Openwind

A state-of-the-art wind farm design and optimization software used throughout a wind project's development to create optimal turbine layouts that maximize energy production, minimize energy losses, account for plant development costs and generate overall project efficiencies. Perform energy estimates and conduct additional analyses that are key components to a plan banks will approve.

Maximize energy production

Cost of Energy Optimization

Optimize layouts and turbine positions to minimize the cost of energy, taking into account energy production, O&M costs and capital costs including turbine and plant development costs. Understand the impact each turbine has on the bottom line. Arrive at the best layout by taking into account:

- Access road costs
- Collector system costs
- Waterways, pipelines, fence-lines, wetlands and more
- Substation & grid connection locations
- Electrical losses
- Power Purchase Agreement length
- Operations & Management costs
- Wind resource and wake losses

Gridded Turbine Layers

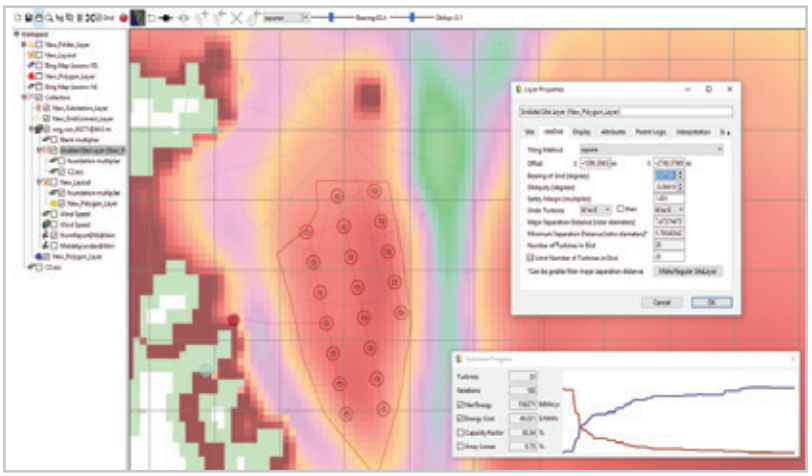
- Quickly create and modify gridded turbine layouts using the user-friendly GIS interface
- Design by hand using intuitive graphical tools
- Allow optimizer to determine downwind and crossing spacing, grid orientation and obliquity

Reduce and Quantify Uncertainty

- Model environmental and directional curtailments
- Take account of measurement uncertainty, MCP uncertainty and modelling uncertainty
- Assign turbines to met masts, adjust WRGs and run energy estimates
- Let the software suggest additional sites for met masts to extend the monitoring campaign and minimize project uncertainty

Multiple Design Turbine Layout Option

- Analyze multiple turbine layout options for cost effectiveness including different hub heights & turbine types



Minimize energy losses

Deep Array Wake Model (DAWM) & Standard Wake Models

Leading-edge wake models consider the interactions between turbines and atmospheric boundary layer as well as allowing wakes to vary with turbulence intensity and stability

- Openwind offers users 5 different customizable wake models to choose from including
  - Modified Park
  - N. O. Jensen (variety of wake combination schemes)
  - Eddy-Viscosity
  - Deep Array Wake Models (Park & Eddy-Viscosity versions)

Time Series Energy Capture

(12x24s, annual or long-term time series at hourly or 10 minute intervals)

- Run energy capture calculations that take into account time-varying temperature, air density, and turbulence intensity
- Model realistic availability using Markov chain models, which can vary with season
- Model high wind hysteresis, low- and high-temperature shutdown losses
- Diurnally varying wake losses
- Icing losses based on met data
- Parasitic consumption, blade heating & electrical losses
- Effects of bat curtailment and NRO modes
- Output results for entire project or individual turbines

Directional Curtailment, Inflow Angle, Turbulence

- Model effects of directional curtailment by specifying curtailment strategy in detail or by setting criteria for automatic sector management

Non-Ideal Performance Losses

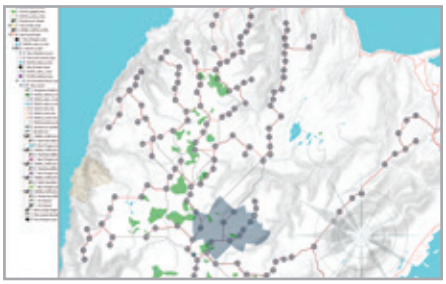
- Use multi-height met mast data to assess the effects of non-standard shear using the rotor equivalent wind speed and adjust power curves for different ranges of turbulence intensity

Environment management

- Noise Modeling
  - ISO 9613-2
  - Harmonoise
  - CNOSSOS-EU (NMPB 2008)
- Vary atmospheric attenuation based on ISO 9613-1
- Automatically generate NRO strategies based on noise constraints
- Turbine Scheduling (Noise, Bat, Shadow-Flicker Curtailments)
- Shadow Flicker
  - Take account of wind time-series data
  - Take account of sunshine hours
- Visual Impact Modeling (variety of ZVI measurements)

Suitability & work efficiencies

- Effective Turbulence Intensity and Terrain Complexity
  - Implements IEC 61400-1 editions 2, 3, 3 amendment 1 and draft edition 4.
  - Allows customization of those elements open to interpretation
  - Facilitates easy comparison of turbines to their appropriate IEC curve or custom curves
  - Automatically generate wind sector management strategy to meet IEC requirement
  - Optimize layouts while taking account of likely wind sector management losses
  - Set suitability limits for turbine layouts based on the appropriate IEC standard
- GIS and GPS Integration
- Validated energy capture
- Comprehensive import/export capabilities



Wind Developer Suite

Openwind is part of the Wind Developer Suite. The Wind Developer Suite is an all-inclusive bundle offering clients a range of products to support the development, assessment and operation of renewable energy projects. The Suite leverages our knowledge and expertise to enable your team to do its work more productively, effectively and the option to work more independently.

The Wind Developer Suite includes:

- Windnavigator
- Windographer
- Openwind
- 10 training hours

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