

D2.2 LCoE tool description, technical and environmental impact evaluation procedures

This document describes a Floating Offshore Wind Assessment Tool (FOWAT) by including a detailed description of the economic evaluation module, the environmental evaluation module and a description of the technical Key Performance Indicators (KPI) that are used in the evaluation. In accordance with the projects objectives, the Overall Evaluation Tool described here includes procedures to enable the calculation of the following aspects to be considered in both Phase I and Phase II evaluation of the concept designs:

- Economic assessment: Levelised Cost of Energy (LCoE) calculation expressed in €/MWh and included in the LCoE module of the Single Calculation Mode of the tool.
- Environmental assessment: Life Cycle Assessment (LCA) analysis using three environmental indicators included in the LCA module.
- Risk evaluation: Technology risk assessment included in Risk module.
- Uncertainty assessment: Provides LCoE calculation considering an uncertainty range as per the inclusion of uncertainty ranges in some of the inputs used for the LCoE computation. This assessment is available in the LCoE module in the Evaluation Mode of the tool.
- Ranking generator for concepts designs: Calculation of the final evaluation ranking of the designs using the results of LCoE, LCA and Risk assessment (multi-criteria analysis). This operation is executed in the Multi-Criteria module.
- KPI information: Concept design technical description using key performance indicators and generation of a KPI report.

Section 2 of the report includes a brief review of existing available LCoE tools that have been taken into account to inform the development of the LIFES 50+ evaluation tool. The aim of this section is to provide a general overview of existing and similar tools to calculate LCoE for offshore wind technology, but a thorough review and comparison of tools has been omitted.

Section 3 provides a general description of the tool and how it has been structured, including the general description of the modules (LCoE, Risk, LCA, KPI report maker, Uncertainty and Multi-Criteria).

The LCoE calculation approach in Section 4 will give detailed descriptions, which include methodology, general assumptions, life cycle cost of floating wind farms, energy production calculation approach, LCoE uncertainty approach and finally an overall description of the evaluation tool.

Further, the LCA analysis dealt with in Section 5 focuses on describing the methodology behind this assessment and the selection of three environmental impact indicators that are going to be calculated for the four concepts at each site (Global warming potential, Non-fossil abiotic depletion potential, Primary energy consumption).

Section 6 provides a description and list of the technical KPIs that have been selected to characterise the concept designs. These KPIs will be used during the data collection process in order to verify the consistency of the data provided by the concept designers for the LCoE calculation. Moreover, KPIs will not be included in the multi-criteria decision methodology for selecting the two concept designs for Phase 2 evaluation.



Section 7 of this deliverable provides a description of the multi-criteria methodology implemented in the tool to provide a single final ranking of the four concept designs using the following weighting factors:

- Economic Assessment-LCoE= 70%
- Risk Assessment= 20%
- Environmental Assessment- LCA= 10%

The Multi-Criteria module will store the different matrix results of the LCoE and LCA calculation for each site and concept design. Each matrix will be treated in order to convert the absolute values (e.g. €/MWh for LCoE, or kg CO₂eq for LCA) into scores from 1 to 4 as explained in D2.5. There will be no need of further treatment of the outputs from the Risk module, as they will be expressed in the same dimensionless scoring system.

Section 8 gives a detailed case description of the LCoE module tool being tested by defining a Floating Offshore Wind Power Plant (FOWPP) at a specific location and calculating its LCoE. The specifications of the components are based on available data from literature. However, some restrictions are related to the LIFES50+ project such as a minimum water depth at the location of 50 m and an offshore wind turbine with a rated power of 10 MW.

Finally, Section 9 concludes as follows: The aim of D2.2 is to describe modules that comprehend the LIFES 50+ Overall Evaluation tool named “Floating Offshore Wind Assessment Tool- FOWAT” that has been developed within this project to qualify the four concepts designs under an economic, environmental, risk and technical perspective. The objective of this deliverable is to provide the methodological framework used for the development of both LCoE and LCA modules, to describe the tools’ architecture and the data introduction Excel document, and to provide a visual description of the overall tool appearance and how the specific modules have been integrated.

As a final remark, it should be stated that the methodology that this document presents for the LCoE ranking considering the uncertainty has been proposed by IREC to the Evaluation Committee and its use within the project is subject to its approval by the end of M17 (October 2016).

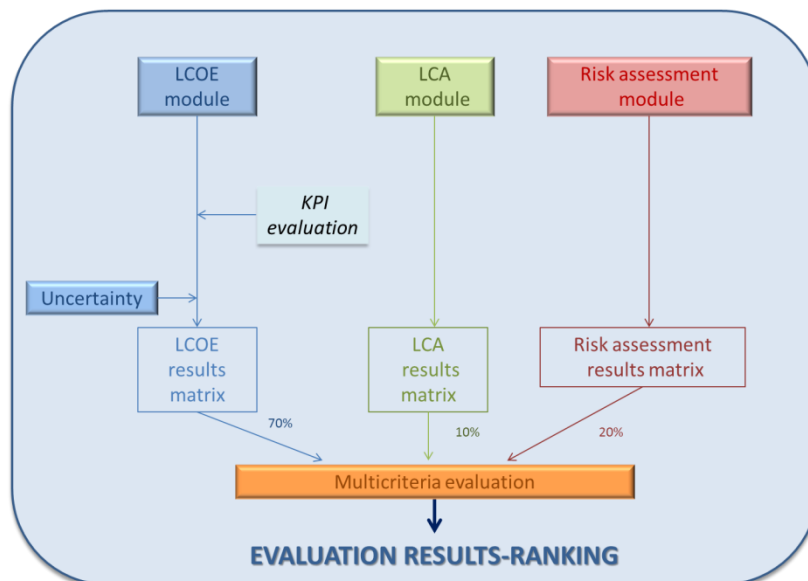


Figure 1. Overall evaluation tool structure