

De-risking offshore solar scale-up

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Climatic validation of a floating 66 kV transformer prototype

Offshore solar is moving fast. The sector is shifting from pilot projects to scalable building blocks for offshore solar farms. The EU-funded BAMBOO project addresses the remaining technical and operational hurdles. The goal is clear: make offshore floating solar robust, reliable, and ready for large-scale deployment.

From engineering assumptions to real-world validation

Offshore solar is evolving from experimental pilots to standardised systems that can operate at scale. In the EU-funded BAMBOO project, partners across Europe work together to solve the remaining technical and operational challenges.

Within this effort, **Sirris, Pauwels Transformers, and Oceans of Energy** engineered and validated a key enabling component: a **66 kV / 630 kVA transformer**. The transformer is designed for integration into a containerised offshore concept for future floating solar parks.

For offshore assets, engineering does not stop at theoretical performance. Equipment must continue operating when environmental conditions become challenging. That reality guided the transformer design process.

The engineering approach combined **computer-aided simulations and system-level design decisions**. Thermal and mechanical load cases supported the development of the transformer and the cooling strategy for the full containerised system.

Still, simulations alone cannot confirm performance in complex environments. Testing remains essential to verify that the system behaves as expected.

Climatic testing in the Port of Antwerp

To validate thermal behaviour and operating margins, the team conducted a dedicated climatic testing campaign in **Sirris' large-scale climatic test chamber in the Port of Antwerp.**

This facility can recreate extreme environmental conditions and simulate solar heat loads. These conditions closely reflect what containerised offshore equipment must withstand in real operation.

(More information about the test facility can be found here.)

The climatic campaign took place at the end of December. The objective was straightforward but critical.

The tests aimed to:

- Verify that transformer temperatures remain within safe limits
- Determine maximum temperatures under representative conditions
- Validate both transformer internal design choices and container cooling performance

Several environmental scenarios were reproduced during the campaign:

- Cold start down **to -10°C**
- Hot ambient conditions **up to +40°C**
- Hot-weather scenarios combined with solar heat load on the container housing

These tests helped confirm whether the transformer and container cooling concept perform safely under realistic offshore conditions.

Sustainability focus: biodegradable ester and cold starts

A notable part of the campaign focused on **cold-start testing using a biodegradable dielectric ester**.

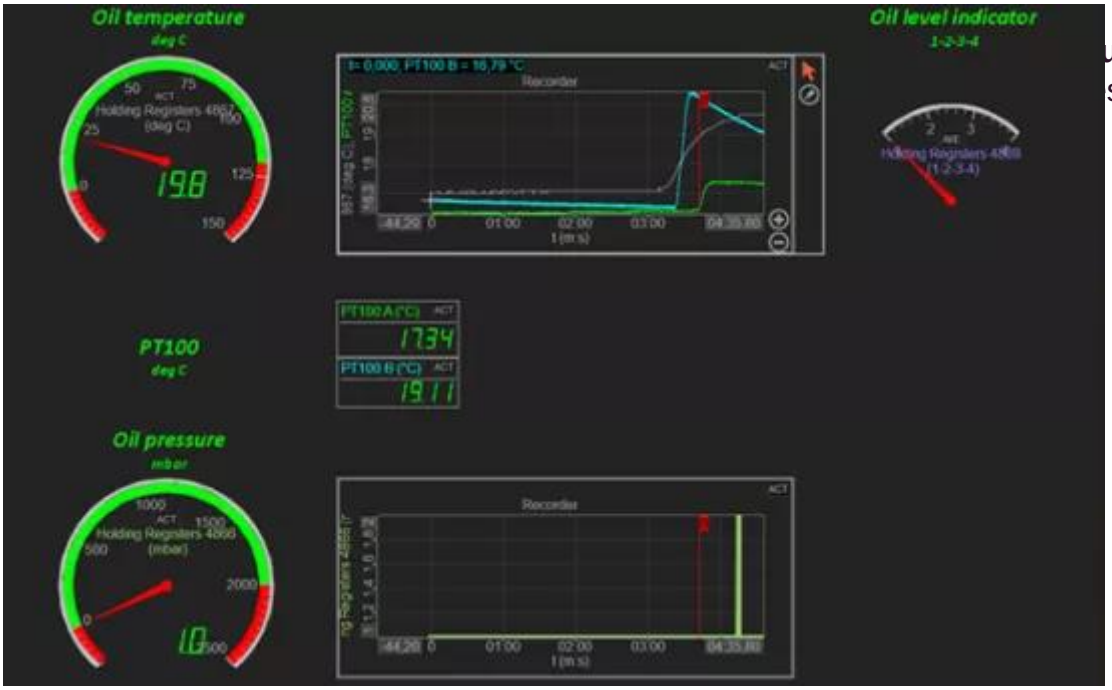
Offshore energy systems increasingly face sustainability requirements beyond technical performance. Environmentally friendly materials therefore become part of system design choices.

However, these alternatives must still guarantee reliable operation. The cold-start tests verified whether the transformer remains operational at low temperatures when using biodegradable insulating fluids.

This step helps ensure that sustainable design choices do not compromise performance or reliability.

Monitoring that turns tests into engineering insight

Testing generates the most value when engineers collect detailed operational data.



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The monitoring supported safe operation and deeper analysis of the results. It also enabled control, alarming, and post-processing of the collected data.

These insights help engineers better understand system behaviour and identify potential optimisation opportunities.

Why system-level testing matters

Early-stage prototypes always involve uncertainty. The most effective way to reduce risk is to test systems under conditions that closely resemble reality.

Facilities like the Sirris climatic chamber allow engineering teams to reproduce complex environmental scenarios before equipment is deployed offshore.

This approach helps teams detect design sensitivities early, shorten iteration cycles, and prevent costly surprises during offshore operation.

The transformer validation campaign forms part of the broader **BAMBOO project**, which focuses on enabling large-scale offshore solar deployment. More information about the project can be found here.

Offshore solar is entering a phase of industrial-scale deployment. Reliable electrical infrastructure is essential to support this transition. Climatic testing helps bridge the gap between simulation and real-world conditions. By validating components early, engineers can reduce uncertainty and increase confidence in future offshore solar systems.

Are you developing offshore energy systems and looking to validate performance under realistic conditions?

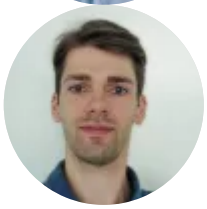
The Sirris testing infrastructure and engineering expertise help you reduce technical risk and accelerate innovation.

Feel free to contact our team to explore how we can support your project.

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