

## ECN O&M Tool



### EWIS

Being one of the leading institutes on wind energy research, ECN established the EWIS (ECN Wind Industrial Support) group in 2009 to better bring the R&D results to the market. During the last three decades, ECN has developed expertise on aerodynamics, structural analyses, turbine control, offshore operation and maintenance, and grid connection. With the growing wind industry, ECN received more requests for assistance and EWIS has become the vehicle to support the wind energy industry in their product developments.

EWIS's focus is on the high end of the market which means that we will make use of tools and knowledge that have been developed in-house and include the latest R&D results!

The EWIS team is a mixture of young professionals and experienced researchers which ensures a fast response and high quality.

#### More information

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### Product description

#### The Software

The ECN O&M Tool Version 4 has been developed to estimate the long term annual average costs and downtime of an offshore wind farm. The O&M tool should be used in the planning phase of a wind farm. By means of "what-if analyses" project developers are able to compare the adequacy of different maintenance strategies with each other. Parameters like the reliability of components, usage and costs of vessels and weather conditions can be changed very easily and the program responds with cost and availability figures per year and per season.

#### The Model

The ECN O&M Tool is implemented in MS-Excel and consists of three modules:

WaitingTime This module analyses the wind and wave conditions and for each type of equipment the module determines the waiting time as a function of the mission time, which is expressed as a simple polynomial function.

CostCal In this module the costs and downtime for a certain wind farm with a certain O&M scenario are being calculated.

Application With this module the user can determine how many vessels and labour are needed in every season (and is new as compared to the previous versions of the ECN O&M Tool).

The tool uses long term average data as input (failure rates, wind and wave statistics, costs of vessels and spare parts, lead time of vessels and spare parts, etc.) and generates long term average values as output (costs, downtime, and required resources). Based on the results of the baseline scenario, cost drivers can be identified and by means of scenario studies the optimal strategy can be determined. The add-in module "@Risk" can be used to carry out uncertainty analyses once the optimal strategy is determined and to check the robustness of the output.

The tool functions very straight forwardly as it is programmed in MS-Excel. Each change in the input parameters immediately results in a change of the output parameters. Most users appreciate the openness of the software and consider the tool very user-friendly. The tool includes generated tables, pie charts and bar charts to identify the drivers for costs and downtime and to assist in defining an improved strategy.

## Specifications

Description of software:	<ul style="list-style-type: none"> <li>• ECN O&amp;M Tool 4-X Empty.xls</li> <li>• ECN O&amp;M Tool 4-X DemoK13.xls <i>(tool with reference study: large wind farm, far offshore, large turbines)</i></li> <li>• ECN O&amp;M Tool 4-X DemoProbK13.xls <i>(tool with reference study for probabilistic analyses)</i></li> <li>• User manual with model description and informative annexes (a.o. generic failure rates, access vessels and crane ships)</li> <li>• An MS-Word file with the public reference study to be used as an example and as reporting template (Not included is the MS Excel add-in module “@Risk” for uncertainty analyses.)</li> </ul>
Designated sites:	All offices of Licensee world wide
Licence fee:	€ 30000
Licence term:	Unlimited use
Services:	One day technical and software support (by telephone and/or e-mail, not on-site)
Additional maintenance fee:	€ 2 500
Additional options:	Three-day course given by ECN experts for € 6 000; dates and detailed contents on request

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The model requires an extensive list of input parameters and a detailed description of the proposed O&M strategy. By doing so, the tool forces the user to consider all aspects relevant for O&M in large detail. During the process of defining the baseline O&M strategy and collecting the required input data, users are often confronted with the fact that only little information on e.g. failure rates and capabilities of vessels is known in the planning phase. Most users of the ECN O&M Tool consider the process of discussing the O&M approach in detail and finding agreement on the assumptions and input parameters equally important to the model output itself!

### The Experience

In 2007, the tool received a validation statement from Germanischer Lloyd, which makes it the only software validated worldwide for analysing O&M aspects! More than 20 leading project developers, manufacturers of offshore wind turbines, and consultants make use of the tool, and for many European offshore wind farms cost efficient O&M strategies have been developed with the tool. The results of the analyses are accepted by financiers and due diligence. Every year the users of the tool meet during the annual user day meetings and a.o. they give feedback about the tool. ECN has incorporated their recommendations in Version 4.

### Optional: three-day training

A three-day training is offered to help you to get the most out of the ECN O&M Tool.

Day 1 is intended to make you familiar with the three modules and the uncertainty analyses. First an introduction is given, second the modules are shown live, and third you will do exercises yourself.

Day 2 is used to learn how to determine the input parameters for the model like failure rates, vessel capabilities, weather conditions, and costs for the wind farm under consideration. You will learn how to deal with uncertainties and missing information, and to draw up a baseline O&M scenario for your own wind farm (learning-by-doing). Emphasis will be put on reporting assumptions, input data, and results in such a way that they can be reviewed easily within your company or by external parties, for instance during project certification and due diligence.

Day 3 is usually spent some time later. After the second day you are able to use the tools to model your wind farm and find the optimal O&M strategy. During the work you may get confronted with difficulties. The third day can then be spent having your work reviewed by ECN and/or having a meeting and getting assistance on specific issues.