



# D5.3



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# WILLOW

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## EXECUTIVE SUMMARY

The present document constitutes Deliverable D5.3: Report on stakeholder engagement and activity, in the framework of the Project titled “Wholistic and Integrated Digital Tools for Extended Lifetime and Profitability of Offshore Wind Farms” (Project Acronym: WILLOW; Grant Agreement No 1011122184).

This deliverable has been produced in relation with Task 5.2 “Stakeholder engagement”, which aims to manage the interactions with the Advisory Board to assure the highest potential for innovation and market uptake for all activities during WILLOW improvement and deployment.

This report contains the initial summary of the activities carried out with the Advisory Board in the first year of the project, such as the conformation of the Advisory Board and interactions with its members.

The content of the document can be summarized as follows:

- Section 1 introduces the current deliverable.
- Section 2 details the objectives of the Advisory Board and which are its target group and milestones.
- Section 3 gives an overview of the approach and of the five subgroups of the Advisory Board.
- Section 4 presents the methodology that has been followed.
- Section 5 concludes with the results obtained after the first meeting.



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## ABBREVIATIONS AND ACRONYMS

Abbreviations / Acronyms	Description
AB	Advisory Board
AI	Artificial Intelligence
CDEP	Communication, Dissemination and Exploitation Plan
EC	European Commission
KPI	Key Performance Indicator
O&M	Operation & Maintenance
OEM	Original Equipment Manufacturer
OWF	Offshore Wind Farm
SBOM	Software Bill Of Material
SG	Subgroup
SHM	Structural Health Monitoring
WFOp	Wind Farm Operator
WFO	World Forum Offshore Wind
WP	Work Package



# 1 Introduction

This document is a deliverable of the WILLOW project, funded by the European Commission (EC) under its call HORIZON-CL5-2022-D3-03 (Sustainable, secure and competitive energy supply). The project aims to design a novel Structural Health Monitoring (SHM) system able to provide high quality data to perform a reliable fleet life assessment using physical models and artificial intelligence (AI) methods which will be used for decision-making and maintenance scheduling.

The document is the third deliverable of Work Package (WP) 5 “Communication, dissemination and exploitation activities”. Effective dissemination will enhance the visibility of the project results and encourage interested stakeholders to actively participate, thus achieving successful integration.

The report covers the main conclusions of the Advisory Board (AB) for the first year.

## 1.1 Connection to Communication, Dissemination & Exploitation Plan (D5.2)

Dissemination refers to sharing research results with potential users - peers in the research field, industry, other commercial players and policymakers. By sharing research results with the rest of the scientific community, WILLOW aims to contribute to the progress of science in general.

In that sense, the Dissemination Strategy included in the Communication, Dissemination and Exploitation Plan (CDEP) includes describes activities mostly connected to specialist audiences (scientific outreach, EU events, workshops, clustering with similar EU-funded projects and related initiatives, webinars and WILLOW final event). It is key for good coordination of all the dissemination initiatives and for defining the messages about the project and its results that should be targeted to different audiences. Effective dissemination will enhance the visibility of the project results and encourage interested stakeholders to actively participate, thus achieving successful integration.

In terms of dissemination, this CDEP of WILLOW aims to:

- Outline the main objectives of the project dissemination strategy.
- Identify the target audiences for the dissemination objectives and actions.
- Define the tools and channels to be implemented and the activities required to reach targeted audiences.
- Measure the impact and effectiveness of WILLOW dissemination activity through identified Key Performance Indicators (KPIs) and established target values.
- Establish how the dissemination activities will be managed and administrated.



## 2 Objectives and Expected Impact

The objective of having an Advisory Board is to involve and engage relevant entities with different profiles to provide their support and advise on relevant technical, economic and sustainability objectives and priorities within the project. On one side, technical requirements and inputs from end users, test-sites or certification bodies will help align the tasks and expected results with the current situation of the sector. On the other hand, it is also key for the project to involve entities that can provide inputs regarding environmental, socioeconomic and sustainability concerns.

In that sense, in order to maximize the success potential of the project, the Advisory Board will be the main group supporting the consortium in providing expert advice to ensure consistency in the project outcomes in accordance with market expectations. Stakeholders' involvement will be key for validation and improvement at critical project stages, where checkpoints on the work performed are (and will be) required.

As set in the Deliverable D5.2 "Communication, Dissemination and Exploitation Plan", the Advisory Board will have at least one annual meeting for the duration of the project. The Advisory Board members will commit themselves to:

- Assume a key role and accompany the WILLOW project during the project lifetime.
- Be involved from the very beginning by providing advice and guidance to point the activities in the right (industry relevant) direction.
- Contribute to the disseminate and communication of project results using their outreach and industry pertinent networks.
- Play a crucial role in exploitation of results, advising WILLOW partners on the needs and requirements of future end users.

### 2.1 Target Audience

The Advisory Board for WILLOW considers the following groups as a target audience.

**Research organisations:** World-leading research institutes and academia in the domain of wind farm monitoring, simulation and control.

Type of information: Research results and general information on development in the field of open-source solutions addressing current pitfalls in state-of-the-art wind farm simulation.

Channels and tools: Scientific conferences. International reference Journals; events and joint events; Guest lectures/ courses

**Potential end users. Wind industry audience:** Wind Farm Operators (WFOps), i.e. EnBW, EDF, Iberdrola, etc.; wind turbine manufacturers (also known as Original Equipment Manufacturers, OEMs); suppliers of structural components (tower, transition piece, foundations); Engineering & Consultancy companies specialised in offshore wind energy projects; Operation & Maintenance



(O&M) engineering companies; large metallic structures constructors; companies which provide services such as inspections or monitoring; insurance companies; industry associations.

Type of information: (i) WILLOW results that can help to achieve improved decision support for operation & maintenance activities and decommissioning strategies taking into account loads and lifetime thanks to: 1) solutions that will improve considerably the detection, quantification, classification of damages with the final aim of getting a remote and reliable map of the state of the structure in real-time in order to reduce the O&M costs (earlier detection, controlled repairs, future improvements in the design of the structure) and 2) a modelling framework that can help reaching better grid integration with an increase in the production rate and reduction of the O&M costs. (ii) Thermography and other sensors data (corrosion and coating degradation data).

Channels and tools: Scientific conferences; International reference Journals; International events; webinars; B2B meetings with OEMs.

EU policy actors and decision makers (sector specific): EU Relevant DGs: DG Energy, DG RTD, CINEA, national public administrations and decision makers.

Type of information: WILLOW results can support reaching and maintaining the national and EU targets of offshore wind power by better providing insights for feed studies and decision support with respect to decommissioning and lifetime extension studies.

Channels and tools: WILLOW events and other events (conferences, etc.).

Standardisation and certification bodies: ISO, Bureau Veritas, CEN, DNV-GL.

Type of information: Standardisation relevant results obtained in WILLOW.

Channels and tools: Presentation at relevant working groups.

## 2.2 Monitoring

All the activities related to stakeholders are monitored with KPIs. In that sense, an annual meeting is targeted for the lifetime of the project, as shown in the next figure extracted from D5.2.

		Target values			
Dissemination activity	KPI	Year 1	Year 2	Year 3	Total
Advisory Board	Presence meetings	1	1	1	3

*Figure 1 – Advisory Board meeting number KPI*



### 3 Overall Approach

The Advisory Board, with a limited number of participants by invitation, are experts in the project topics (structural health monitoring, corrosion, pitting, etc.) of wind turbine manufacturers, windfarm developers, wind testing site or certification entities.

The WILLOW consortium set up an Advisory Board formed by a limited number of experts that overview the advancement of the project as well as advise and support the consortium on its development to ensure consistency in the project outcomes in accordance with market expectations. The scope of the contribution of the participants would, at least, be focused on one annual meeting with the consortium.

As each AB member is an expert in different topics that are worked on in WILLOW, subgroups (SG) will be created so that in meetings these more specific topics will be discussed with the corresponding partners.

1. Cybersecurity strategy and standardization for Offshore Wind Farm (OWF). Coordinator: CEIT
2. Coating condition continuous monitoring, prediction and standardization for OWF. Coordinator: C-CUBE
3. Uniform corrosion and pitting monitoring, prediction and standardization for OWF. Coordinators: SIRRIS/CEIT
4. Fleet lifetime assessment and standardization for OWF in curtailed conditions. Coordinators: VUB/24SEA
5. Wind Farm Control in curtailed conditions. Coordinator: SINTEF

#### 3.1 SG1 - Cybersecurity strategy and standardization for OWF

Supply Chain Software Security:

- During the development lifecycle of corrosion measurement sensor software.
- Secure application of CI/CD methodology (hardening pipelines, secrets discovery, etc.), secure firmware installation thanks to embedded root secure services, Software Bill Of Material (SBOM) collection.

End to end IoT communication security:

- Ensure identification, authentication, authorization, secure transmission of sensor-edge-cloud information.
- Risk assessment and identification of vulnerabilities at HW/FW level (monitoring devices)

Industrial Control Systems Security:



- Providing a test/simulation environment with security mechanisms that are not currently implemented in the architecture.
- Security best practices document to implement such security countermeasures on the production environment managed by the operator.

### 3.2 SG2 - Coating condition continuous monitoring, prediction and standardization for OWF

Proposed techniques to detect and monitor coating condition (spectroscopy, ultrasounds).

- Description of the Sensors & Models and foreseen experiments.

Related standard and identified gaps:

- Most common defects in the coatings ISO 4628.
- Damage classification standardisation for structures.
- DNVGL-RP-0416:2016 Corrosion protection for wind turbines.
  - Principles, technical recommendations and guidance for design and construction and in-service inspection of corrosion protection systems for wind turbines (cathodic protection, sometimes with coatings).
  - The recommended practice does not include any recommendations with respect to continuous monitoring of coatings.

### 3.3 SG3 - Uniform corrosion and pitting monitoring, prediction and standardization for OWF

Proposed techniques to detect and monitor uniform and pitting corrosion (electrochemical sensors, ultrasounds, thermography).

- Description of the Sensors & Models and foreseen experiments.

Related standard and identified gaps:

- Most common defects in steel structures ISO 8044.
- Damage classification standardisation for structures.
- DNVGL-RP-0416:2016 Corrosion protection for wind turbines.
  - Principles, technical recommendations and guidance for design and construction and in-service inspection of corrosion protection systems for wind turbines (cathodic protection, sometimes with coatings).



- The recommended practice does not include any recommendations with respect to continuous monitoring of corrosion (either uniform or localised).

### 3.4 SG4 - Fleet lifetime assessment and standardization for OWF in curtailed conditions

Loads monitoring (virtual sensing, accelerometers, ultrasounds).

- Description of the Sensors & Models and foreseen experiments.

Fleet lifetime assessment data-driven models

- Loads and corrosion prognosis.
- Neural networks for fleet lifetime assessment.
- Novelty detection methods.

Related standard and identified gaps:

- DNVGL-ST-0262 “Lifetime extension of wind turbines”, DNVGL-SE-0263 “Certification of lifetime extension of wind turbines” and IEC 61400-28 (draft) “Through life management and life extension of wind power assets”.
  - The recommended practice does not include any recommendations with respect to the wind turbine control mechanism “curtailment”.

### 3.5 SG5 - Wind Farm Control in curtailed conditions

Characterise wind power curtailed in future energy system scenarios (forecasting curtailed operation).

Acceptability and usability guidelines:

- Role of stakeholders involved in wind farm curtailment and terms of agreements
- Prospects in new energy markets (balancing market)
- Implications for wind farm control

Control approaches for damage-aware curtailment:

- Approach 1: Selecting turbines participating in curtailment
- Approach 2: Actively dispatching power commands between turbines
- Approach 3: Turbine-level downregulation control

Implementation in smart curtailment decision support tool.

Optimal O&M planning.



Validation and lifetime assessment.



## 4 Final Composition of the Advisory Board

The Advisory Board was created during the first months of the project, with technical stakeholders that due to their profile or relevance would benefit from the research of the project and whose participation would benefit the project.

A group of 11 stakeholders has been established as Advisory Board (i) to act as a sounding board for project work in progress and findings, (ii) to enforce that the project activities and results meet the needs of potential users and (iii) to serve as a platform for promoting the future take up of WILLOW outputs. This Advisory Board has been made up primarily of potential end users of WILLOW framework. It includes, as can be seen in the following figure, offshore wind operators, certification companies, companies providing services to wind farms (as inspections) and wind turbine manufacturers, among others.



Figure 2 – Members of WILLOW’s Advisory Board

As for their profiles, the 11 members include:

Relevant wind farm developers worldwide:

- [Capital Energy](#) is a Spanish energy company founded two decades ago and committed to becoming the first 100%-renewable, vertically integrated electrical company on the Iberian



Peninsula. In 2022, BlueFloat Energy and Capital Energy join forces in Tenerife to promote the first offshore wind farm in a Spanish port. The Granadilla offshore wind farm, which will be located adjacent to the port of the same name, will have an installed capacity of 50 MW and will supply most of the clean energy to the Tenerife Port Authority and its concessionaires, as part of the port's commitment to decarbonisation.

- [Otary](#) is a partnership of eight Belgian companies active in the field of renewable energy. Their team is composed of professionals who combine their experience, expertise and strengths to contribute to a sustainable future for all. Otary develops, finances, builds and manages offshore wind farms. They furthermore provide a broad range of services during an offshore wind project's life cycle. Some of the most relevant projects carried out by Otary are Rentel and SeaMade offshore wind farms.
- [ParkWind](#) is a Belgian company founded in 2012 with the conviction that wind energy is key to a sustainable future. Today that conviction is stronger than ever, as they grow globally to make offshore wind energy available and affordable to everyone. Parkwind's current portfolio includes four offshore wind farms off the Belgian coast with 225 turbines with 1 GW of power capacity. Together, these wind farms produce enough power to provide the equivalent of 1.1m households with green energy. They currently have an additional 4.5 GW in development globally.

#### Engineering and service providers:

- [Aeroblade](#) is a company with deep aeronautical roots. Its technical and management team has been present in the wind energy field since the first steps of the industry. After a period of a quarter of century designing and manufacturing composite and metallic structures including wind blades, Aeroblade is consolidated today as a reference engineering company providing services and technological solutions for the most important players in both the wind and offshore wind energy sectors. Among their main activities are the design, validation and certification, industrialization, inspections and repairs, asset lifetime management and decommissioning.
- [ISATI Engineering Solutions](#) is a recognized engineering provider for the wind sector. Isati's expertise in design and stress has been applied on some of the most important wind turbines developed and installed around the world. Isati offers engineering services for onshore and offshore wind turbines and also provides optimization and maintenance solutions for already installed wind turbines as well as to improve the performance of existing designs. In the framework of W2P-HERA project, a multi-use offshore platform, Isati participates in different aspects of the development and is fully responsible for the design and manufacture of the leaning towers and all of the associated systems.
- [Nabla Wind Hub](#) is an independent solution provider for life extension and performance improvement of wind turbines, specialized in wind assets' redevelopment in a post-subsidies market. Life extension and performance improvement of wind farms, and long-term maintenance plans, are the keys of their company to unlock the hidden potential of



your wind farm and fuel the transition to green energies worldwide. Nabla's independent and multitechnology solutions for all market spectrum have gained the confidence of key players in the market ranging from utilities, investment funds or IPPs to OEMs, consultants, developers and ISPs.

- [Nautilus Floating Solutions](#) is a technological and industrial consortium formed by Subsea 7 and Vicinay Marine Innovación, leading companies in advanced technology and with presence in international markets that aspire to become a world reference in the development of floating platforms for the offshore wind energy, and the research centre Tecnalia in the development of floating platforms for the offshore wind energy. Together, Subsea7 and Nautilus provide a robust integrated EPCI offering for floater technology, construction & installation for FOW farms.

#### Certification bodies:

- [DNV](#) is an independent expert in assurance and risk management. Driven by their purpose, to safeguard life, property, and the environment, they empower their customers and their stakeholders with facts and reliable insights so that critical decisions can be made with confidence. As a trusted voice for many of the world's most successful organizations, they use their knowledge to advance safety and performance, set industry benchmarks, and inspire and invent solutions to tackle global transformations. They are the world's leading classification society and a recognized advisor for the maritime industry. They deliver world-renowned testing, certification and technical advisory services to the energy value chain including renewables, oil and gas, and energy management.
- [SGS TECNOS](#) is the world's leading testing, inspection and certification company. They are recognized as the global benchmark for sustainability, quality and integrity. SGS offers assessment, verification, testing and support services throughout the entire life of your wind energy project, from the conceptual phase to the design, manufacturing, transportation, installation and set-up of wind turbines.

#### Manufacturer:

- [SMULDERS](#) is a multidisciplinary and international construction company with an established reputation in the engineering, production, supply and assembly of heavy, technically complex and architectural steel structures. They are also systems integrator for offshore wind farms. Smulders offers a full range of services from engineering and fabrication to the complete turnkey solutions (EPCI) of substations and foundations for offshore wind. Smulders has a track record of over 2,000 transition pieces, 160 jackets and 35 substations.

#### Association:

- [World Forum Offshore Wind \(WFO\)](#) is the world's leading business platform for the offshore wind industry. By connecting and supporting our members, WFO is helping to make offshore wind one of the world's leading sources of renewable energy. WFO acts as



an independent non-profit business platform. Their more than 120 members from around the world cover the complete offshore wind value chain.



## 5 Results

The AB meeting was planned for September 2024 (M12) in a physical format, but due to calendar restrictions, this was changed into an online format meeting in June 2024 (M8) and postponed the face-to-face meeting until November 2024 (M14).

The 1<sup>st</sup> WILLOW Advisory Board meeting took place on the 19th of June and 9 out of the 11 AB members participated on it: Aeroblade, DNV, Isati Engineering Solutions, Nabla Wind Power, Nautilus Floating Solutions, Otary, ParkWind, Smulders and SGS Tecnos.



Figure 3 – First AB meeting

The 1-hour meeting aimed to introduce the project to the members of the AB and to present the different topics that have started to be worked on within the scope of the WILLOW Project. In addition, mention was made of the data protection procedure, as participants were informed that as members of the AB, contact information will be shared with the WILLOW Consortium.

The agenda of the meeting is shown in the next figure.



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Figure 4 – Agenda for the AB meeting

## 5.1 Conclusions of the 1<sup>st</sup> AB meeting

During the meeting, members were reminded of the commitments they made when signing the AB contracts, which are:

1. Attend one general meeting per year
2. Provide valuable feedback
3. Attend specific requests from project partners whenever possible

The next AB meeting, which would be a hybrid meeting, was also reported. It was originally planned to be held in October in Belgium, to coincide with the consortium meeting. However, due to partners' agendas the project meeting will take place in SIRRIS facilities (Technologiepark-Zwijnaarde 48, Ghent, Belgium) on 20<sup>th</sup> and 21<sup>st</sup> of November and, therefore, the first hybrid meeting with the AB will be on 22<sup>nd</sup> of November 2024. The agenda of this meeting will be:

09:00 – 09:30 Brief introduction to the project and the connection between work packages and/or sub-groups

09:30 – 13:00 Technical meeting by sub-groups

Technical meeting A (Subgroups 2 & 3)

09:30 – 11:00 SG 2: Coating condition continuous monitoring, prediction and standardization for OWF



11:00 – 11:30 Coffee break

11:30 – 13:00 SG3: Uniform corrosion and pitting monitoring, prediction and standardization for OWF

Technical meeting B (Subgroups 1, 4 & 5)

09:30 – 10:30 SG 1: Cybersecurity strategy and standardization for OWF

10:30 – 11:00 Coffee break

11:00 – 12:00 SG4: Fleet lifetime assessment and standardization for OWF in curtailed conditions

12:00 – 13:00 SG5: Wind Farm Control in curtailed conditions

13:00 – 14:00 Lunch

14:00 – 15:00 *Optional visit to SIRRIS facilities*

After presenting the scope of each subgroup, AB members were asked to sign up for those subgroups of most interest to their organisations. The samples of interest from each organisation are shown in the figure below.

SUBGROUPS		Coordinator(s)	Company name
1	Cybersecurity strategy and standardization for OWF	CEIT	Aeroblade ISATI Otary ParkWind WFO
2	Coating condition continuous monitoring, prediction and standardization for OWF	C-CUBE/ SIRRIS	DNV ISATI Nabla Nautilus Otary ParkWind SGS Smulders
3	Uniform corrosion and pitting monitoring, prediction and standardization for OWF	SIRRIS/ CEIT	Capital Energy DNV ISATI Nabla Nautilus Otary ParkWind SGS Smulders



4	Fleet lifetime assessment and standardization for OWF in curtailed conditions	VUB/ 24SEA	Aeroblade ISATI Nabla Otary ParkWind WFO
5	Wind Farm Control in curtailed conditions	SINTEF	Aeroblade Capital Energy Nabla Otary ParkWind

*Figure 5 – AB entities per subgroup*

