These Projects have received funding from the European Union's Horizon 2020 Research and Innovation Programme

Robinson

GIFT

insulae
Maximizing the impact of innovative energy approaches in the EU islands

islander

IANOS
SUSTAINABLE SOLUTIONS
for islands' decarbonisation

MAESHA

New Energy Solutions Optimised for Islands
NESOI
EUROPEAN ISLANDS FACILITY

REACT
Renewable Energy for Self-Sustainable Island Communities

SOCLIMPACT

VPP4ISLANDS

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List of abbreviations

DC Microgrid	Direct Current
DLT	Distributed Ledger Technologies
DT	Digital Twin
DSO	Distribution System Operators
ECs	Energy Communities
EV	Electrical Vehicles
ICT	Information and Communication Technology
TRL	Technology Readiness Level
VESS	Virtual Energy Storage Systems
VPP	Virtual Power Plant

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1. Aim and background

The purpose of this joint document is to raise awareness around challenges and opportunities in the replication of islands decarbonisation initiatives, as well as provide relevant regulatory, socioeconomic, and technical recommendations.

The replication of projects aimed at decarbonising islands is crucial for achieving EC climate goals for 2030 and 2050. The Consortia of ten H2020 projects, hereby represented, offer solutions for cost-efficient, flexible, and secure energy systems:

- GIFT H2020, aiming at decarbonising the energy mix of European islands through the development of innovative solutions. This are achieved by increasing RES penetration, ensuring better visibility of the grid, developing synergies of energy sectors, reducing use of hydrocarbons, and ensuring replicability.
- IANOS H2020, aiming at facilitating seamless adoption of extremely high RES penetration. This will be achieved by encompassing synergetic operation of energy resources and carriers through a Virtual Power Plant (VPP) framework, for pro and re-active orchestration of energy flows. IANOS solutions will be demonstrated up to TRL8.
- INSULAE H2020, aims to foster deployment of innovative solutions for EU islands' decarbonisation by developing and demonstrating interventions linked to seven use cases on three Lighthouse Islands in Croatia, Denmark and Portugal. The results validate an Investment Planning Tool demonstrated in four Follower Islands located in Spain, Germany, Greece and the French overseas Territories, and is followed by the development of subsequent energy action plans.
- ISLANDER H2020, aiming at developing a smart IT platform to manage distributed energy resources, hybrid energy storage and incorporating demand response services.
- MAESHA H2020. Its objective is to decarbonise the energy systems of geographical islands, by fostering the large deployment of RES through the installation of tailored innovative flexibility services. MAESHA will demonstrate the solutions on the French overseas island of Mayotte and study replicability potential on 5 follower islands.
- NESOI European Islands Facility, aiming at promoting investments for energy transition in the islands, facilitating the decentralization of energy systems, and contributing to EU policies and the achievement of 2030 targets. The NESOI Facility works in close contact with the Clean Energy for EU Islands Secretariat, which was established to facilitate the clean energy transition on EU islands.
- REACT H2020 brings energy savings, carbon emission and energy cost reduction leveraged by an integrative approach to multi-carrier supply and demand side optimization contributed to higher renewable energy source penetration combined with a cooperative demand response strategy to enhance grid security and reliability.
- ROBINSON H2020, aiming at developing an integrated, smart, modular, and optimised energy system to help decarbonise islands. The objective is to ensure a reliable, cost-efficient, and resilient energy supply, by helping to decrease CO2 emissions.
- SOCLIMPACT H2020 produced tailored information about the likelihood and dimension of priority climate risks that affect four blue economy activities of EU islands (tourism, marine energy, aquaculture and maritime transport), and the inter-related socioeconomic, and non-market consequences for the islanders. The action focused

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on 12 EU islands case studies, where 300 high-level representatives of the blue economy sectors and policy makers were engaged in a participatory design of adaptation pathways until 2100.

- VPP4ISLANDS H2020, aimed at developing new concepts (VESS, DLT, and DT) for energy production, distribution, and monitoring for islands. The concept will promote RES use and revolutionize the existing small grids and Energy Communities (ECs) in Islands.

2. Findings

Challenges

During the implementation of activities, a wide range of findings in the replication of islands decarbonisation projects was collected by our consortia. These are covering matters of both socio-economic and technical dimensions.

Firstly, challenges arose in the **creation of clear and comprehensive guidelines** that demonstrate the replicability of each project solutions. This involves documenting technical designs, plans, knowledge, consumption and production database and historical records. Guidelines shall also include data generated within the projects. Such information shall be easily accessible and understandable for external decision-makers and stakeholders.

Existing regulations and policies are recognised as a second challenge to the smooth implementation of long-term sustainable projects. Regions and countries have varying regulatory frameworks, permitting processes, and policy priorities. Complex regulations and permissions eventually result in significant obstacles in the installation of project technologies, the export of local excess production, and real-time communication of equipment. Navigating through these regulatory landscapes and ensuring compliance also constitute a hurdle to replication efforts.

Our consortia also experienced that **adequate financial resources and funding** is a key tool to ensure the replication process. Suitable funding sources and establishing sustainable financing mechanisms are essential tools to ensure the security of funding for infrastructure development and installation, technological investments, and equipment purchase, as well as capacity building and ongoing operations.

Replications of projects also required our consortia to pay particular attention to socio-economic matters. The creation of local value is hence a key driver in the replication of sustainable projects. In this regard, **public acceptance and promotion of behavioural changes** towards sustainable practices have a pivotal role in ensuring successful results. Convincing individuals, communities, and users to adopt new technologies, changing consumption patterns, or embrace renewable energy sources may require extensive awareness campaigns, education, and addressing cultural/social barriers. This phenomenon, however, is less affecting young individuals, who are more aware of and educated about sustainability and climate change as a result of their schooling.

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The replication of projects to decarbonise islands brought our consortia to also face relevant technical challenges. Different contexts may **require adaptations and modifications** to account for varying geographical, socio-economic, and regulatory conditions. The granularity of the analysis and the advanced modelling work developed on an island-specific entity should be remarked. When planning the replication of sustainable projects, the harmonisation of flexibility products is also another key technical aspect to be considered.

Consortia also identified challenges in the scalability of projects, namely logistical and financial constraints. The **scaling up of sustainable and decarbonisation initiatives to larger areas or multiple locations** hence requires careful planning, resource allocation, and coordination.

In the replication process, **it is also essential to identify and engage the right stakeholders** and prospective participants. It can be a challenge to recruit and involve government agencies, local authorities, energy providers, research institutions, community organizations, and industry representatives to actively participate in the replication process. Main drivers in the replication process – namely, energy and economic savings – can be exploited to ensure active involvement of such local and national stakeholders.

Findings gathered by our Consortia suggest successful replication requires the **support** of **relevant actors** involved in the replication, by addressing their needs and challenges. This includes providing assistance, resources, and guidance to ensure the effective adoption and implementation of each project solutions in different contexts.

Relevant tools

The findings reported assure the successful replication of project solutions. In this regard, project partners engaged with local communities and individuals, with the scope of raising awareness around our projects' solutions in an understandable manner. For instance,

- ROBINSON developed advanced tools aimed at providing guidance for decision support integration and supporting the scaling-up of the replication (respectively with the Evidence Base and the Replication Roadmap solutions).
- SOCLIMPACT creates the `Adaptation Support Tool for Islands' to facilitate, matchmaking and networking virtual sessions between the consortia and island stakeholders, on methods and models that can be replicated for the analysis of climate risks for the energy sector and productivity of Renewable Energy Systems.
- VPP4ISLANDS is defining an AI-based planning tool to support decision makers and planners optimizing size of energy assets through multi-objective algorithms. A forecasting tool is also developed to predict production, consumption, price, and weather.
- In IANOS project the IANOS Island Energy Planning and Transition (IEPT) suite has been developed to assess replicability of IANOS innovative technologies in other islands. The IEPT is based on three components: INTEMA.grid is a grid modelling and simulation tool able to analyse various energy management and operational strategies; VERIFY-D is a tool for the life cycle environmental and economic assessment of replicated technologies; CBA is a cost benefit analysis tool which gives to stakeholders

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and investors an analytical approach that offers quantified insight into whether a smart grid intervention exceeds the current baseline scenario in terms of costs and benefits.

- INSULAE develops the Investment Planning Tool as a key replication tool extending beyond the interventions of INSULAE to assist island decision-makers to design energy strategies. In particular, the IPT is tailored to build medium to long term energy transition scenarios, using dedicated optimisation algorithms for capacity expansion planning. *"How to reach a net-zero energy system at the 2050 horizons ?"* or *"What could be the benefits of installing a battery system on my island ?"* are typical questions of islands decision-makers that the IPT can address. The IPT will be commercialized after the end of the project.
- GIFT developed twelve new innovative technologies to support energy storage, demand response, available flexibility and grid management on geographical islands. GIFT implemented and demonstrated Virtual Power System to trade flexibility using the FlexOffer protocol. Various new energy management systems have been developed and integrated to support better utilization of harbours, factories, homes and vehicles in grids. Better prediction of supply and demand and visualization through a GIS platform and innovative storage systems allowing synergy between electrical, heating and transport networks. The GIFT solutions achieved high TRL levels and are commercialized after the end of project.

3. Socio-economic and technical recommendations

Based on our socio-economic and technical findings, the replication of project solutions requires impactful reforms to be enhanced. Our consortia therefore call on the European Commission and Member States to take into account the following **technical and socio-economic recommendations,** which will support achieving climate ambitions and goals in 2030 and 2050.

The **vital need for long-term planning and integrated strategies** is firstly emphasised. Decarbonisation projects should be part of a comprehensive long-term plan and strategy for the island's sustainable development. Setting clear decarbonisation, energy efficiency, and conservation targets, developing integrated energy and climate action plans, and aligning with broader sustainable development goals are important for ensuring the sustainability and long-term viability of the projects' replication.

As a second recommendation, we call on the establishment of **innovative financing mechanisms**, aimed at supporting the projects replication and reducing dependency on fossil fuels. This could involve public-private partnerships, green bonds, crowdfunding platforms, and access to grants and incentives. Opportunities for leveraging (inter)national funding sources to attract investments and reduce financial barriers shall be explored. Other relevant instruments may include **incentives**, such as carbon pricing mechanisms and those for the electrification of transportation.

The **engagement with policymakers and government agencies** is key to streamlining permitting processes, incentivising the adoption of clean technologies, as well as ensuring alignment with national decarbonisation goals. Peculiar regulations and permissions in the domains of equipment installation are currently put in place in protected areas, hence

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increasing the complexity of replicating sustainable projects. To overcome such hurdles, **supportive policies and regulatory frameworks** shall be implemented at the EU and national level. These reforms require, among others, the **modification of safety regulations** to accommodate new technologies, including hydrogen for storage. Ultimately, the European Commission and the national bodies shall also take into account incentives, aimed at enabling a faster uptake of a wide range of solutions, including storage and ICT.

The successful replication of projects solutions may be further enhanced by establishing a **responsible body** tasked with projects coordination and implementation, stakeholder engagement and accountability. The performance and impact of the replicated projects also require **comprehensive monitoring and evaluation frameworks** of outcomes, impacts, and progress against targets. Collecting data on energy consumption, emissions reduction, cost savings, and social benefits will provide valuable insights for optimization and future replication efforts.

Adequate investments shall be ensured for the implementation of **capacity-building programs**, aimed at enhancing the skills and knowledge of local stakeholders. Relevant areas include training on renewable energy technologies, energy management practices and consumption patterns, as well as sustainable urban planning. Ultimately, the empowerment of local communities and organizations will enable them to take ownership of the replicated project, control the energy management, and overcome technical issues in a timely manner.

We also recommend **encouraging innovation and facilitating technology transfer**. EU and national authorities must foster cooperation opportunities among research institutions, industry, and local stakeholders, as well as establish mechanisms for sharing knowledge, expertise, and best practices on socio-economic and technical aspects. Such initiatives shall ultimately aim at accelerating the deployment of projects' **innovative simulation techniques** and **integration of flexible solutions**.

In light of the recent experience with the COVID pandemic, we also believe the replication of projects solutions requires the European Commission and Member States to take appropriate measures to **secure the supply chains**. New regulatory proposals shall hence consider these needs, with the aim of preventing logistical constraints and delays in the future.

Mature market frameworks provide further support in successfully replicating projects' solutions, aimed at decarbonising islands. For this purpose, the European Commission and the national bodies should undertake relevant **actions to further develop market frameworks**, capable to accommodate specific operating schemes. This constitutes a pivotal initiative, as it will enable more services towards Distribution System Operators (**DSOs**) by prosumers. Public authorities are also recommended to **combine business cases with use cases**, as this is key in tapping the maximum potential of technological solutions. Close synergy between different utility providers or across functional areas could also be key to success: conflicting organisational objectives may be reduced, by ensuring shared responsibility.

Representatives from civil society expressed interest in familiarising with topics such as energy management, storage, demand response, and the role of energy communities. To address these needs, **awareness campaigns** to educate the public about the benefits and

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importance of replicating sustainable projects shall also be promoted by the European Commission and Member States. **Success stories, case studies, and best practices** shall be therefore shared through various communication channels to inspire and motivate other regions to undertake similar initiatives. Such activities also ensure transparency and communicate in a clear manner objectives and progresses. The European Commission and Member States shall also take active measures to support the establishment of Renewable Energy Communities on islands, the involvement of public authorities during the project proposal, and the cooperation with international networks and organisations (such as the Global Island Partnership). Such initiatives foster the exchange of best practices and lessons learned in the decarbonisation of islands.

Lastly, to achieve the most ambitious results in projects replication, we believe the European Commission and the Member States shall consider the experience of relevant initiatives at the local level, which aim at enabling investments for energy transition and contributing to the achievement of EU energy transition targets in 2030 and 2050.

The **NESOI European Islands Facility** is a successful case in this sense, as it serves as an instrument to unlock the potential of EU islands to become the locomotives of European energy transition and provide first-step funding. NESOI recently is currently developing a **guidebook for replication** containing best practices (on e-mobility, energy planning, renewable energy sources, energy community and hydrogen) and lessons learned from a set of 54 projects, as well as tailored criteria for undertaking the replication. The Guidebook will also include the "**Replicability Readiness Level**" (RRL), an indicator which help identify the extent of replicability of a given project.

4. Conclusions

EU funded projects and initiatives provide concrete solutions to achieve cost-efficient, flexible, reliable, and secure energy supplies. Therefore, the replication of such projects aimed at decarbonising geographical islands will support the European Commission and the Member States in reducing CO2 emissions, achieving the ambitious net-zero targets set in the Green Deal, and creating a sustainable circular economy.

For this purpose, the implementation of the recommended financial, incentivisation and regulatory measures, as well as initiatives aimed at promoting the engagement of relevant stakeholders shall become a priority in the agendas of EU and Member States policy makers.

Our Consortia are available to provide supporting evidence on the short-, medium-, and long-term impacts that the replication of our projects could provide in the net-zero society.

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