

# OPTIMIZE

## Optimizing a Wind Farm Layout



### Function

Optimizes a wind farm layout with regard to energy production or optimizes the operation mode plan to comply with noise limits with minimum loss of production. Includes Park Design - a utility for fully geometrical wind farm layout with interactive control of design requirements for the wind farm area.

### Calculation model

The calculation is based on a pre-calculated wind resource map using the WAsP model or CFD. The available land for the wind farm is digitized or loaded from GIS and within this area the optimization takes place. Different modes of optimizations are possible: gradual addition of turbines, incremental change of geometric layouts, filling up the land with maximum number of turbines or optimization of noise operation mode of fixed layouts. The calculation models are developed by EMD.

### Necessary input data (objects)

Note, that entering of objects is done via the WindPRO module BASIS. Please read the BASIS description for further details.

#### The WTG Area Object:

One or more WTG areas are digitized on the screen. For each partial area specific requirements as number of WTGs and/or installed capacity can be entered together with required minimum distances between the WTGs. The WTG area object can also define restriction zones where turbines cannot be placed, such as road, lakes, built-up areas and otherwise protected land including an identification of terrain too steep for wind turbines.

#### Wind Resource Map (.rsf WAsP file):

Normally, a pre-calculated wind resource map is required for the area in order to carry out the automatic optimization. However, for areas with simple and uniform wind conditions, e.g. for offshore projects, a simple wind distribution can be used.

#### WTG type(s):

A WTG type can be selected from the WTG catalog (where you can create new/own WTGs) but it is also possible to define different WTG types in different project areas before starting the optimization in order to allow an optimization of areas with different WTGs. Existing WTGs can be included in the calculations but naturally the positions of the existing WTG will remain unchanged. Each turbine type may have several noise operation modes for which power curves can be selected. This is used to optimize the noise operation settings.

### Description

Several different methods can be used for the optimization either independently or together:

**A:** Park design with strict requirements to a geometrical layout (for example straight parallel lines with equal distances between the WTG).

Based on the initial geometric layout the optimizer can test a matrix of parameters (spacing, angle etc.) to find the optimal layout of the wind farm. This is particularly useful for off-shore wind farms.

**B:** Random layout optimization: The optimizer gradually add turbines to the layout on the best location available keeping the already placed turbines optimal until the requires number is reached or no more turbines can be placed.

**C:** Fill area: The optimizer automatically packs an area with turbines keeping the specified spacing between turbines.

**D:** Noise optimization: A specified layout is optimized with respect to noise operation mode to get the minimum loss of production. If the wind farm cannot comply with noise limits even at the lowest settings the most problematic turbines will be removed until the wind farm comply with the noise requirements.

### Calculation Report

The resulting optimized layout can be used by all WindPRO modules, please see the respective module descriptions for details. It is possible to print maps with wind resources, wind farm areas and the resulting layout together.

