NESOI
EU ISLANDS FACILITY

Energetic fish farm

EFF

SAAREMAA

“The project intends to demonstrate a business model boosting the whole aquaculture sector on the Estonian islands.“

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

Energetic fish farm

ABOUT
THE PROJECT

Project Promoter Conversio Design Ltd

Stakeholders Conversio Design Ltd, Estonian Hydrogen Association, The Aquaculture Stewardship Council

Country Estonia | **Sector** Renewable energy sources, hydrogen | **PROJECT VALUE** 360,000 €

DESCRIPTION

The project aims at equipping a state-of-the-art renovated onshore fish farm on the Sõrve peninsula with wind and solar energy production means. The possibility to use surplus of electricity for hydrogen production is investigated. The electrolysis side product oxygen will be used for improving fish life environment.

AIM OF THE PROJECT

To provide a full technical solution for the energy system in the fish farm.

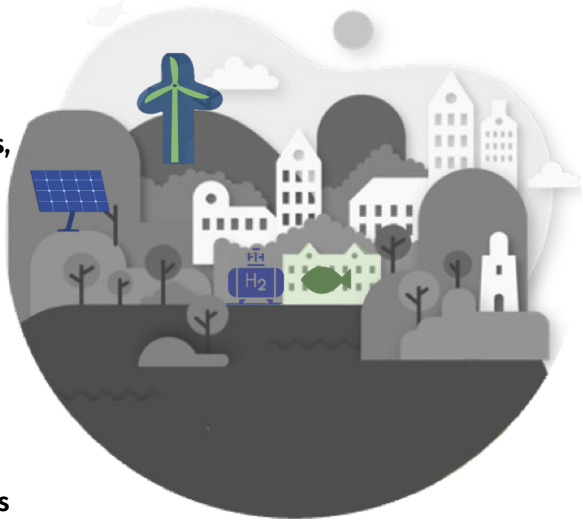
- Simulate the generation and consumption of renewable energy.
- Techno-economic analysis of the application of hydrogen technologies, including electricity production based on H_2.

FUTURE STEPS

Addition of solar panels to the fish farm is certain and and the addition of a wind turbine is probable in the long run. Produced surplus RE will be shared with neighboring households. In case of an expansion of the farm doubling the production can be achieved. Further RE-based solutions for heating are investigated.

HOW THE EU ISLANDS FACILITY NESOI
SUPPORTS THE PROJECT

1. Data collection and market analysis
2. Analysis of existing planning documentation, identification of the project boundaries
3. Assessment of the key project sizing drivers (e.g. expected users, baselines, energy demand, etc.)
4. Identification of suitable technological options given existing project sizing requirements
5. Definition of the required environmental permitting procedures given the identified project options
6. Cost-benefit analysis and socio-economic and environmental impact evaluation
7. Definition of the technical, economic and financial, fiscal project inputs (assumption book)
8. Risk analysis and identification of available mitigation strategies
9. Design of the energy system, financial modelling, identification of financing/funding options, action plan



INTERVIEW WITH

Sulev Alajõe, R&D manager at Conversio Design Ltd

Q: How was the project initially designed?

A: We wanted to know what is the best technical solution based on renewable energy for a fish farm and whether it would make sense to use hydrogen technologies there. Hydrogen would have several advantages for us. Renewable energy production could be increased regardless of the electricity grid and energy independence could be achieved. In addition, hydrogen technology could contribute to the production of heat, and the by-product of electrolysis - oxygen - could also be used very well in the fish farm to decrease fish mortality.

Q: What are the challenges of the project? How does NESOI help overcome them?

A: Unfortunately, the result of the analysis was that hydrogen technologies would not become profitable at the fish farm. We were very happy with the appointed consulting company and the advisor from there. They helped to calculate different scenarios and it became clear what is reasonable to do in the future.

Q: How does the project impact local citizens?

A: The fish farm could create one more job opportunity in the region. Also, if the production volume of the farm is increased, this will significantly improve the availability of local fish in the market throughout the year. Locals can also benefit from the surplus RE produced in the fish farm.

Q: What are the next steps of the project?

A: Thanks to the calculations and studies carried out within the project, we found out that given the local climate and the current price of technologies it is now economically reasonable to add more solar panels on the fish farm. This process has already been started. Wind energy is also worth adding to the system, but since the previous project documentation for installing the wind turbine is deprecated and not valid, obtaining new documentation will take time and the addition of a wind turbine will probably not happen soon. We would also be interested in exploring renewable energy-based options for obtaining thermal energy and other possible ways to develop aquaculture on islands. Perhaps taking more clever use of leftover biomass can also be interesting for us in the future.

THE IMPACT

ON LOCAL COMMUNITY

1. **Local Economy**
   The improved technical solution enables to expand the fish farm, which could bring about many positive impacts to the region, e.g. new job opportunities, improving of roads etc.. The business model will set an example for followers boosting aquaculture on the island.
2. **Social Acceptance and Impact**
   Saaremaa municipality sees fish-farms as a perspective business to enhance local economy. The project will be a great example of semi-autonomous energy solutions. This will further demonstrate the benefits of RE to the local citizens that can help to increase the acceptance of new wind turbines.

New Energy Solutions Optimised for Islands
NESOI
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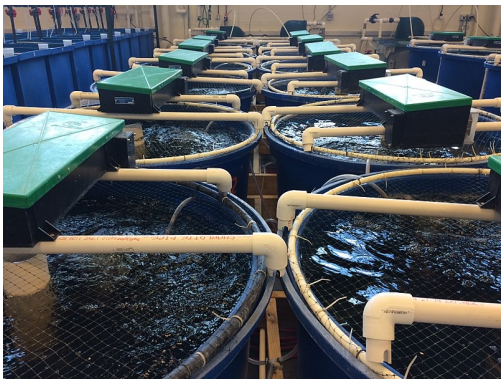
Energetic fish farm – Technical Data

FOCUS ON
RENEWABLE ENERGY SYSTEMS FOR AQUACULTURE

Global demand is increasing for dietary fish protein, which has resulted in widespread overfishing in wild fisheries, resulting in significant decrease in fish stocks and even complete depletion in some regions. As of 2016, more than 50% of seafood was produced by aquaculture.

Indoor fish farming involves creating artificial conditions that mimic the natural habitat of fish while providing optimal water quality, temperature, and feeding conditions to maximize growth and productivity.

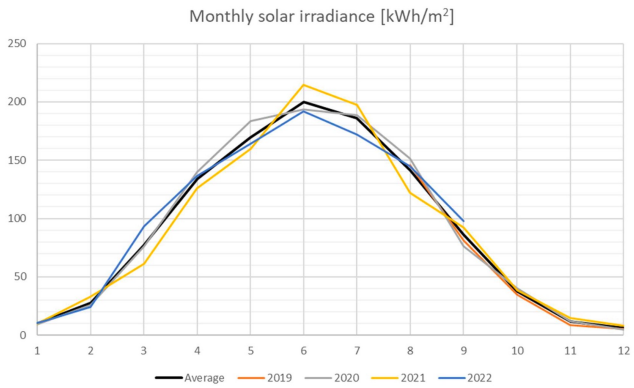
The fish farm owned by Conversio Design uses recirculating aquaculture system (RAS) for growing fish, thus the water demand from outside environment is minimal. In the farm, the water from the growing environment is pumped through various treatment units like mechanical filtration, biofiltration, CO_2 removal, etc..



Example of a fish farm using Recirculating Aquaculture System (Wikipedia, photographer Narek75)

The fish farm already had 50 kW of solar panels installed. If the RE production is increased, the selling of all the leftover electrical energy to the grid will no longer be possible due to the current grid infrastructure. In total, 12 scenarios were analyzed, six of which included the fish farm at its current state and six in which the fish farm expansion was considered. The proposed changes in the system architecture for the fish farm that had undergone expansion were to

- add a 330 kW wind turbine,
- add PV solar panels,
- move existing PV panels to a more suitable place where energy production will be increased,
- add a battery energy storage system (optional).



Monthly estimated solar irradiance near the fish farm (Energetic fish farm case study)

KEY NUMBERS
OF THE PROJECT

550 MWh – Amount of energy saved each year*

303 tCO_2eq – Amount of CO_2 emissions avoided per year

63% – Percentage of locally generated RE consumption

3.5 years – Pay-back time

** Due to self-consumption of renewable energy, based on the proposed system consisting of wind and solar RE generation*

REPLICABILITY
IN OTHER ISLANDS

The results can be replicated in other areas with similar climate and economic conditions. EFF is about the optimization of an energy system that operates in an isolated location where grid is highly constrained. The results of this project are relevant to those interested in the production and storage of renewable energy to create a semi-autonomous energy system.

R2M RESEARCH TO MARKET SOLUTION
NESOI contact:
Sara Ruffini, sara.ruffini@r2menergy.com

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