CALIBRATE 2024 PARTICIPANTS WORKSHOP

BLUE ECONOMY COOPERATIVE RESEARCH CENTRE

Australian Government
Department of Industry, Science and Resources
AusIndustry
Cooperative Research Centres Program

OPTIMAL HYBRID ENERGY STORAGE AND DEMAND SIDE MANAGEMENT FOR OFFSHORE STANDALONE HYDROGEN- DC MICROGRIDS

Hasith Jayasinghe, University of Technology Sydney

A.Prof. Kosala Gunawardane (UTS), Dr. Ramon Zamora (AUT), Prof. Evan Gray (Griffith), Robert Nicholson (pitt&sherry)

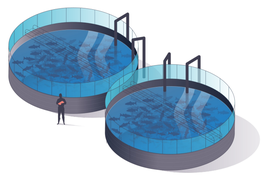
I undertook a PhD with the Blue Economy CRC because of my interest in working with renewable energy projects. My research focuses on DC microgrids, energy storage technologies, and demand response.

Following my PhD, I wish to pursue a career in the power systems industry in Australia, where I can apply my expertise to practical industry scenarios.

Proposed Project

Diesel Generator

Current Method of Energy Supply



Offshore Aquaculture Site

Proposed Method of Energy Supply

DC Microgrid (Renewable Energy with Energy Storage)

Objectives

1. Design a hybrid energy storage system to enhance the battery life and stability of the offshore DC microgrid.
2. Model electrical loads in the salmon aquaculture industry to identify demand response possibilities.
3. Establish an optimal demand-side management program by integrating hydrogen storage into the offshore DC microgrid.

Potential Impact of the Project

- ❑ Contribute to achieve the main aims of Blue Economy CRC: Decrease production cost of offshore aquaculture systems, and increase offshore renewable energy generation and use.
- ❑ Evaluate the possibility of integration of renewable energy sources into the offshore industries in terms of technical and economic aspects, which will reduce the operational cost and carbon footprint significantly.
- ❑ Build a framework for integration of energy storage and demand side management technologies for offshore DC microgrids which provides sustainable power supply for the offshore industries.

Methodology

Hybrid Energy Storage Systems (HESS)

- ❑ Find the most optimum HESS combination from different ESS technologies.
- ❑ Objectives: Reduce the stress on Battery & Increase the battery lifespan.
- ❑ Probabilistic Approach to size the HESS

Electrical Load Modelling in Salmon Aquaculture Operations

- ❑ Model the different electrical loads in salmon aquaculture operations
- ❑ Seasonal Variations of Loads.
- ❑ Digital Twin approach for integrate load models.

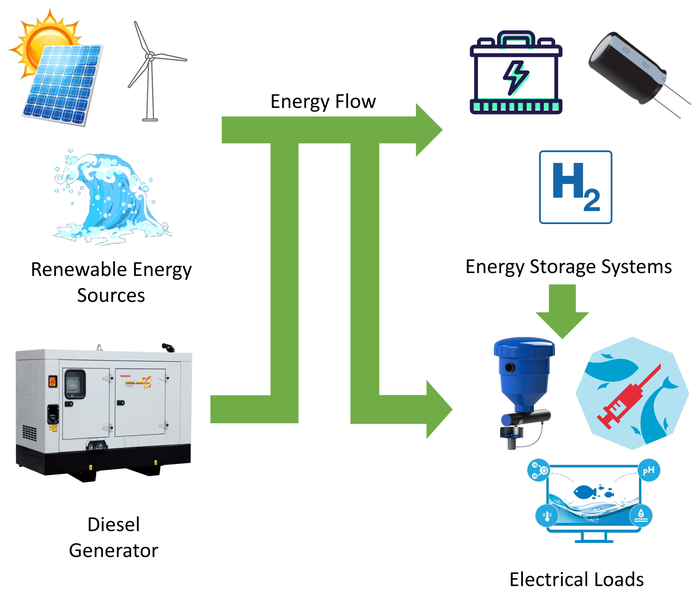
Hydrogen Energy Storage

- ❑ Optimum usage of onsite Hydrogen production with Electrolysers.
- ❑ Optimal design of Hydrogen fuel stations for vessels and ships.

Demand Side Management (DSM)

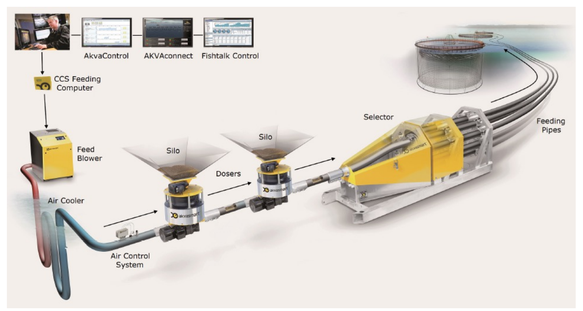
- ❑ Possible DSM applications with integration of controllable loads and Hydrogen fuel stations.
- ❑ Optimize the microgrid operation with metaheuristic optimization approaches.

Architecture of proposed DC Microgrid



Progress

- ❑ Literature Review on,
  - ❖ Hybrid Energy Storage Systems
  - ❖ Load Modelling
  - ❖ Demand Side Management,
    Applicable to standalone microgrids
- ❑ Identification of Electrical Loads of Salmon Aquaculture Operation. (Feeding System, Dead Fish Handling, Lighting etc)
- ❑ Modelling of Electrical System in Salmon Aquaculture Operation



Actual Load Profile vs. Load Model – Blower System