

Introduction

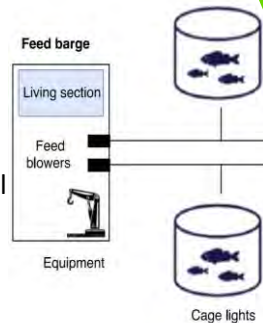
- Aquaculture farms will become important in ensuring adequate food supply in the midst of a rapidly increasing population.
- A disadvantage of aquaculture farms is the common use of diesel generators for energetic needs, due to their high levels of emissions.
- **Solution:** Implementation of renewable energy in aquaculture farms using the offshore environment.
- To design a sustainable energy-powered aquaculture farm, power consumption of aquaculture net pens must be determined.
- Power consumption of Atlantic salmon farm is modeled.
- The original data comes from related publication on the reduction of CO₂ emissions in salmon farming², which is scaled to our fish yield.



Sample Aquaculture Farm¹

Materials And Methods

- The modeled farm has 12 cylindrical net pens each with a 30m diameter and a 15m height, a stocking density of 20 kg/m³, a fish yield of 2,545 tonnes, and a production cycle of 2 years.
- Hourly power consumption for one day is separated into that related to feeding, equipment, cage lights, and living section².
- The hourly power consumption for one day duplicated through a season, under the assumption that summer/spring and winter/fall is each half a year (182 days). This is repeated four times to represent the full production cycle. The data was scaled between seasons for a smoother transition.

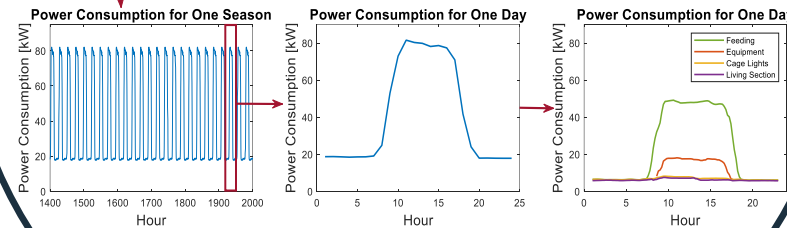
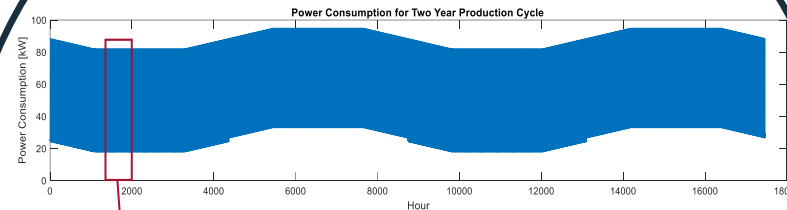


Sources of Power Consumption (Seen From Above)²

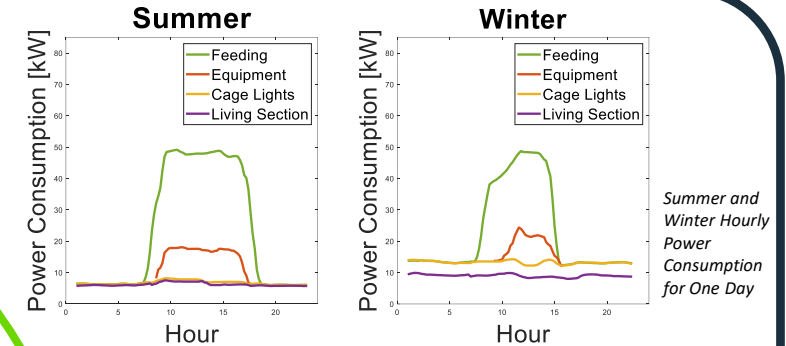
Graphs/Diagrams

Research Highlights

Result of turning daily power consumption into model for entire fish production cycle.



The approach can be implemented to farms of any size and any type of finfish.



Summer and Winter Hourly Power Consumption for One Day

- Winter has higher energy needs for cage lights and living section due to the less hours of sunlight and lower temperatures.
- Summer has higher energy needs for feeding, since this is when the fish growth rate is highest.

Discussion/Conclusion

- The hourly power consumption for the offshore aquaculture farm is necessary data for the implementation of renewable energy.
- Separation of seasons and sectors of energy usage is critical to finding accurate numbers.

Finding accurate and comprehensive power consumption data is the first step to designing and sizing a combined renewable energy and energy storage system for an aquaculture farm.

1. Rohit, P.M. (2018). Offshore Fish Farm Project a Few Miles West of San Diego's Coast. <https://www.thelog.com/local/on-the-port-of-san-diegos-radar-offshore-fish-farm-project/> 2. Möller, S. L. (2019). Reduction of CO₂ Emissions in the Salmon Farming Industry: The Potential for Energy Efficiency Measures and Electrification. <https://ntnuopen.ntnu.no/ntnu-xmlui/handle/11250/2624655>