QUICK GUIDE – LIFETIME ANALYSIS

Purpose:

The following quick guide shows you how to perform a lifetime analysis according to DNVGL-ST-0262 (2.2 Analytical part) using the LOAD RESPONSE module in windPRO 4.0. This fatigue lifetime calculation provides indicative results and is intended as an initial analysis of the potential for a lifetime extension of the WTG asset.

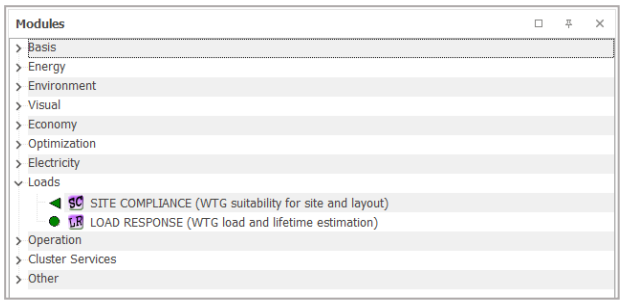
Outline of Guide:

1. **Prerequisites for the analysis**
2. **Setting up the analysis**
3. **Reviewing results**

1. PREREQUISITES FOR THE ANALYSIS

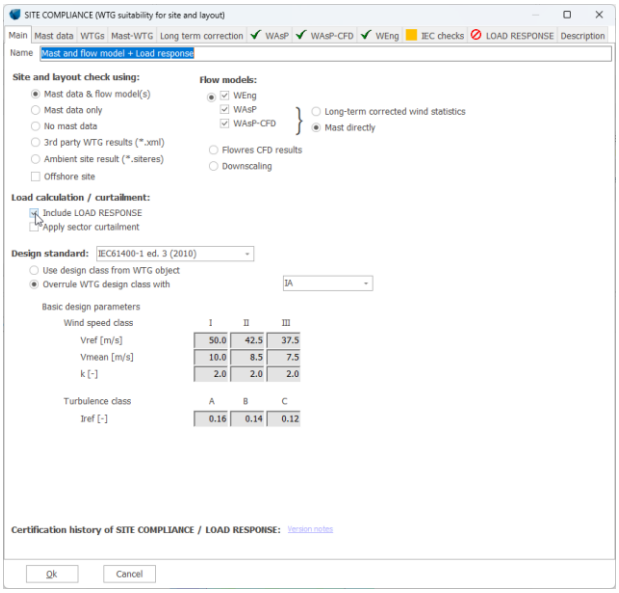
The lifetime analysis in windPRO 4.0 is performed using the LOAD RESPONSE module. As a result, you must ensure that both the SITE COMPLIANCE and LOAD RESPONSE modules are installed, and you have valid licenses for both.

From the "Settings & Help" tab clicking "Show window" all your installed modules can be viewed. If both SITE COMPLIANCE and LOAD RESPONSE are installed and licensed properly you should see the same as shown below.

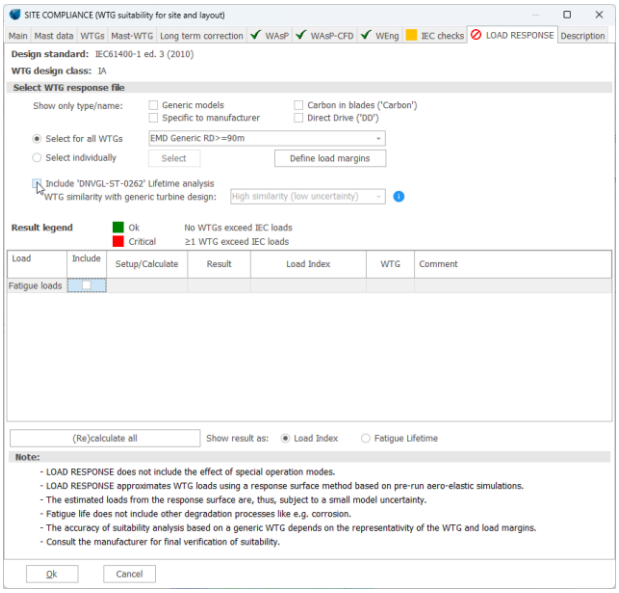


2. SETTING UP THE ANALYSIS

Firstly, a SITE COMPLIANCE analysis must be performed, where LOAD RESPONSE must be included in the main tab.



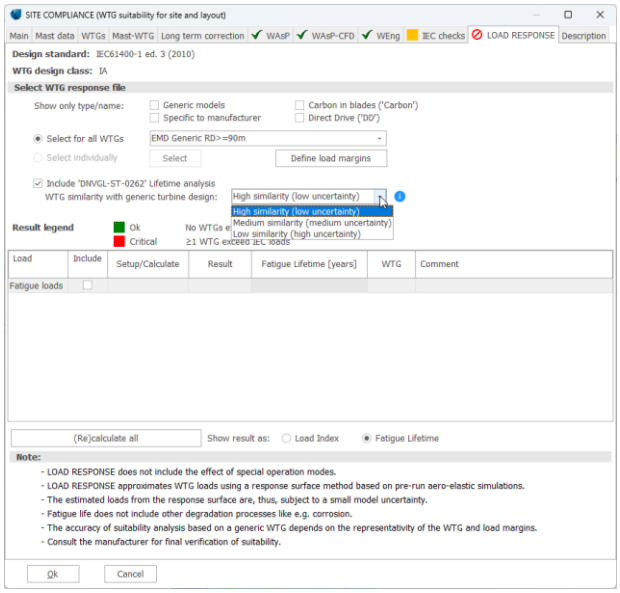
In the LOAD RESPONSE tab, the lifetime analysis is included by checking the "Include "DNVGL-ST-0262 Lifetime analysis" box.



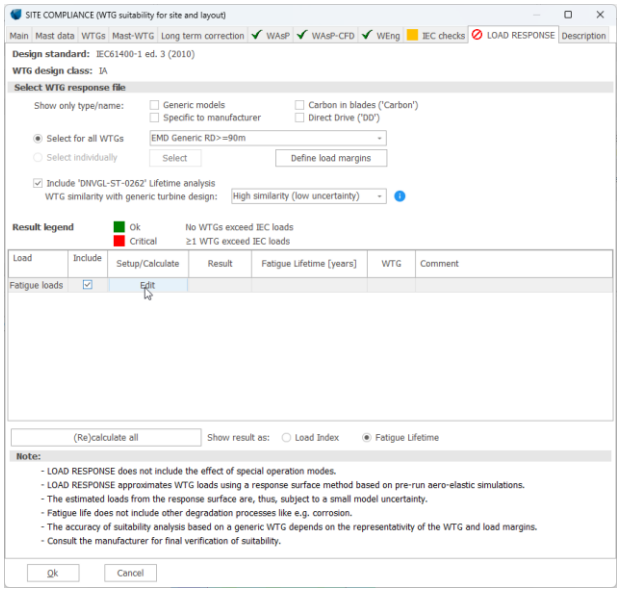
When using a generic WTG response file, you must further specify the similarity of your WTG with the generic turbine model.

Choosing e.g., high similarity results in a lower amount of uncertainty included in the lifetime assessment. As a result, this decision should be considered carefully to include appropriate uncertainty

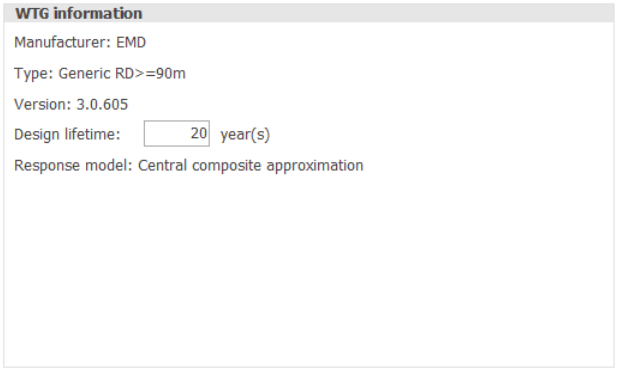
in the fatigue life assessment. The generic turbine model to compare your WTG with is a standard 3-bladed with standard nacelle/hub, steel tower and collective pitch, similar to e.g., NREL 5MW or DTU 10MW.



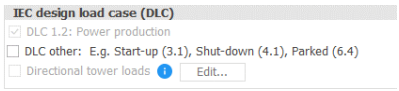
Access the calculation setup by clicking the "Edit" button as shown below.

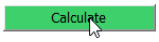


Verify that the design life in the WTG information window corresponds to your specific WTG. By default, this is set to 20 years.



Consider including the DLC other in the IEC design load case (DLC) window. Since excluding the contributions from start-up, shut-down and parked conditions would result in an overestimation of the lifetime assessment.

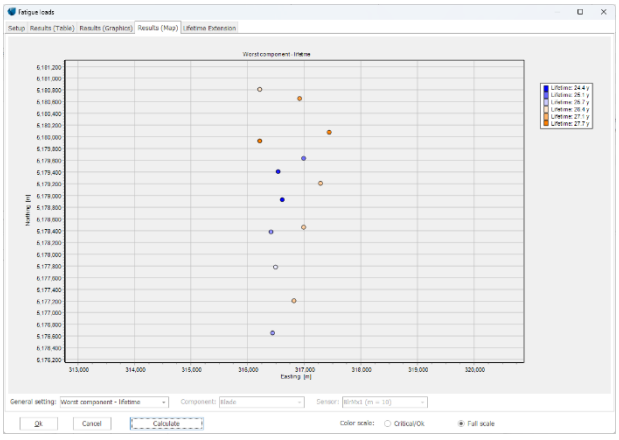


After reviewing the remaining load calculations setup options perform the lifetime analysis by clicking the calculate button. 

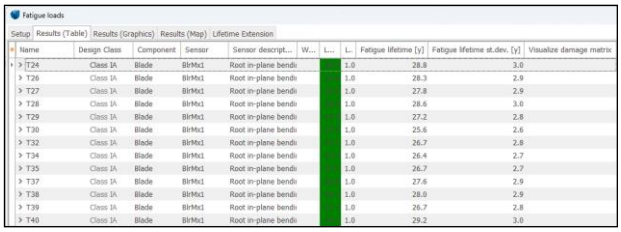
3. REVIEWING RESULTS

After the calculations are performed (typically only a few seconds) several results tabs will be available.

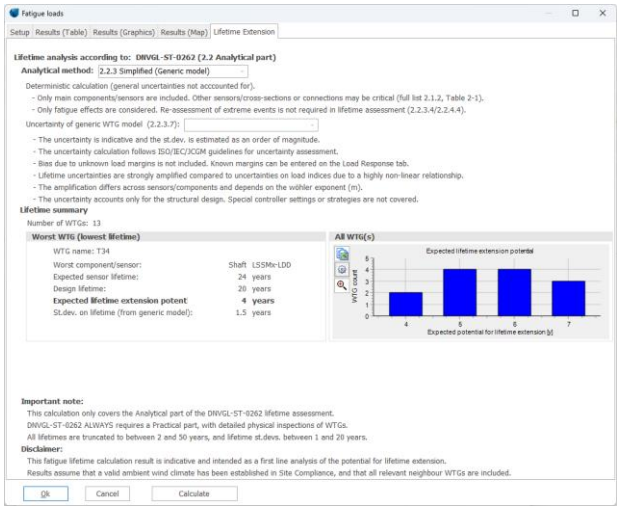
The lifetime estimates for each WTG can be viewed at the "Results (Map)" tab. The figure visualizes how the fatigue lifetime estimates of the WTGs vary across the site.



In the "Results (Table)" tab the fatigue life and the standard deviation of the fatigue lifetime can be viewed for each sensor included in the WTG response model.



Finally, the "Lifetime Extension" tab presents general information about the lifetime analysis. Furthermore, it outlines main assumptions and uncertainties related to the calculations and summaries the expected lifetime extension potential of the WTGs.



It should be noted that the calculation only covers the analytical part of the DNVGL-ST-0262 lifetime assessment which states that there must always be a practical part, with detailed physical inspections of the WTGs in any lifetime extension of a WTG. Nevertheless, this simple fatigue lifetime assessment can be indicative of the potential of a lifetime extension. As a result, it would provide valuable input to the planning process of any WTG park or as an initial analysis of the potential of a lifetime extension of an existing park.

For more detailed information about the theorical background for the lifetime analysis please refer to LOADS manual.