HYDROELECTRIC
PUMPING STORAGE

HPS

SAN PIETRO

"HPS will improve the system's flexibility and make it possible to envisage a carbon-free future for the island"

This project is supported by the EU Islands Facility NESOI.
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NESOI
EU ISLANDS FACILITY

The European Islands Facility NESOI aims to unlock the potential of EU islands to become the locomotives of European Energy Transition. To do so, NESOI aims to mobilize more than €100 million of investment in sustainable energy projects to give EU islands the opportunity to implement energy technologies and innovative approaches, in a cost-competitive way. NESOI has selected 56 such projects across the European Union and provide them with financial resources and technical support.

Hydroelectric Pumping Storage

ABOUT THE PROJECT

Project Promoter: Sasso Srl

Stakeholders: Province of Sud Sardegna; Municipality of Carloforte

Country: Italy | **Sector:** Hydro | **PROJECT VALUE:** 2,500,000 €

DESCRIPTION

As the island includes an energy community of about 30 dwellings with rooftop PV, the objective is to use the excess of PV energy to drive pumps and stock sea water in an upper reservoir (already constructed). The project consists in a feasibility study for integrating a micro-hydro pumping plant on San Pietro Island (municipality of Carloforte).

AIM OF THE PROJECT

The hydroelectric pumping-storage system will be designed to exploit the surplus of renewable energy surplus produced on the island both from PV system and wind farm.

FUTURE STEPS

The possibility to include more energy sources (for instance wind turbines) will be considered to design the optimal hydro plant that can guarantee further implementations.

HOW THE EU ISLANDS FACILITY NESOI SUPPORTS THE PROJECT

1. Assessment of the key project sizing drivers, Action plan and identification of project monitoring procedures
2. Identification of suitable technological options given existing project sizing requirements
3. Definition of the required environmental permitting procedures
4. Cost Benefit analysis and socio economic and environmental impact evaluation
5. Definition of the technical, economic and financial, fiscal project inputs
6. Risk analysis and identification of available mitigation strategies
7. Assessment of existing procurement options
8. Financial modelling and identification of target scenario
9. Identification of financing/funding options, technical feasibility including inspections, measurements, field tests & dynamic simulations

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Hydroelectric Pumping Storage - Interview

INTERVIEW WITH
Andrea Sasso, partner in Sasso srl

Q: How was the project initially designed? Why choosing this specific technology?
A: For many years, there had been a desire on the island of San Pietro to create an independent energy community to decrease the energy dependency of the island. Over time, the members of this community have installed several PV systems for self-consumption. The technological choice of the project was influenced by the desire to re-exploit the existing infrastructure (reservoir and dam which are not used anymore for irrigation) and the surplus of energy from PV and Wind that cannot be consumed on site at the times it is produced. The surplus of energy is used to pump up sea water and the reservoir serves as storage system, alternative to a classic electrochemical one that is expensive and environmentally unsustainable.

Q: What were the challenges? How did NESOI help overcome them?
A: The main challenges are financial, as public administrations do not have sufficient financial resources to invest, and technical, due to the use of sea water in hydroelectric turbines. NESOI gave the chance to start with the first step of the project, the feasibility study. It also allowed to gather around the same table different partners with various competences: this allows other technological options to emerge, for instance PaT (Pump as Turbine). NESOI's assistance was also very helpful in mapping out funding sources, which is much appreciated because this island is a very small one with little resources.

Q: What will be done next to pursue this project? How far is it from concrete implementation?
A: Implementation is not far off because the technical choices have already been made and because the project is strongly supported by the municipality. The next steps to be taken are mainly administrative, contractual and financial: for instance, tender documents still need to be prepared; and potential investors to be identified and approached. Some support will also be needed to finalise the design of the installation.

Q: What are your next steps towards clean energy transition?
A: Our company is working on projects related to small- and micro-hydro applicable to small watercourses and infrastructures (aqueducts, canals and sewage treatment plants) and capable of supplying energy to companies, isolated shelters and small communities.

THE IMPACT
ON LOCAL COMMUNITY

An awareness and information campaign is underway (by the European project REACT) on the usefulness of installing PV systems that can benefit the entire community. The surplus production from PV will be used to power the pumping plant; it is necessary for more community members to install more PVs to have the necessary amount of energy.

Overall, the citizen energy community will benefit the storage facility and improve their energy autonomy.

Hydroelectric Pumping Storage – Technical Data

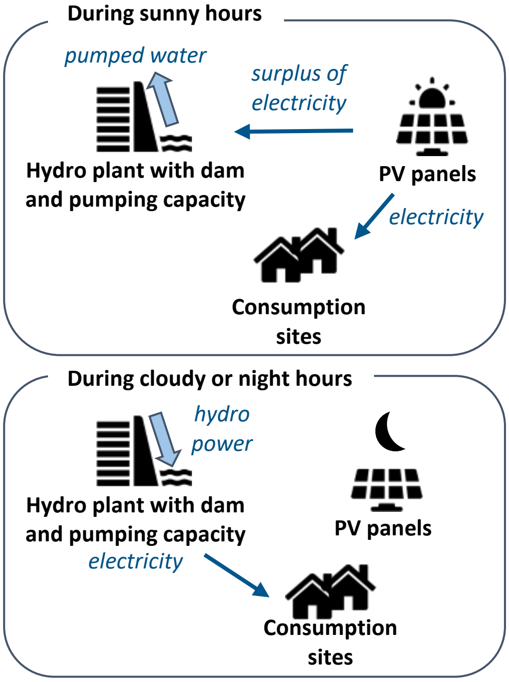
FOCUS ON
MICRO HYDRO ELECTRICITY

Hydro energy is renewable, and when there are a dam and a reservoir it is also a flexible source of electricity. Combined with pumped storage, such a facility can also use excess electricity generated by non dispatchable sources (PV, wind) to store water in the upper reservoir in order to generate electricity when the sun does not shine or the wind does not blow.

In San Pietro, a reservoir and a dam were built in 1932 to provide water for irrigation. It is not in use anymore. The project therefore aims at making use of this existing infrastructure to store clean energy, integrating the local energy system characterized by the PV plants already installed and by the new renewable energy sources that will be installed in the future.

Due to the lack of spring, river and rainwater, the project considers using sea water provided by a connection via penstock from the sea to the artificial lake. Solutions and materials need to resist to corrosion of seawater.

Several technical solutions are studied regarding the architecture of the hydro facility: essentially, either a traditional system a pump to charge the reservoir and a turbine to produce electricity; or a system with only one machine with one reversible pump, which works for both pumping and power generation. According to the technical specifications of the project the first option is considered more appropriate.

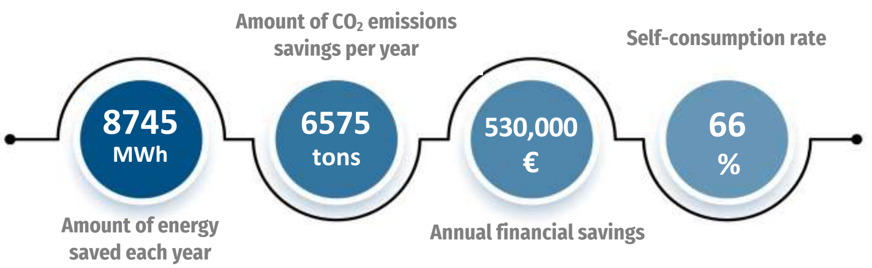


Schematic representation of the combination of PV and pumped hydro (Icons by FREEPIX, design by NESOI)

EXPECTED
ENERGY SAVINGS

The total demand of the energy community is about 15,800 MWh/year with a self-consumption rate of 66%. Considering the medium production yield of the national grid of 41,5% (2017 value) the calculation shows approximately 21,000 MWh of PES.
On average the Italian power generation grid produce 301 grams of CO_2-equivalent for every kWh produced. In total the amount of avoided GHG rise to 6575 tons considering the same data used for the PES estimation.

KEY NUMBERS
OF THE PROJECT



REPLICABILITY
IN OTHER ISLANDS

The project is replicable on sunny and coastal areas that have exploitable height differences behind them, and it is very effective on not-electrified islands. The concept is also replicable in developing countries where electricity grids are not sufficiently developed to store PV energy far from the production site: if suitable water basins exist, this type of plant can be an interesting alternative and more sustainable storage system than electrochemical.

NESOI contact:
Sara Ruffini , R2M Solution, sara.ruffini@r2menergy.com

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