

Application of LES CFD for evaluating mast and turbine positions for a complex terrain site at Scottish mountain

Tsubasa Windfarm Design has carried out LES CFD calculation for a complex terrain site for AGR-Group, UK. The unsteady LES CFD code from the software RIAM-COMPACT®, developed by Dr. Uchida of Kyushu University, Japan was employed for flow simulation.

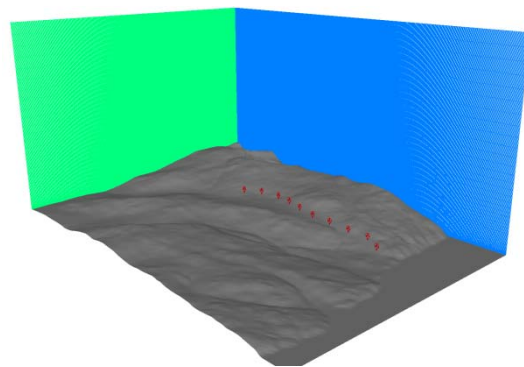
Topography data (WAsP map file) provided from AGR was combined with ASTER GDEM data for constructing the CFD model.

Calculation domain and grid mesh spacing was carefully considered. A total of 20 million grid points was calculated for a real time output of five minutes.

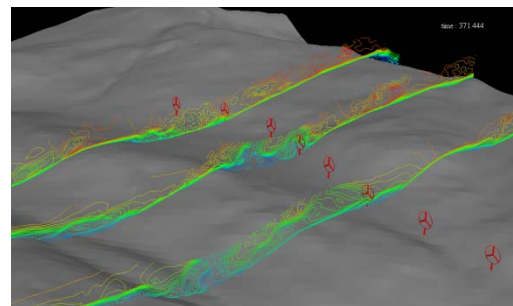
The LES CFD simulation predicted flow separation and onset of turbulence in the upstream terrain. As a result, turbulent wind conditions are seen across the turbine rotor face for several turbine positions.

The time series of inflow angle were analyzed. Inflow angle at hub height level were found to exceed IEC Standards. [Click here to see the interactive inflow angle time series.](#)

Based on the analysis results, it was recommended to avoid turbine placement at the identified areas of highly turbulent wind conditions. And a number of representative mast locations were proposed.

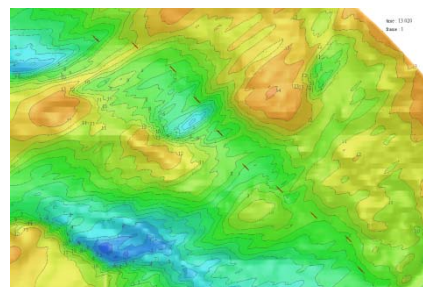


CFD Domain & Calculation Mesh



Flow Separation and Onset of Turbulence

[\(click here to see animation\)](#)



Average Wind Speed Map

[\(click here to see enlarged plot\)](#)

"The results of LES CFD simulation provide us essential information for evaluating turbine and mast positions. Highly recommended for complex terrain greenfield sites."

Gerd Habenicht, Technical Director of AGR Group