



CASE STUDY /

Simulation of Wind Turbine Sites Increases Power Yield and Reduces Risk – SSE

“Our internal policy is that using CFD reduces flow modeling uncertainties by a third over using the industry standard linearized models. The consulting and support services provided by Ansys significantly reduced the time needed to deploy this powerful modeling capability in an HPC cluster environment.”

Christopher Rodaway

CFD Engineer & Wind Analyst / Resource Assessment, SSE

Wind energy is a rapidly growing source of electricity. When developing wind farms, turbine siting assessment is critical to maximizing the energy yield and economics at a given location.

/ Company Description

SSE is the largest renewable generator of electricity from across the UK and Ireland with a significant wind portfolio.

/ Challenges

Detailed understanding of how the prevailing wind conditions interact with the local terrain and potential wind turbine installations is an essential part of the process of developing onshore wind farms. Many currently-employed software programs are not well suited to complex onshore terrain where factors such as atmospheric stability, forestry and turbine interactions play a significant role. The accurate prediction of wind conditions including wind speed, wind shear, wind veer and turbulence intensity both under ambient and waked conditions is vital for intelligent project design.

/ Technology Used

- Ansys CFD with WindModeller
- Ansys ACE Consulting and Support Team

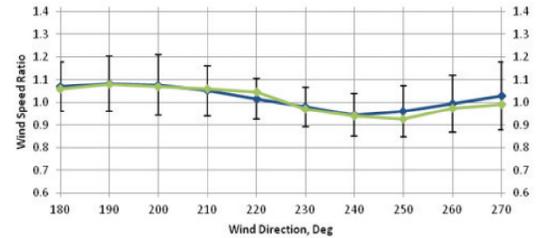
/ Engineering Solution

Powerful electromagnetic simulation tools are essential to Polytenna. The most important features for us are:

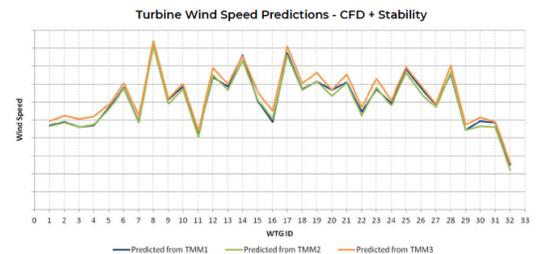
- Collaboration with the Ansys ACE consulting and support team.
- Deploying Ansys CFX with WindModeller onto the in-house HPC cluster.
- Using over 25 onshore development and operational wind projects across SSE's portfolio to produce validation results. Industry standard tool, with widespread acceptance. The industry recognises HFSS as a reliable tool, and customers readily accept the simulation results.

/ Benefits

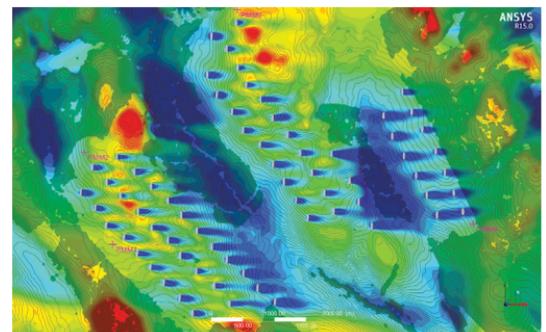
- Software tools were well validated.
- Ansys CFX with WindModeller is an essential part of SSE's wind farm development toolset.
- WindModeller is used for energy production assessments, site suitability analysis, turbine positioning and turbine model selection. A 1% improvement on yield can generate additional revenue of several million pounds on a typical 100MW project over a 20-year lifetime.
- CFD can be used not only to calculate the wind resource, but also to assess site suitability for a particular turbine type (i.e., ensuring that the site turbulence conditions will not adversely affect the turbine lifetime).
- Accurate modelling of complex wind climates and turbine placement optimization significantly reduce the risk posed to long-term asset integrity.



Wind speed ratio comparison with measurement at site B. *Courtesy SSE.*



Turbine wind speed predictions at site B as predicted from three development meteorological masts. *Courtesy SSE.*

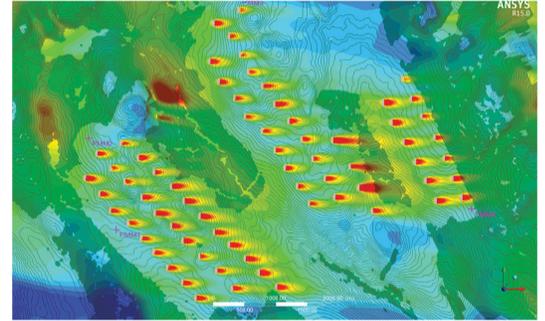


Waked velocity flow field at site A showing the wind turbines (grey disks) and permanent meteorological masts (pink crosses). *Courtesy SSE.*

/ Ansys WindModeller

WindModeller is a powerful tool for wind farm analysis that automates the simulation process from input known to the site analyst. It utilizes topographic data for the site, wind turbine types and locations, roughness and forestry information as well as wind data from anemometers on site, to evaluate a potential onshore site for wind energy generation. With the Ansys CFD solver, advanced turbulence modeling can be used to simulate complex terrain, forestry effects on the turbulence field, turbine wake interaction effects and atmospheric stability more accurately than alternative simulation tools used in the industry.

Additional reading: Jones, I.; Montavon, C. Where the Wind Blows, Ansys Advantage, V5 II.



Waked turbulence intensity flow field at site A showing the wind turbines (grey disks) and permanent meteorological masts (pink crosses).
Courtesy SSE.

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