



DESIGN AND IMPLEMENTATION OF A FLOATING PV

POWER PLANT FOR MADINAH REGION

Introduction

Due to the high temperatures in Saudi Arabia, solar panels often experience reduced efficiency. “The Design and Implementation of a Floating PV Power Plant for the Madinah Region” project addresses this issue by utilizing the cooling effect of Alaqoul Lake. This system enhances panel efficiency, reduces water evaporation, and promotes panel sustainability. It supports Vision 2030 by offering a cost-saving, long-term renewable energy solution.

Objective

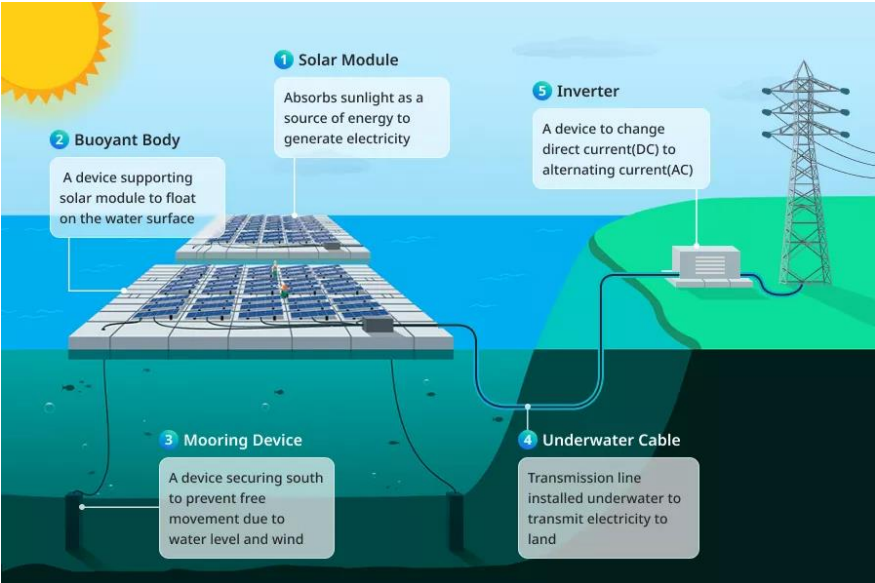
This project aims to develop renewable energy sources through the innovative utilization of water surfaces to enhance energy efficiency and reduce water evaporation. By implementing advanced solar technologies, it supports economic development.

Deliverables

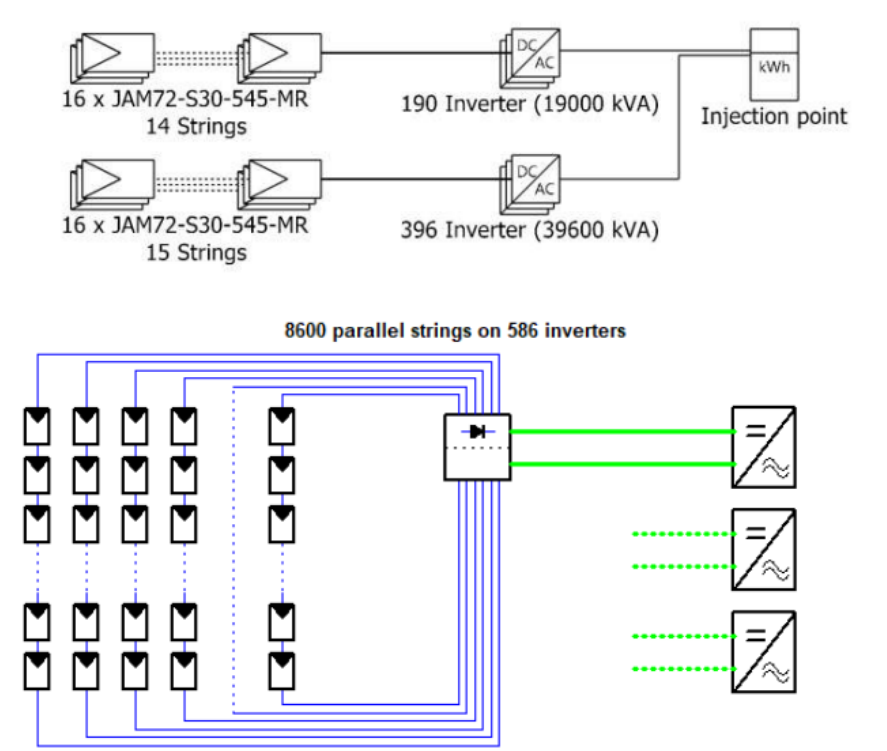
- Study, simulate, design, and analyze the real **mega FPV Power Plant**.
- Build a functional, creative, and representative **prototype**.
- Conduct **financial study**: Prove floating PV's cost-effectiveness over land-based systems.

Operation of a Floating Solar Power Plant




This diagram shows a floating solar power plant with solar panels on a **buoyant platform**. The **panels** generate electricity, which is converted to AC by an **inverter**. The structure is **anchored** and connected to the land by **underwater cables**, optimizing space and efficiency.



PVsyst Electrical Design

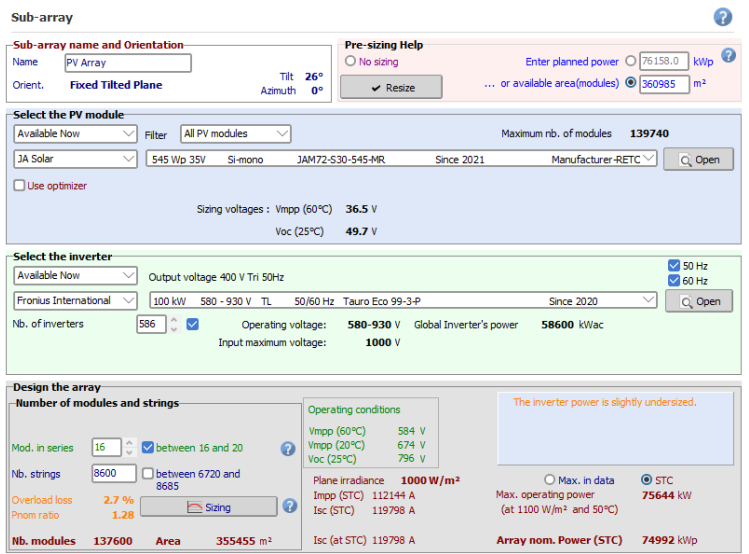


Financial Results

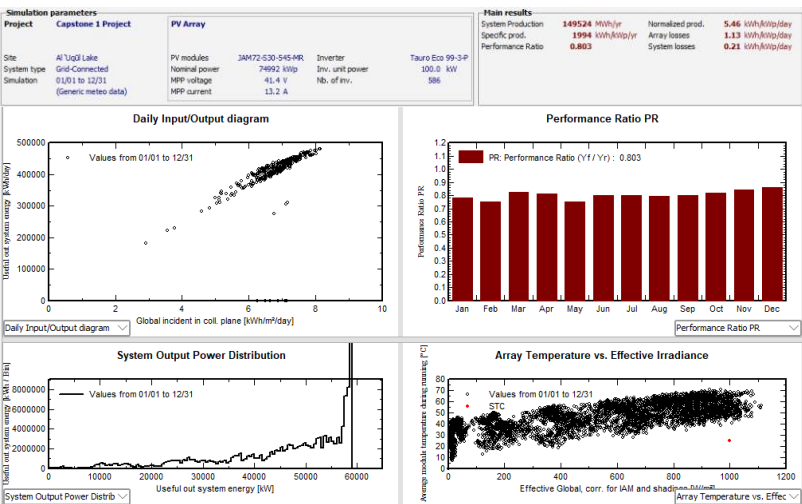
Revenue Stream		<i>Initial Capital Investment</i>
Market Analysis		<b>318,836,800 SAR</b>
Cost Structure		<i>Annual Revenue</i>
Financial Projection		<b>26,914,320 SAR</b>
Investment Requirements		<i>Break-even Point (kWh)</i>
Break-Even Analysis		<b>122,659,333 kWh</b>

Electrical Results

1) System Parameters:



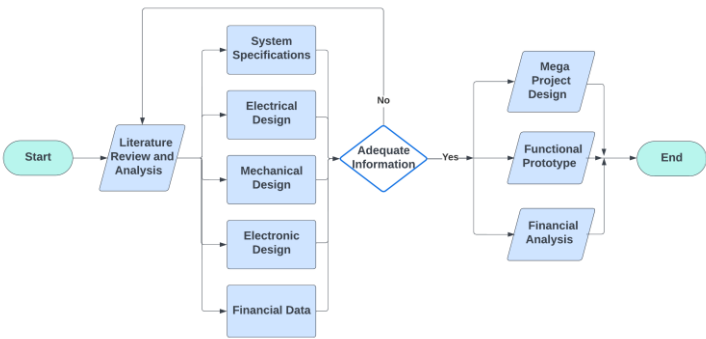
2) PVsyst Main Results:



3) Prototype Operation:



Project Flow Chart



Conclusion

In conclusion, the project leverages the cooling effect of Al-Aqoul Lake to counteract the efficiency reduction in solar panels caused by high temperatures in Saudi Arabia. This innovative approach not only enhances panel efficiency but also reduces water evaporation, contributing to sustainability. With a power production of **149,524 MWh/year**, significantly surpassing the break-even point of **122,659,333 kWh/year**, the project is highly successful. It boasts a **performance ratio of 0.803** and utilizes **137,600 panels**. Aligning with Vision 2030, this project provides a cost-effective, long-term renewable energy solution that fosters economic development through the advanced utilization of water surfaces for energy generation.

Future Work

- Integrate AI for efficiency and resilience.
- Benchmark future projects on the FPV system.
- Leverage the scalable model and benefits of the FPV plant.
- Establish the FPV plant as a key part of the region's sustainable energy landscape.