Floating PV system modelling and analysis

System 3D modelling

Department: Copernicus Institute of Sustainable Development
Research group: Energy and Resources
Supervisor: Dr. Sara Golroodbari
Email address: s.z.mirbagherigolroodbari@uu.nl
Telephone number: 030 2537681

Project description

Floating PV technology presents a promising avenue for bolstering our energy generation, especially for countries blessed with abundant lakes, canals, and extensive coastlines with easy access to open water. However, unlocking its full potential requires thorough research to assess its technical feasibility. To this end, we categorize Floating PV systems into three different groups: onshore, nearshore, and offshore installations. Scaling up the latter two categories is both essential and in high demand. To achieve this, a cautious and precise approach is paramount. One critical aspect to consider is the mechanical properties of the floaters, which must strike a balance between robustness and heat transfer efficiency to maximize energy yield.
In the pursuit of designing the optimal floater, a critical step is to create a 3D model. Along this path, we aim to address a series of important research questions:

Research Questions:

- *How can we effectively mitigate mechanical stress at various points on the floater while assessing the extent to which this stress is transferred to the panels?*
- *What constitutes the ideal design and material choice for offshore and nearshore floaters that can simultaneously meet the requirements for efficient heat transfer and robustness?*

Objectives

Our research objectives are as follows:

- **3D Modelling:** Create an accurate 3D model of Floating PV floaters, enabling the visualization of stress distribution and dynamic behaviour in varying water conditions.
- **Analysis:** Conduct a comprehensive analysis to identify stress concentration areas and assess the mechanical performance of Floating PV floaters in different operational scenarios.

Methodology

We will employ a mixed-methods approach involving:

- **3D Modelling with Autodesk CFD:** Create a 3D model of Floating PV floaters using Autodesk CFD software. Incorporate geometrical and structural details, including the floater's shape, size, and material properties. Define boundary conditions to simulate real-world scenarios.
- **Finite Element Analysis (FEA) with Autodesk CFD:** Apply FEA methods to the 3D model to simulate mechanical behaviour. Define material properties, loads, and constraints, considering factors like wave interaction and PV panel weight.
- **Python Coding for Post-Processing:** Develop Python scripts to extract, process, and visualize simulation results.

Deliverable:

- The first draft of a research paper, consisting of the aforementioned analysis.

Job requirements

- *Knowledge of Solar PV integration*
- *Knowledge of 3D modelling and Autodesk software*
- *Knowledge of Python Programming and visualization*