy systems alongside heat and cold pump technologies. This objective is equivalent to a defined volume of avoided CO₂ emissions, a surface area of equivalent forest in terms of carbon absorption, and the energy demand of an equivalent number of families (Figure 68).



Figure 68: the energy share for carbon neutrality, and equivalent values for the whole island of Crete.

Solar energy potential is **very high** across the island, particularly on south-facing mountain slopes, suggesting a central role for solar energy systems in the transition pathway. **Wind energy potential is very high offshore**, particularly along the southern coast, while onshore wind development faces significant constraints due to the mountainous geomorphology of much of the territory. Beyond abstract energy potential maps, it is necessary to understand which land uses can play a significant role in the transition and where the installation of renewable energy technologies can generate additional benefits, for agriculture, water storage, and ecosystem services, beyond decarbonisation alone (Figure 69).

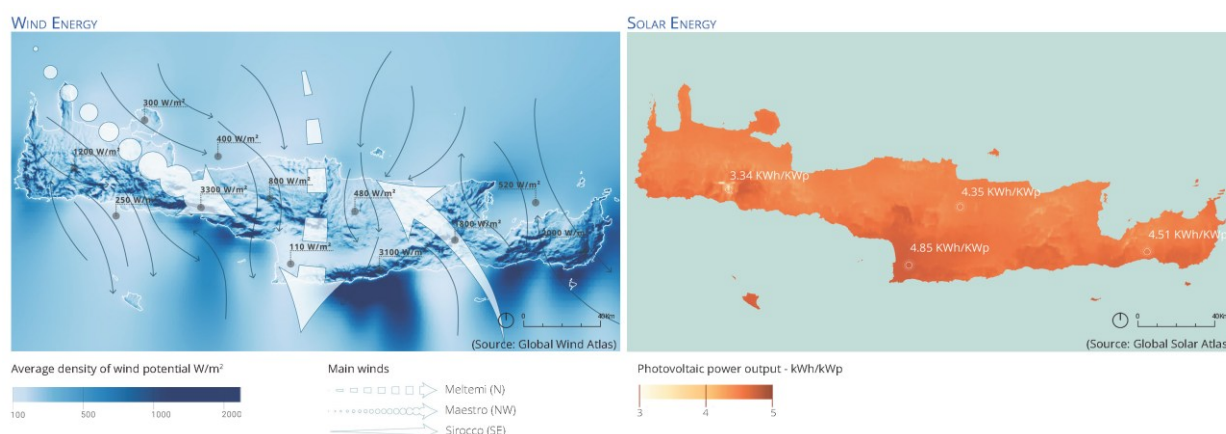


Figure 69: the wind and solar energy potential maps for the Crete island (source Global Wind and Solar Atlas).



Landscape suitability and capability to generate renewable energy

The topographic suitability analysis was carried out through a multi-criteria approach combining Corine Land Cover data, slope conditions, and protected area designations under European environmental directives. Natura 2000 sites were excluded from the analysis in order to preserve sensitive and protected ecosystems. The results show that the majority of suitable areas fall within agricultural land categories, while most forest and semi-natural areas are protected under the Natura 2000 framework. An offshore wind park area was additionally identified by ReSEL TUC as presenting high potential for offshore wind development (Figure 70).

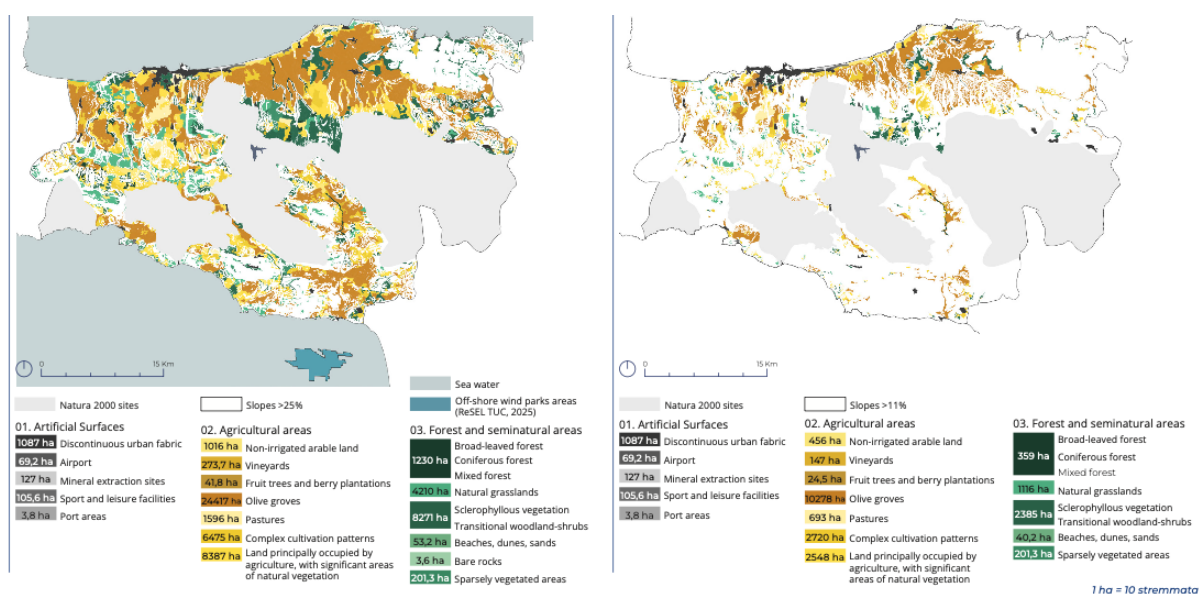


Figure 70: the topographic suitability, For the map on the right, areas with slopes lower than 11% were excluded, while for the map on the left, areas with slopes lower than 25% were removed from consideration.

The expert-based evaluation of opportunity for different land uses to integrate renewable energy technologies highlighted several key findings (Figure 71). The greatest opportunity for transition lies in the implementation of agrivoltaic greenhouses for tomato and pepper cultivation within agricultural areas. A significant proportion of the island's existing plastic tunnels for vegetable cultivation are located near coastal zones; converting these structures into agrivoltaic greenhouses would reduce plastic use, enable renewable energy generation, and support the gradual redistribution of agricultural activity away from the coast — helping restore ecological balance by reducing pressure on coastal zones and allowing more space for natural habitats. At the same time, this technology could promote the productive reuse of currently abandoned or underutilised inland non-irrigated arable land. In contrast, onshore wind parks were identified as a critical or highly critical option, given the challenging geomorphological configuration of much of the territory.



EXPERT BASED LANDSCAPE SUITABILITY PER LAND USE - NATURA 2000 SITES EXCLUDED

SUITABILITIES

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+2

HIGH OPPORTUNITY FOR CHANGE

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+1

OPPORTUNITY FOR CHANGE

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+1 -1

POSSIBLE OPPORTUNITY FOR CHANGE

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-1

CRITICAL FOR CHANGE

↓↓

-2

VERY CRITICAL FOR CHANGE

✕

NOT COMPATIBLE

High opportunity for change with strong habitat enhancement at all levels - highly beneficial impacts on multiple ecosystem services could occur

Opportunity for change with habitat enhancement for more than one level - beneficial impact on at least one ecosystem service could occur

Opportunity for change at global level in terms of avoided CO2 emissions without relevant trade-offs with other ecosystem services, yet possible potential synergies to be activated through proper designed change

Installation of technology is critical for the preservation of habitat for more than one level- critical trade-offs with at least one ecosystem service could occur

Installation of technology is very critical for the preservation of habitat at all levels - very critical trade-offs with multiple ecosystem services at all levels could occur

Technology installation is not compatible

ONSHORE LAND USES

01. Artificial Surfaces

Continuous and Discontinuous urban fabric/ Industrial or commercial units

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02. Agricultural areas

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01. Artificial Surfaces

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Figure 71: the matrix of the landscape suitability per land use to integrate RET.



Landscape scenarios for the energy transition

The landscape capacity for agrivoltaic, photovoltaic, and wind energy across different land uses, combined with an assessment of where renewable energy integration presents the greatest opportunity for beneficial change, informed the development of three landscape-based scenarios for the Rethymno Regional Unit's energy transition. These scenarios do not represent univocal pathways but rather different lenses through which the transition can be explored; they are therefore complementary and can be combined.

Scenario 1 — Would you like to cool down your city while generating solar energy and enhancing nature?

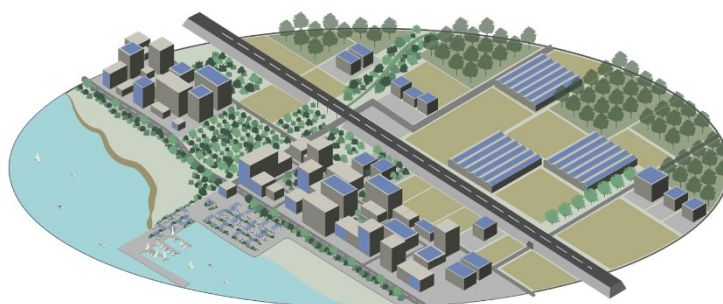
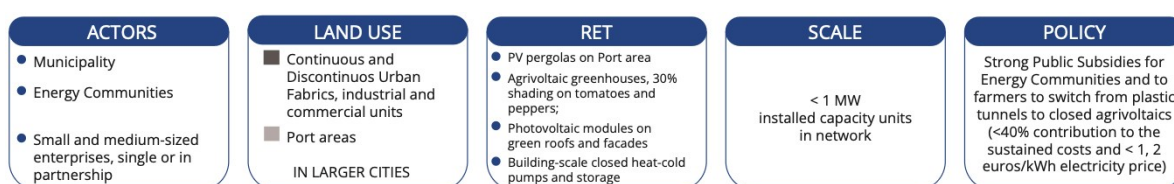


Figure 72: the factsheet reports on scenario main actors, potentially suitable land uses, technology, spatial and investment scale and possible supporting policies.

This scenario, aligned with blue economy local strategies, supports the cooling of large **urban parking areas** by **integrating photovoltaic modules** into public spaces combined with new planting (Figure 72). A centralised action by the Municipality, co-financed by local enterprises, can enhance the urban microclimate of vast unshaded parking areas in Rethymno by shading them through a system of **photovoltaic pergolas** integrated with new natural habitat. A decentralised and cooperative action by farmers and energy communities can support the conversion of coastal plastic tunnels for vegetable production into more energy-efficient agrivoltaic greenhouses, making more space available for natural river courses and coastal habitats. A further decentralised and cooperative action by tourism entrepreneurs and energy communities can sustain the implementation of building-integrated photovoltaics on rooftops and facades, alongside heat and cold geothermal pumps for tourism facilities along the coastline.



Scenario 2 — Would you like to enhance the sea and the lakes' natural habitat while generating wind and solar energy?

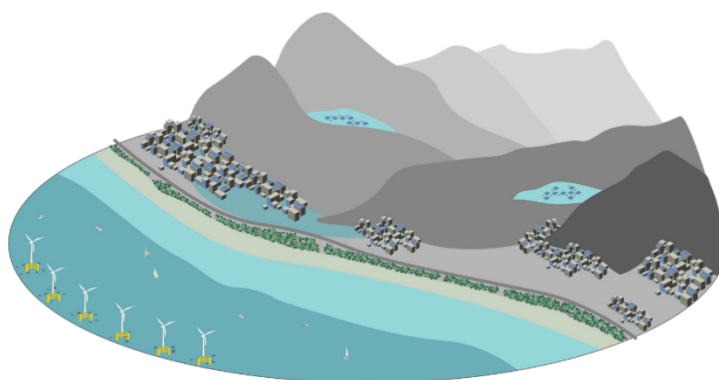
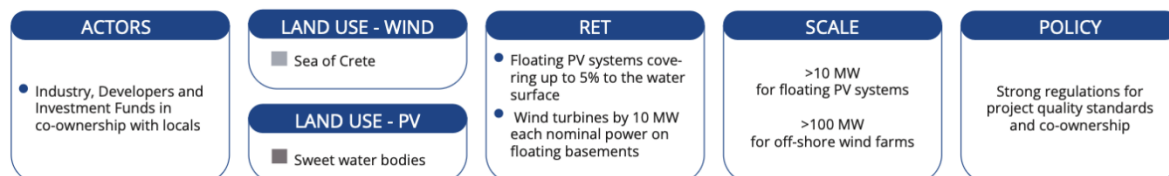


Figure 73: the factsheet reports on scenario main actors, potentially suitable land uses, technology, spatial and investment scale and possible supporting policies.

This scenario explores the capacity of inland water bodies and offshore areas to host **floating photovoltaic systems** and **offshore wind turbines**, designed to simultaneously generate renewable energy and enhance aquatic and marine habitats (Figure 73). Inland floating photovoltaic systems can be combined with floating vegetated islands sustaining niches for inland plant and animal species reproduction. Offshore wind turbine floating platforms can support marine habitat by interdicting commercial fishing in the park area and incorporating artificial reef structures. These initiatives are conceived through compensative measures and energy justice tools, including co-ownership opportunities and lower energy tariffs for the local population. For inland floating photovoltaics, the approach envisages investing in 1 hectare of floating vegetated island per **10 MW** of installed capacity, for a total of **5%** of the **water surface** covered by the integrated system.



Scenario 3 — Would you like to sustain inner agriculture and natural habitat while generating renewable energy?

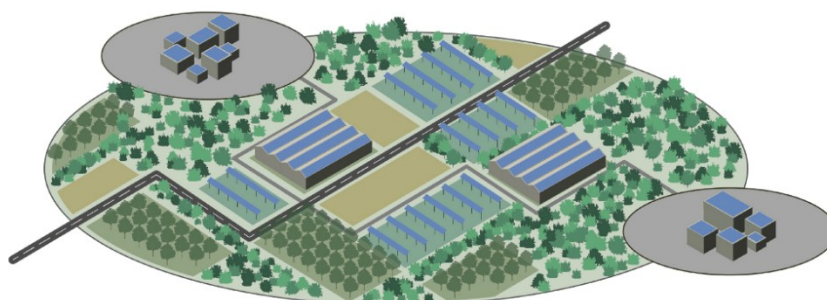
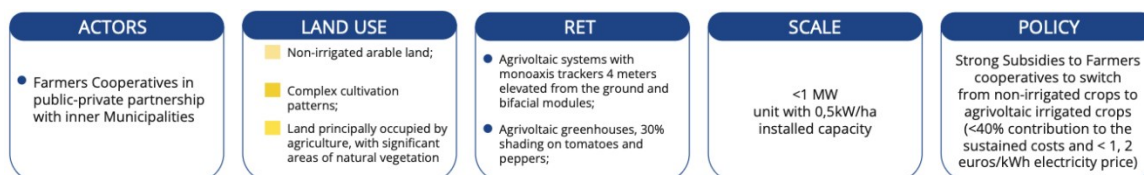


Figure 74: the factsheet reports on scenario main actors, potentially suitable land uses, technology, spatial and investment scale and possible supporting policies.

Rural areas in the local LEADER programme are characterised by low economic activity, insufficient investment in infrastructure, and lack of attractive employment opportunities. **Agrivoltaic systems** on inland non-irrigated arable land can support the transition from low-productivity farming towards more competitive irrigated cultivation, enabling tomatoes and peppers currently grown in coastal plastic tunnels to be more sustainably produced in open agrivoltaic systems, supporting a revival of inner agriculture (Figure 74). This scenario **requires strong economic subsidies** — up to **40% of supported costs** — for newly established cooperatives of young farmers, alongside guarantees for access to local credit. The generated energy can supply inner villages, contributing to local energy autonomy and to the broader decarbonisation of the island while strengthening the socio-economic capacity of inner territories to pursue sustainable development.

The images below (Figure 75, Figure 76, Figure 77) illustrate the **landscape suitability** and land-use capability associated with the installation of different renewable energy sources (RES) for each of the scenarios described above.

For each scenario, specific areas and technologies were identified based on their solar and/or wind energy potential. These combinations define the proposed development strategies aimed at achieving the target installed energy capacity while considering the characteristics of the landscape.

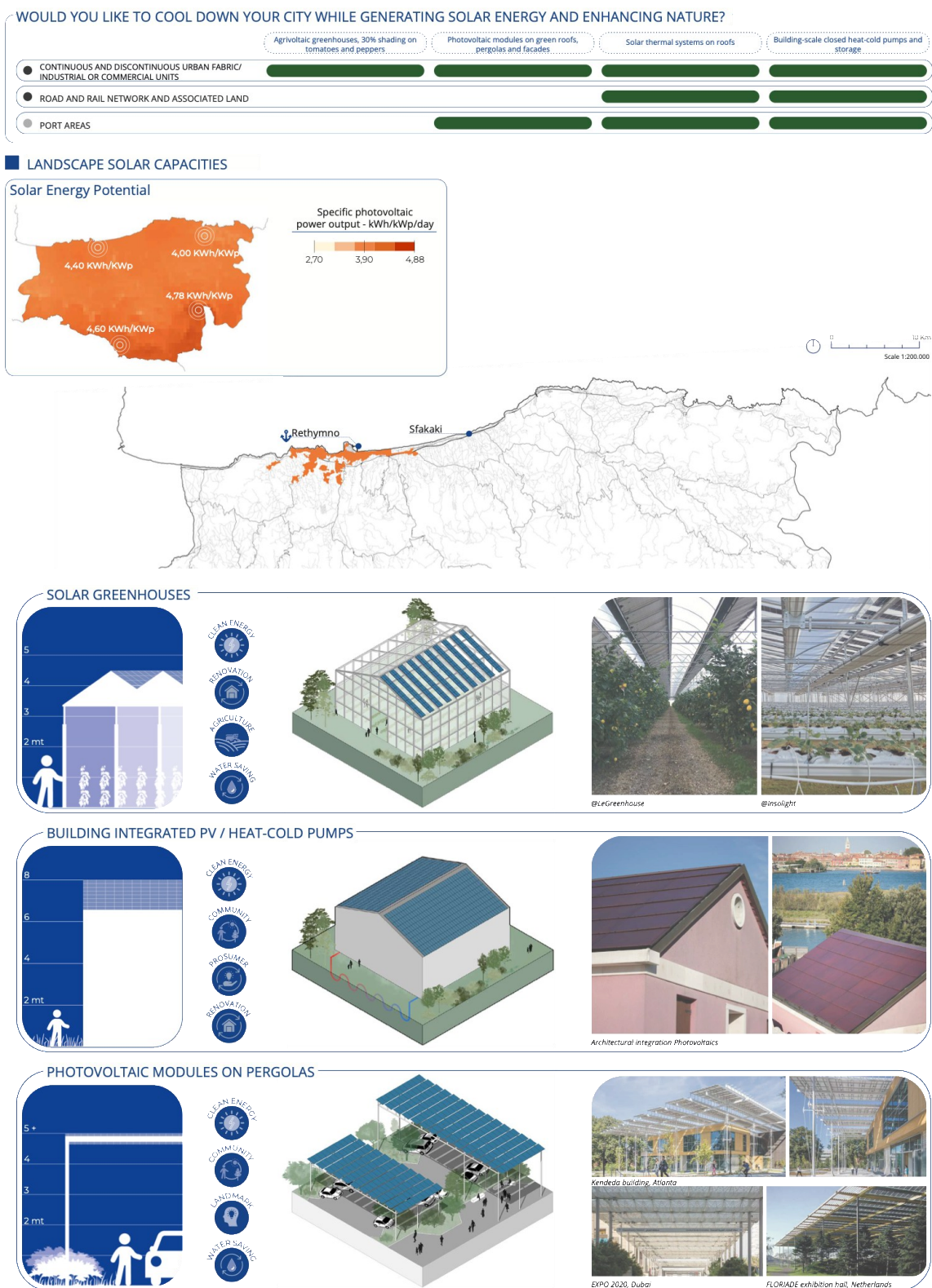


Figure 75: the image describes the landscape capability for scenario 1, through a map (on top), models and reference images.

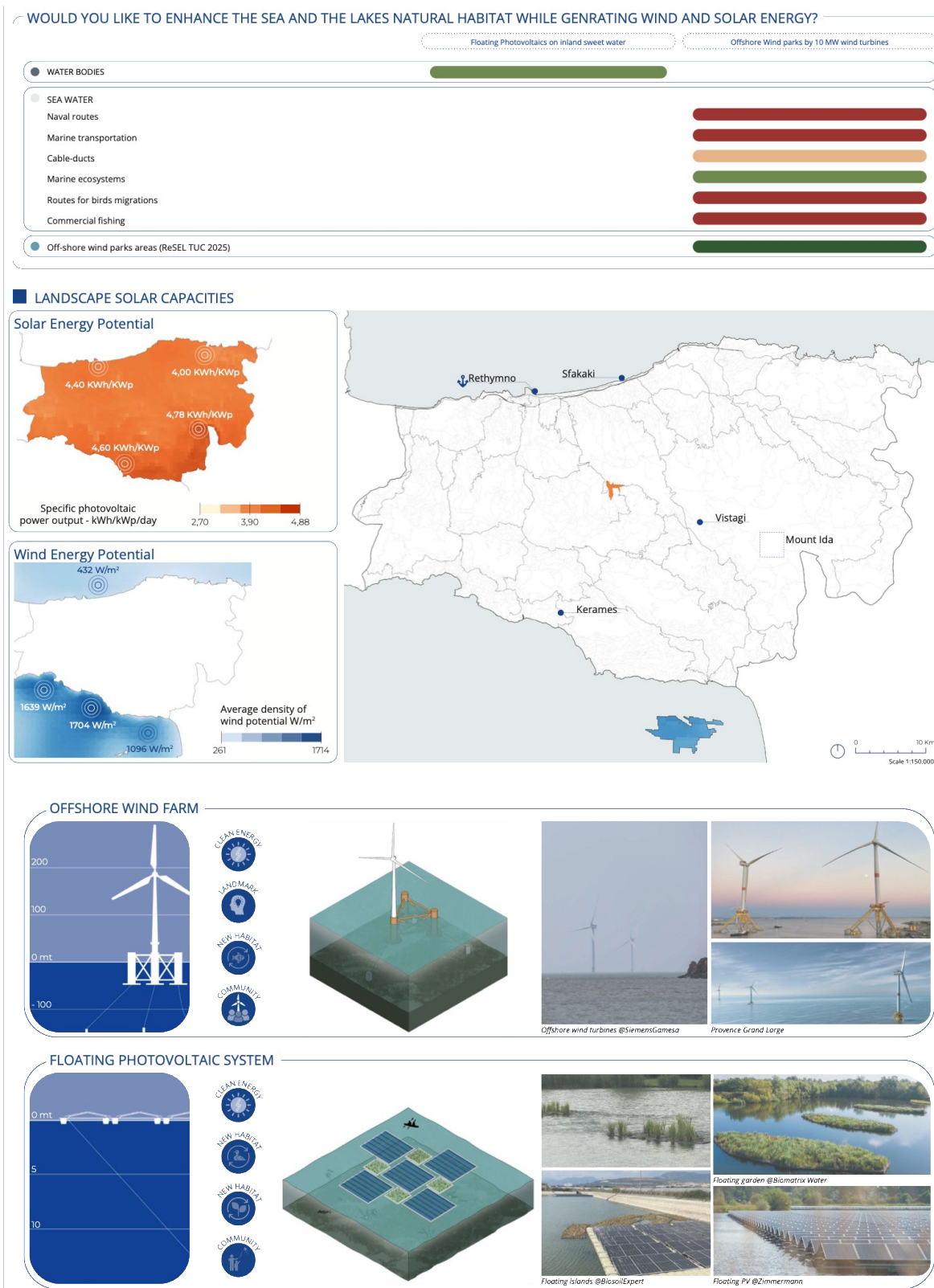


Figure 76: the image describes the landscape capability for scenario 2, through a map (on top), models and reference images.

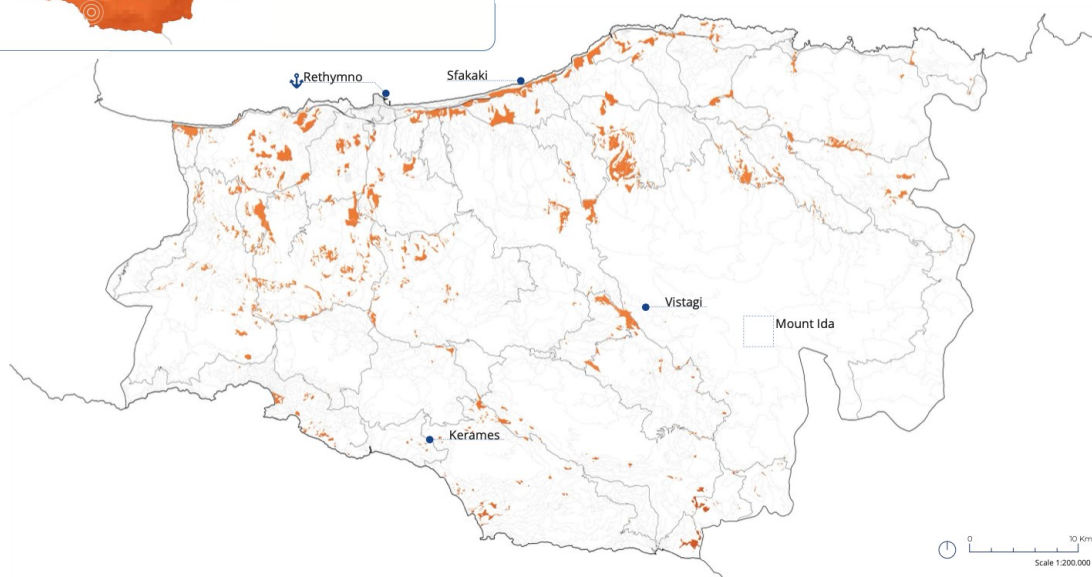


WOULD YOU LIKE TO SUSTAIN SUSTAINABLE AGRICULTURE AND NATURAL HABITAT WHILE GENERATING RENEWABLE ENERGY?

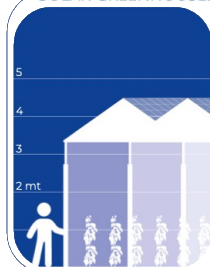
	Agrivoltaic systems with monoaxis trackers 4 meters elevated from the ground and bifacial modules	Agrivoltaic greenhouses, 30% shading on tomatoes and peppers
NON IRRIGATED ARABLE LAND AND PERMANENTLY IRRIGATED ARABLE LAND		
COMPLEX CULTIVATION PATTERNS		
LAND PRINCIPALLY OCCUPIED BY AGRICULTURE; WITH SIGNIFICANT AREAS OF NATURAL VEGETATION		

LANDSCAPE SOLAR CAPACITIES

Solar Energy Potential



SOLAR GREENHOUSES



AGRIVOLTAIC SYSTEM

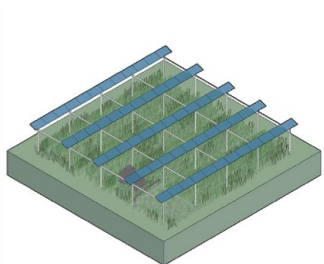
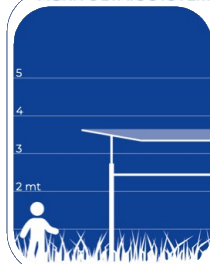


Figure 77: the image describes the landscape capability for scenario 3, through a map (on top), models and reference images.



Design prototypes

Three design prototypes were developed for the Rethymno Regional Unit.

For Scenario 1, the prototype was developed for the parking area in Rethymno harbour, currently used as both a parking space and for port-related activities but lacking adequate shading and pedestrian accessibility. The design integrates photovoltaic pergolas at different heights, conceived as architectural landmarks simultaneously generating renewable energy and supporting climbing vegetation. New trees and vegetated areas complement the photovoltaic structures, enhancing thermal comfort, shading, and the overall environmental quality of the waterfront space. The selected plant species were chosen according to existing coastal vegetation and local microclimate characteristics (Table 6, Figure 78).

Table 6: the parking area design prototype in numbers.

Total surface	3 ha
PV surface	0,4 ha
Installed capacity	520 kW
System energy density	173 kW/ha



MASTERPLAN



PERSPECTIVE VIEW



- PV technology
Photovoltaic modules on pergolas
- PV surface
4,300 m²
- Installed capacity
520 KW

Section A-A'



Section B-B'



Figure 78: The image illustrates the design details of the parking area intervention. On top left the masterplan shows the new integrated system of photovoltaic pergolas combined with vegetation. On top right a photo-impression on the area. Below, a series of section drawings highlights the spatial proportions of the design prototype and its relationship with the existing waterfront, emphasizing the integration between the new structures and the surrounding coastal landscape.

For Scenario 2, two prototypes were produced. The first is a floating photovoltaic system with integrated natural habitat islands at the Amari Dam (Table 7, Figure 79). Floating islands incorporating photovoltaic systems and vegetation were distributed homogeneously across the lake surface, combining renewable energy production with ecological enhancement to transform the reservoir into a multifunctional landscape capable of generating environmental, social, and educational value. The second prototype is an offshore wind park named "The Pέα wind park", conceived as a tribute to Rhéa, Titan



Mother of Zeus. Composed of 12 floating turbines located in the Gulf of Mesara south of Rethymno and strategically positioned for high visual visibility from both the Timbaki waterfront and Mount Ida, the park is intended to become a visual landmark reinforcing the connection between the energy transition and the island's cultural and mythological heritage. The park's floating platforms are designed to support marine biodiversity by interdicting commercial fishing and incorporating artificial reef structures (Table 8, Figure 80).

Table 7: the Floating PV design prototype in numbers.

Total surface	107 ha
PV surface	4 ha
Nature habitat surface	1 ha
Installed capacity	9,8 MW
System energy density	92 kW/ha



DESIGN PROTOTYPE FOR FLOATING PHOTOVOLTAIC SYSTEMS - LAYOUT 01

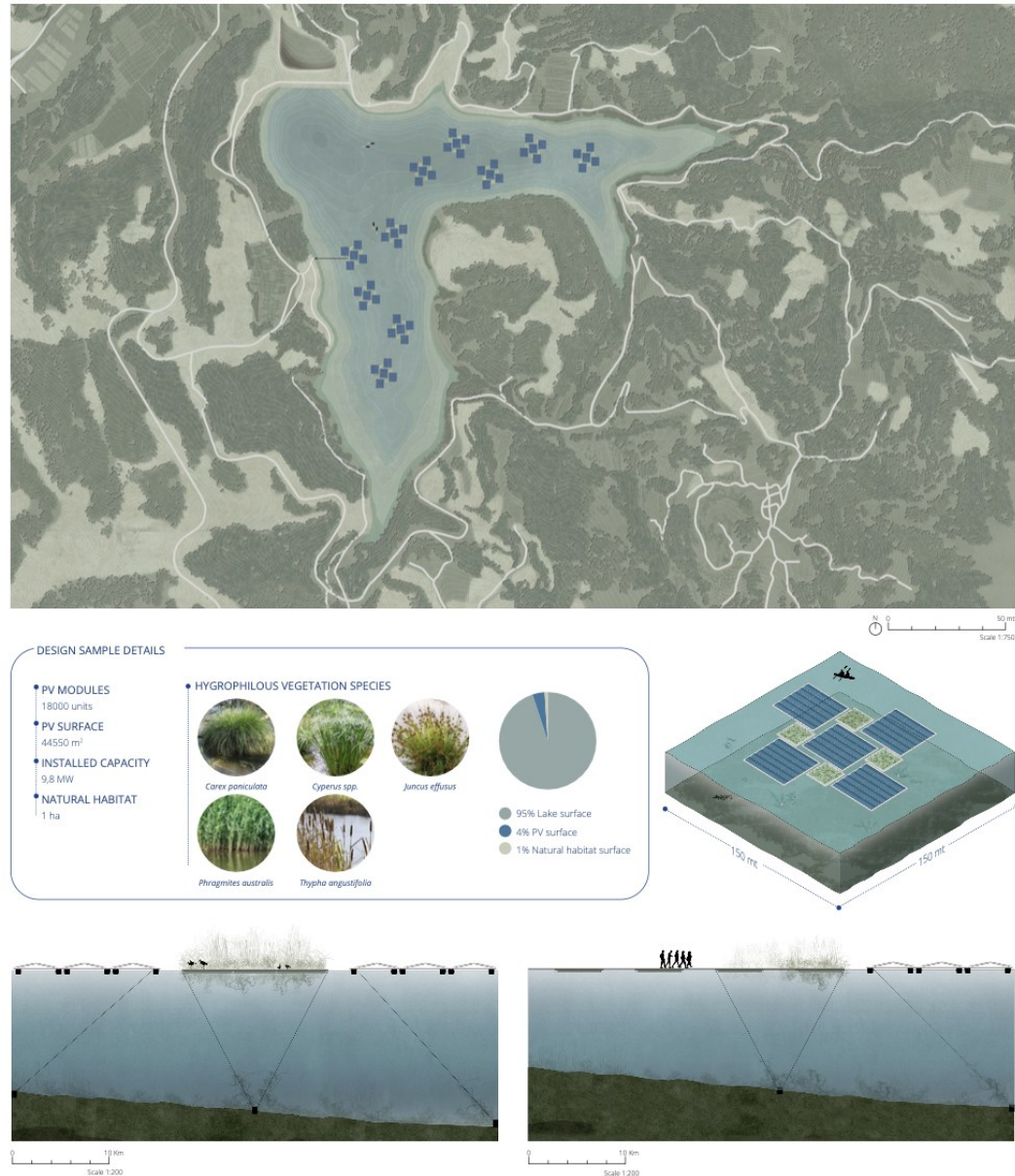


Figure 79: The image illustrates the proposed floating photovoltaic system. The masterplan shown above highlights the spatial balance between the new floating islands and the overall surface of the lake. Below, detailed drawings and technical sections present the configuration of the individual island systems. Attention is given to the relationship between technology and nature, demonstrating how renewable energy infrastructure can coexist with and support ecological enhancement within the aquatic environment.

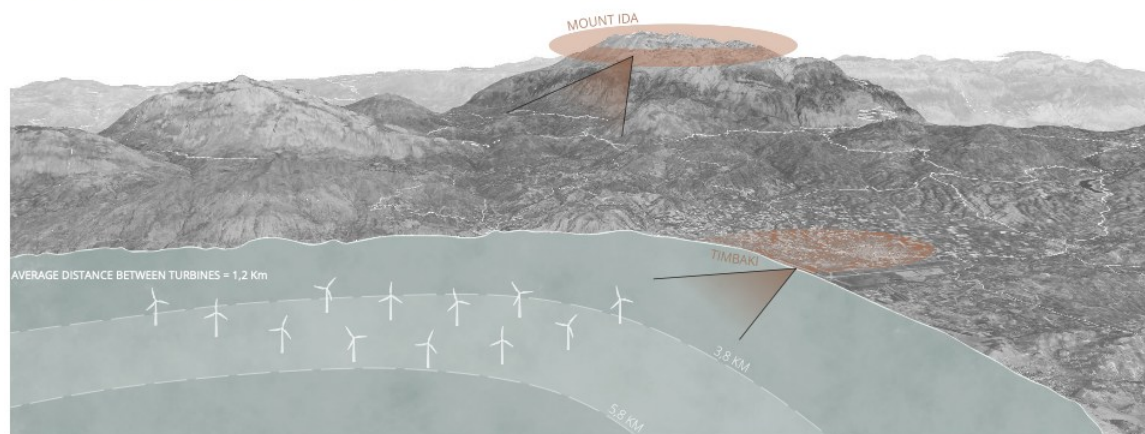


Table 8: the wind park in numbers

Average annual wind speed in the area	8 m/s
Nominal power per unit	8 MW
Effective power per unit	3,2 MW
Number of units	12
Total effective power of the wind farm	38 MW



DESIGN PROTOTYPE FOR 'Πέα OFFSHORE WIND PARK



VIEW FROM MOUNT IDA



VIEW FROM TIMBAKI SEAFRONT



TECHNICAL SECTION

SCALE REPRESENTATION OF A SEA PORTION WITH ONE OF THE 12 FLOATING WIND TURBINES



Figure 80: The images illustrate the proposed floating wind park. On top the image presents bird view of the new installation, highlighting the relationship between the wind turbines, the coastline, and Mount Ida. Additional renderings in the center show the project from both the coastal perspective and the viewpoint of Mount Ida. Below, detailed drawings and technical representations of the wind park system are provided, illustrating the configuration and structural characteristics of the proposed installation, highlighting the fact that floating off-shore wind parks easily turn into fish populations nursey due to the interdiction of commercial fishing activities.



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