

Optimising Performance of Air-Cooled Condensers Using Wind Shields

Organizations

Galebreaker Ltd., an SME located in the United Kingdom, is recognised worldwide for manufacturing fabric-based products which guard against the elements in the industrial and agriculture sectors.

Ergon Research srl is an Italian SME that provides consulting and research optimisation using advanced simulation tools in the thermo-fluid-dynamics field.

CINECA is the largest Italian HPC centre and cooperates with academia and industrial partners.



End User



Technology Expert



HPC Provider

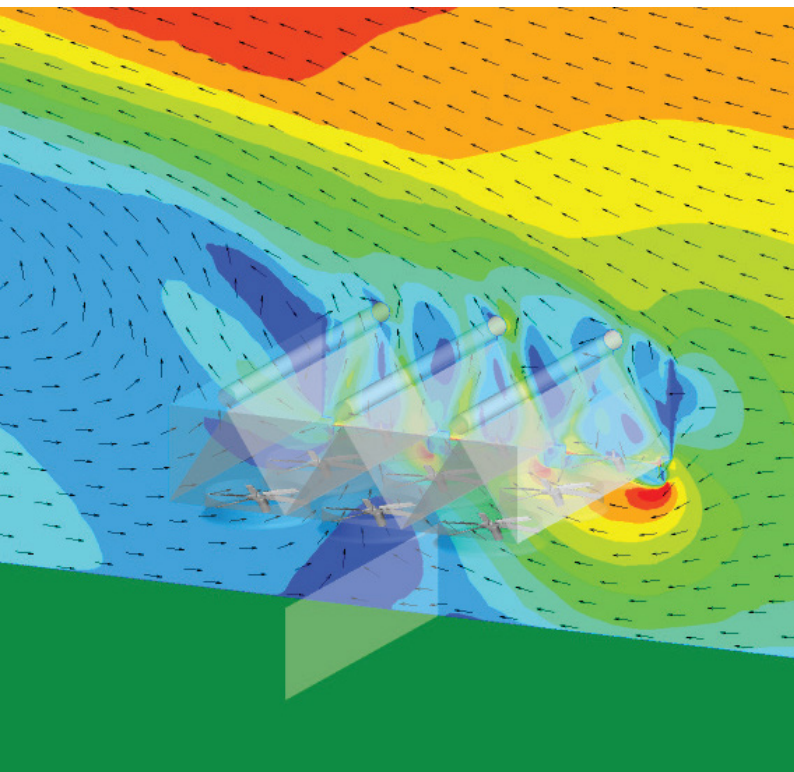


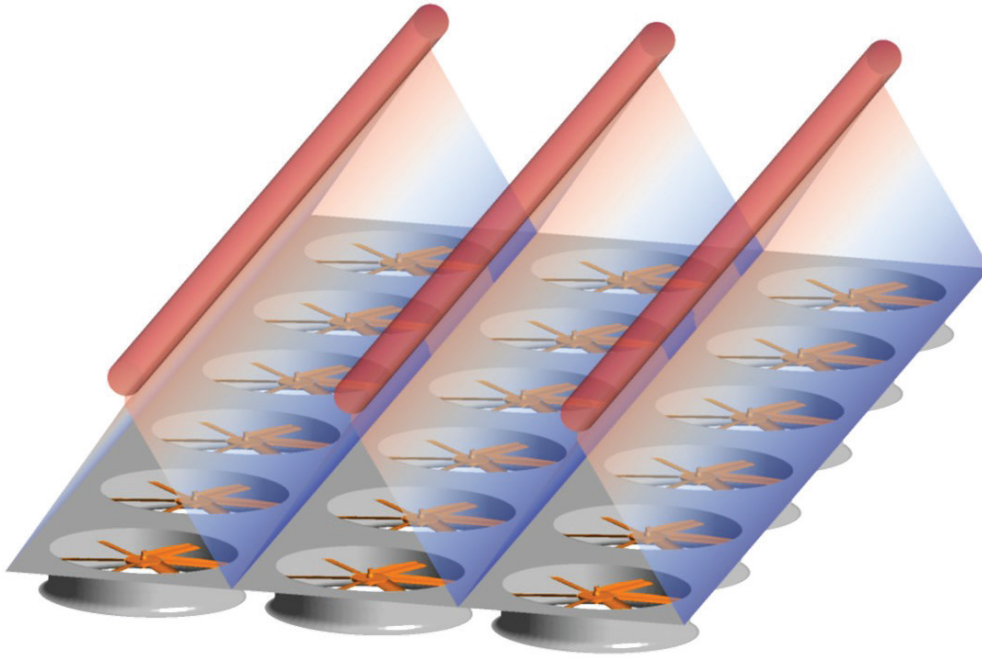
CINECA is part of the Italian NCC.



The Challenge

The performance of Air-Cooled Condensers used in power generation is affected by crosswinds which significantly impact the efficiency of the power generation plant. Windshields are used to optimize the system, but their size, placement and porosity can be subject to many local factors. In the design phase of the wind shields a more effective, accurate and quicker way of predicting the associated performance benefits is required.





Industry Sector
Energy

Technology used:
CFD Simulation

The Solution

The use of High-Performance Computing (HPC) for this application has changed what Galebreaker can offer new customers. Using a high-fidelity CFD model and extensive HPC resources, it was possible to identify windscreen layouts able to reduce the wind losses by 85% and to provide a significant reduction in the oscillating blade load. This has been achieved by implementing a high-fidelity computational procedure based on a full geometrical reconstruction of the blade geometry.

Not only has the accuracy of the analysis been improved, but the use of HPC has also meant the time and labour to obtain these results has been reduced by a factor of two making it possible to compute the benefits for a wide range of wind conditions. This in turn permitted development of a digital twin for real time performance predictions allowing the estimate of the yearly savings for a given annual weather forecast.

The Impact

Through a history of successful projects, Galebreaker and Ergon Research have gradually built a reputation for supplying reliable products that reduce the detrimental effects of wind on ACCs, with tangible improvements in the environmental impact of the energy sector. This has led to a growing number of customers being aware of the solution and wanting to check out if such windshields can benefit them but they do require credibility in the tools used.

Thanks to the outcomes of the experiment (more trustable windscreen design guidelines, the implementation of a digital twin, and a payback calculator) it will be possible, with reduced efforts, to accurately estimate the return on the investment for windscreen installation maximizing the attractiveness for the customers.

Benefits

- The use of HPC reduced the time for delivery of a screen layout optimization analysis by 50%.
- The High-Fidelity approach allows more accurate thermal outputs of the Air-Cooled Condenser.
- Dynamic fan blade loading can be analysed directly thanks to the modelling of the real blade geometry. This quantifies the cost reduction for gearbox maintenance and blade repair.