

Paving the way for offshore solar standards: results from Delta Flume testing

Oceans of Energy

Deltares

TNO

DNV

Offshore Solar enables large scale solar energy generation, without the use of land space

Offshore Solar is implemented in standalone applications and in combination with offshore wind. Amongst others, Shell, Eneco, RWE, TotalEnergies, Vattenfall, and Copenhagen Infrastructure Partners are investing to-date in offshore solar projects.

TNO, Deltares, DNV and Oceans of Energy collaborated to execute two key testing campaigns at the Deltares' Delta Flume –the World's largest flume– marking a meaningful step towards offshore solar certification.

Full-scale hydrodynamic test of offshore solar array

Four full scale Oceans of Energy interconnected floaters were positioned inside the flume to measure the behavior and impacts of the breaking waves.

Results

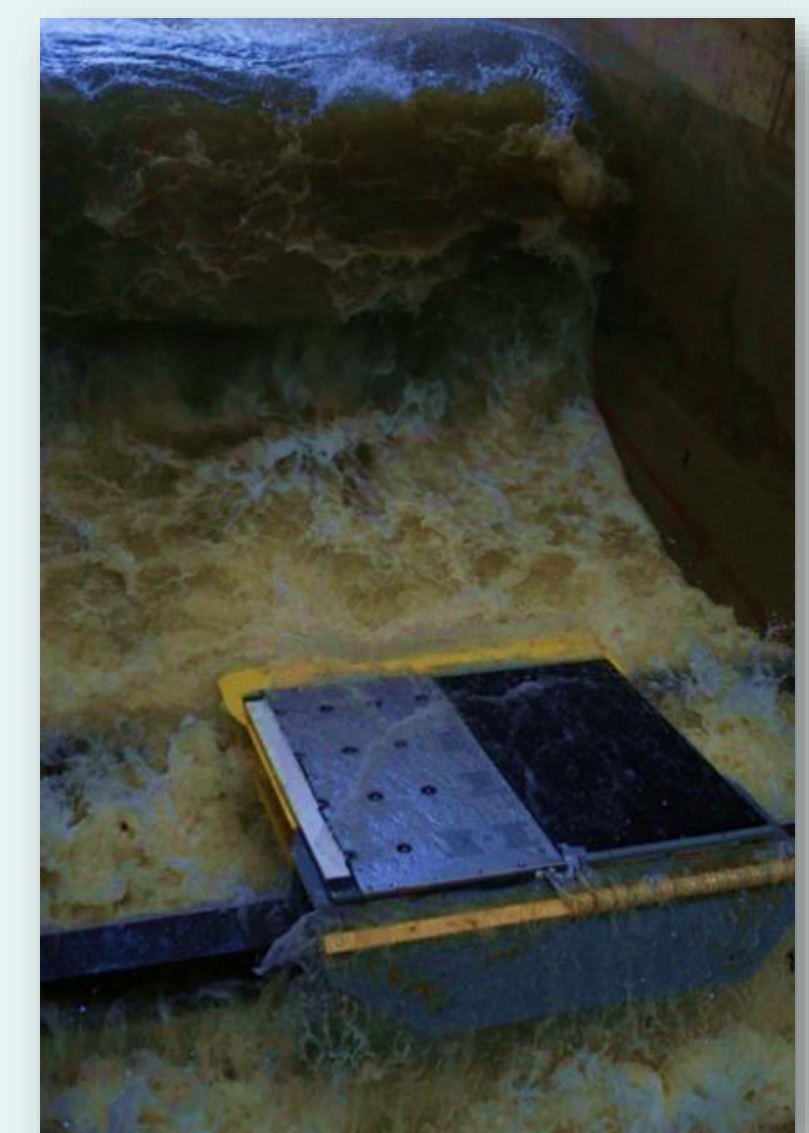
- Correlation was found between system response and wave characteristics.
- Different loading mechanisms were identified: direct wave impact, wave over wash, slamming loads, free span.
- Wave slamming impact are expected to be largest on the floaters at the outer edges of an offshore solar system.

After testing, platforms were demonstrated during 4-years in offshore conditions, 12km offshore The Hague.



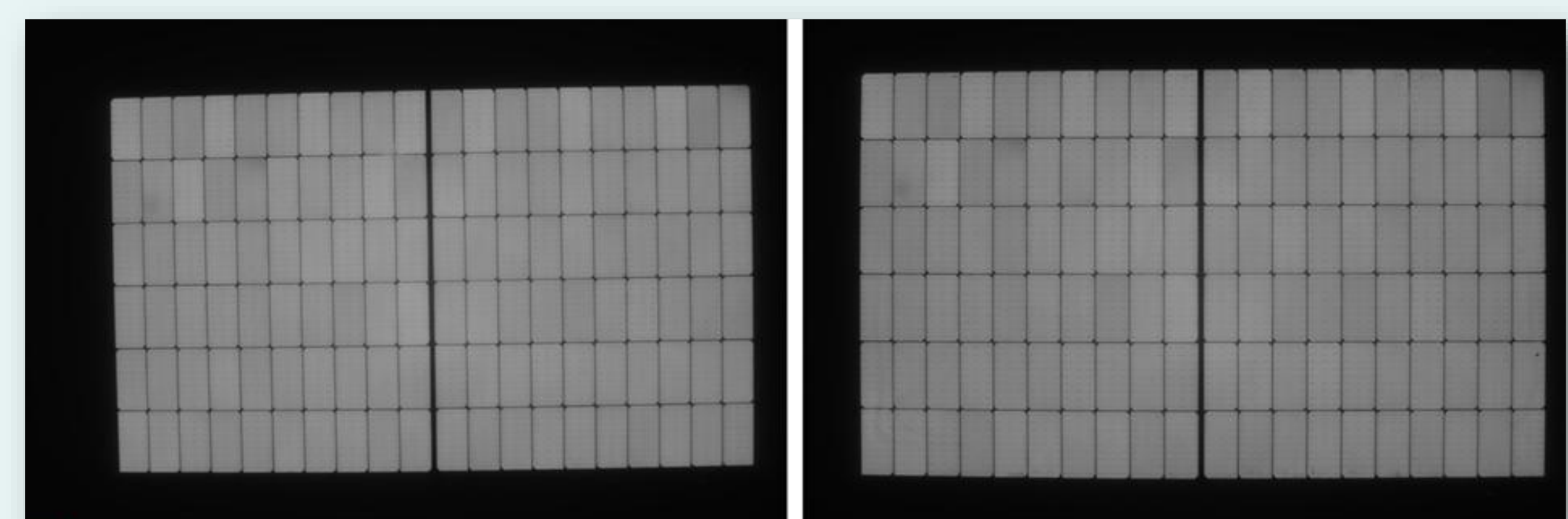
Wave slamming testing of fixed PV-mounting and PV-modules

A glass-glass PV and dummy module were mounted on a fixed partial platform, which was positioned in different orientations with respect to the incoming waves to quantify mechanical stresses caused by direct wave impacts on the PV-module cells, glass and frames.



Results

- Correlation was found between wave height (up to 2.5m) and pressure and force.
- Correlation was found between wave height and measured strain, suggesting that higher waves induce greater deformations. However, strain is also influenced by the PV mounting structure.
- Electro luminescence images of the PV modules taken before (left) and after (right) indicate that no microcracks are formed.



Lessons learned

This research offers valuable insights into the performance of offshore solar technology under real-world conditions. Each test method –like numerical modelling, small-scale and full-scale tests, offshore projects– has its own strengths and should be used together to get the best results. It highlights the need for further collaboration to build a solid scientific base in the path towards establishing standardized testing protocols and certification schemes.



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