

Workshop IV: Multi-use as a practice

Towards a policy framework for offshore floating photovoltaics in Belgian offshore wind farms

Workshop IV report

Executive summary

The fourth and final SWiM stakeholder workshop marked the culmination of a multi-year exchange process bringing together researchers, policymakers, offshore wind developers, technology providers and environmental experts. Building on the outcomes of the previous workshops, the final session aimed to consolidate insights from the different SWiM work packages and translate them into actionable recommendations for future Belgian offshore energy policy.

Throughout the project, offshore floating photovoltaics (OFPV) evolved from an emerging concept into a technology pathway that can now be assessed through a growing body of technical, environmental and governance evidence. The final workshop therefore focused not only on identifying opportunities and challenges, but also on discussing how the accumulated knowledge can support informed policy development towards a robust (offshore) energy system for Belgium.

A central input to the workshop was a dedicated technical assessment of potential undertaken within the project. This study combined spatial, technical and infrastructural data to estimate the opportunities for integrating OFPV within existing and future Belgian offshore wind farms. The results provided a numerical basis that grounded the stakeholder discussions and allowed participants to move beyond merely theoretical considerations towards practical implementation pathways.

Across all discussions, a broad consensus emerged that no fundamental technical barriers prevent future integration of offshore solar within offshore wind developments. At the same time, stakeholders agreed that demonstration projects remain essential to reduce uncertainty regarding economic performance, operational reliability and environmental interactions. The workshop therefore highlighted the importance of moving from studies and modelling towards real-world experience.

The key message emerging from the final workshop is that offshore floating photovoltaics should not be considered as a standalone technology, but rather as a potential component of future integrated offshore energy systems. Realising this potential will require regulatory adaptation, targeted pilot projects, continued knowledge development and governance frameworks capable of supporting multi-use developments at sea. These conclusions form the foundation for the final SWiM policy recommendations.

Context and objectives

The SWiM project was established to explore the opportunities and challenges associated with integrating offshore floating photovoltaics within Belgian offshore wind farms.

The stakeholder process was structured around four workshops.

The first workshop explored regulatory frameworks, environmental considerations and permitting challenges. Participants discussed how OFPV could be embedded within existing offshore governance structures and highlighted the importance of adaptive licensing approaches.

The second workshop focused on technical integration, energy system implications and grid-related considerations. Discussions demonstrated that multiple technical pathways exist to combine offshore wind and solar generation while sharing infrastructure and increasing overall system flexibility.

The third workshop expanded the discussion towards multi-use offshore space, nature-inclusive design, maritime activities and governance challenges. Participants stressed that future offshore energy developments should increasingly be assessed within a broader North Sea context where multiple societal functions coexist.

The fourth workshop was designed as the synthesis workshop. Its objective was to bring together insights generated across all work packages, confront these with stakeholder perspectives and identify the key messages that should inform future Belgian policy development.

Particular attention was given to the findings of a dedicated offshore solar potential study, which assessed integration opportunities in existing and future Belgian offshore wind zones. The study provided a quantitative foundation for discussing realistic deployment scenarios and implementation pathways.

Workshop structure

This workshop was intentionally designed as the final synthesis workshop of the SWiM project. The programme combined presentations of the main research outcomes from the different work packages with an external technical potential assessment and stakeholder discussions structured around the four SWiM research domains. The objective was not only to discuss individual findings, but to identify how the combined results could translate into concrete policy actions for Belgium.

The workshop consisted of three main elements:

- Presentation of the overall SWiM results and project objectives;
- Presentation of the dedicated offshore solar potential assessment carried out by SeaVolt;
- Four parallel thematic breakout sessions reflecting the SWiM work packages, followed by plenary reporting and discussion.

This structure enabled participants to assess both the individual findings and the interactions between technical performance, grid integration, spatial planning, environmental considerations and policy frameworks.

Bringing together the SWiM knowledge base

A defining characteristic of the final workshop was the convergence of knowledge generated throughout the project.

Insights from the work packages covered:

- energy yield and system performance;
- reliability and technology maturity;
- electrical integration and grid connection options;
- spatial planning and offshore infrastructure requirements;
- environmental assessment and monitoring;
- governance and regulatory frameworks;
- stakeholder acceptance and implementation pathways.

Rather than discussing these elements separately, participants examined how they interact when considering actual deployment of OFPV in Belgian offshore wind farms.

This integrated perspective revealed an important finding: while individual challenges remain, none of the investigated domains identified a critical barrier that would prevent pilot-scale deployment. Instead, the outstanding questions increasingly concern how deployment should occur, under which conditions, and through which governance arrangements.

The workshop therefore marked a shift away from asking whether offshore floating photovoltaics are possible and towards discussing how Belgium can responsibly prepare for future implementation.

Technical potential assessment (SeaVolt study)

The SeaVolt study provided the quantitative basis for the workshop discussions. By combining offshore wind farm layouts, available surface areas, grid constraints and expected solar performance, the study translated the research outcomes into possible deployment scenarios for Belgian waters.

The assessment confirmed that offshore floating photovoltaics could make a meaningful contribution to the robustness of Belgium's future renewable energy portfolio. Previous SWiM analyses already demonstrated that deploying OFPV at a scale equivalent to the installed offshore wind capacity could generate a substantial additional annual electricity production. Under ambitious deployment scenarios, this could reach up to 6.6 TWh annually. Such volumes correspond to approximately 5.5-7.6% of Belgium's annual electricity consumption while adding between 20 and 28% additional production to the future offshore wind fleet.

The analysis further demonstrated that only a relatively limited share of the offshore wind farm area would be required. Depending on the deployment scenario, offshore solar installations would occupy minimum 2,5% of the available wind farm area while maintaining compatibility with wind generation activities. Curtailment losses were estimated at approximately 9-16%, confirming the importance of shared infrastructure and integrated system optimisation.

Participants generally agreed that these figures significantly changed the nature of the discussion. Instead of debating whether OFPV could have relevance for Belgium, discussions focused on identifying the regulatory, technical and environmental conditions required to unlock this potential.

Breakout session outcomes

WP1 – Energy yield and reliability assessment

Building on the work conducted by imec and UHasselt, discussions focused on the long-term performance and reliability of offshore photovoltaic systems.

Participants acknowledged that energy yield modelling has matured significantly and that a growing understanding exists of the impacts of wave motion, temperature conditions, marine exposure and dynamic shading caused by offshore wind turbines. The discussion therefore shifted from theoretical performance towards bankability and operational confidence.

Stakeholders stressed that certification pathways, insurance requirements and validated performance data remain essential before large-scale deployment can be considered. Demonstration projects should therefore focus on generating the reliability data required by investors, insurers and regulators.

A recurring message was that technological feasibility increasingly appears achievable, whereas proof of long-term reliability remains the key challenge for market uptake.

WP2 – Electrical design and grid integration

The WP2 breakout focused on how OFPV can integrate into existing and future offshore electricity infrastructure.

Participants discussed the benefits of exploiting the complementarity between offshore wind and solar production, allowing more efficient use of existing transmission assets. Particular attention was devoted to cable utilisation, hosting capacity and future offshore energy hubs.

Several participants indicated that future development should be assessed at energy system level rather than technology level. OFPV should not compete with offshore wind for grid access but contribute to increasing the overall utilisation of offshore infrastructure.

The discussion also highlighted the need to consider storage and energy islands as part of future integrated offshore energy systems. Stakeholders generally agreed that regulatory frameworks have not yet evolved sufficiently to support such hybrid infrastructure concepts.

WP3 – Structures, placement and mooring

The WP3 breakout explored practical questions related to placement strategies, safety distances, anchoring concepts and marine spatial integration.

Participants discussed how existing design concepts can be adapted to Belgian offshore conditions and examined opportunities for integrating OFPV within operational and future offshore wind farms.

A central observation was that technical solutions increasingly exist for addressing mooring and anchoring requirements. However, optimisation of available space remains crucial to maximise energy production while maintaining operational safety.

The discussion linked strongly with broader multi-use considerations. Stakeholders noted that OFPV deployment can only be assessed in combination with other offshore functions, reinforcing the need for a more integrated approach to future marine spatial planning.

WP4 – Environmental aspects

Environmental discussions focused on translating modelling outcomes into future monitoring and permitting approaches.

Participants recognised that environmental knowledge has advanced considerably compared to the start of the project. However, substantial uncertainties remain regarding long-term ecosystem responses and cumulative impacts at larger deployment scales.

The breakout highlighted the importance of adaptive monitoring frameworks that evolve alongside deployment. Rather than relying solely on precautionary assumptions, participants supported evidence-based learning through demonstration projects and field measurements.

The group also emphasised the opportunity to build upon the internationally recognised Belgian offshore monitoring programmes that have already been developed around offshore wind farms.

Discussion on technical feasibility and system integration

Discussions confirmed the findings emerging from earlier workshops that technical integration appears feasible.

Participants identified multiple connection pathways through existing offshore wind infrastructure, offshore substations and future energy hubs. Both AC and DC architectures were considered viable options for future development. Several innovative transformer concepts were

discussed, including containerised implementations sitting on the seabed, illustrating the technological flexibility available for hybrid offshore energy systems.

Reliability discussions highlighted that the most critical technical risks are currently associated with floating structures, anchoring systems, mooring concepts and long-term electrical component performance. Connector reliability and protection against harsh marine conditions were identified as areas requiring further operational validation.

A recurring observation throughout the workshop was that many of the remaining uncertainties can only be addressed through demonstration projects and long-term monitoring programmes.

Consequently, stakeholders broadly agreed that technical feasibility is no longer the primary question. The focus should now shift towards technology validation under real offshore conditions.

Plenary discussion and cross-cutting findings

The plenary session brought together the key insights emerging from the four breakout discussions and the SeaVolt technical potential assessment. While each work package explored a specific dimension of offshore floating photovoltaics (OFPV), the plenary discussion highlighted the strong interdependencies between technological performance, grid integration, environmental considerations and governance. Participants repeatedly stressed that the future of OFPV in Belgium cannot be assessed through a single disciplinary lens, but requires an integrated offshore energy system perspective.

A first cross-cutting finding was the broad consensus that the discussion has evolved significantly since the start of the SWiM project. Early conversations were largely centred on whether offshore photovoltaics could technically function in Belgian offshore conditions. Based on the combined research results and stakeholder experience presented during the workshop, the debate has now shifted towards the conditions under which deployment could realistically occur. Across the different work packages, no fundamental technical or environmental barriers were identified that would preclude pilot deployment within Belgian offshore wind farms. Instead, participants agreed that the main remaining questions concern implementation strategies, regulatory preparedness, economic viability and operational validation.

Energy robustness

The presentation of the SeaVolt technical potential assessment played an important role in shaping this discussion. By translating technical assumptions into concrete deployment scenarios and energy production estimates, the study provided a quantitative basis for evaluating the relevance of OFPV in Belgium's future offshore energy mix. Participants highlighted that the study moved the conversation beyond theoretical potential and allowed stakeholders to discuss potential pathways for deployment. The resulting figures illustrated that OFPV could represent a meaningful complement to offshore wind generation while making more efficient use of existing and planned offshore infrastructure.

System integration

A second recurring theme concerned the importance of system integration. Discussions across WP1 and WP2 considered that the value of offshore solar does not only lie in the additional

electricity generated, but also in the potential to improve infrastructure utilisation and increase the overall efficiency of offshore energy systems. Participants emphasised that future decisions should therefore focus on optimising offshore energy production at system level rather than evaluating individual technologies in isolation. Several stakeholders noted that the increasing development of offshore hubs, hybrid interconnections and energy islands could create favourable conditions for such integrated approaches.

Pilots for better environmental knowledge

Environmental considerations similarly emerged as an enabling rather than limiting factor. Participants acknowledged that important uncertainties remain regarding ecosystem interactions, cumulative impacts and long-term monitoring requirements. However, rather than advocating restrictive precautionary approaches, stakeholders generally supported a phased and adaptive deployment strategy. Demonstration projects coupled with targeted monitoring programmes were considered the most effective mechanism to generate the evidence needed for future decision-making and permitting.

Adaptive/adapted governance is needed for decent ocean management

A fourth overarching finding related to governance and regulatory frameworks. Throughout the discussions, stakeholders repeatedly observed that technological innovation is progressing faster than regulatory adaptation. However the Belgian MSP strategy from the beginning underlined the importance of multi-use of space, existing frameworks have largely been developed around single-use offshore developments, whereas future offshore energy systems are likely to involve multiple technologies sharing infrastructure and marine space. Participants therefore argued that policy frameworks should evolve towards greater flexibility, enabling experimentation while maintaining legal certainty, operational safety (think grid connections and system integration) and environmental protection. In Belgium, first next steps are set by the draft Royal decree for test installations.

Strategic marine planning for a competitive nation: demo time

Perhaps the strongest consensus emerging from the plenary discussion concerned the role of demonstration projects. Across all work packages, participants identified pilot and demonstration initiatives as the essential next step in the development pathway for offshore floating photovoltaics. Such projects were considered necessary not only to validate technical performance and environmental assumptions, but also to test permitting procedures, governance arrangements, business models and stakeholder cooperation mechanisms. Demonstration projects were therefore viewed as integrated learning platforms that can bridge the gap between research findings and future commercial deployment.

Taken together, the plenary discussion confirmed that the results generated within the SWiM project form a coherent knowledge base for future policy development. The combination of research outcomes, stakeholder expertise and the SeaVolt potential assessment points towards a cautious but promising pathway for OFPV in Belgium. Rather than focusing solely on technological readiness, participants concluded that future efforts should concentrate on enabling conditions: creating opportunities for demonstration, establishing appropriate monitoring frameworks, adapting regulatory instruments and integrating the potential of offshore photovoltaics into broader offshore energy planning strategies.

The discussion therefore reinforced the central message of the workshop: offshore floating photovoltaics should not be viewed as a stand-alone renewable energy technology, but as a potential component of future integrated offshore energy systems. Supporting this transition will require coordinated action across research, industry and government, providing the foundation for the policy recommendations developed in the final phase of the SWiM project.

Towards policy advice for Belgium

The final workshop demonstrated that the discussion around offshore floating photovoltaics has matured significantly during the course of the SWiM project.

The combined analyses from the work packages, stakeholder dialogue and dedicated potential assessment suggests that OFPV deserves serious consideration within Belgium's longer-term offshore energy strategy.

The workshop identified several priority actions:

1. Develop and support grid-connected demonstration projects.
2. Create regulatory flexibility for innovative hybrid offshore developments.
3. Integrate future OFPV considerations into offshore wind farm planning and tender design.
4. Continue targeted environmental monitoring and impact assessment.
5. Establish governance frameworks for shared offshore infrastructure.
6. Reduce investment uncertainty through data collection and operational learning.
7. Facilitate cooperation between industry, regulators, researchers and policymakers.

Taken together, these actions can support a phased development pathway in which knowledge generation, risk reduction and policy adaptation evolve alongside technological progress.

Final conclusions

The fourth SWiM workshop concluded the stakeholder dialogue by bringing together insights from all project work packages and confronting them with practical stakeholder experience.

The workshop demonstrated that offshore floating photovoltaics have the potential to become an important component of future Belgian offshore energy systems. The dedicated potential assessment provided a quantitative foundation for discussing realistic deployment opportunities, while stakeholder discussions identified the key technical, environmental and governance conditions needed for successful implementation.

No critical barriers were identified that would preclude pilot deployment. Instead, the main challenges now concern technology de-risking, regulatory preparation, business model development and the generation of operational experience.

The strongest consensus emerging from the workshop was that Belgium should prioritise the development of demonstration projects capable of generating the evidence required for future

decision-making. Such projects should serve not merely as technology tests, but as integrated learning platforms that support technical validation, environmental assessment, governance innovation and policy development.

As the closing workshop of the SWiM project, this discussion provides the foundation for the project's final policy recommendations: a stepwise, evidence-based pathway towards the responsible integration of offshore floating photovoltaics within Belgian offshore wind farms and future multi-use offshore energy systems.