PowerCurve continues to challenge the status quo with its ability to rapidly scale computation resources up and down.

With atNorth's Gompute HPCaaS Platform, PowerCurve has been able to achieve at least a 10% improvement in the aerodynamic performance of their products, yielding even more wind turbine annual energy production.

atnorth

Overview

PowerCurve is a global provider of blade aerodynamic upgrade solutions, digital services, and consultancy services for the wind turbine industry. The company operates at the forefront of aerodynamic innovation using the latest tools and methodologies to help it achieve the maximum energy outputs possible from wind turbines. As part of this, PowerCurve relies on novel Computational Fluid Dynamics (CFD) analysis to model complex 3D flows, which allows them to optimize performance and upgrade solutions to meet the requirements of every individual turbine blade.

The power of CFD

At PowerCurve, CFD is an integrated and essential part of all its workflows for both external consulting and internal design processes. PowerCurve uses CFD to examine the performance of wind turbine blades and assess the upgrade potential from deploying different aerodynamic solutions. All wind turbine models have blades with unique shapes, making CFD a vital part of the design process to ensure that PowerCurve can create the optimal aerodynamic solution for each unique case. Both full-scale 3D rotors and small-scale airfoils are examined.

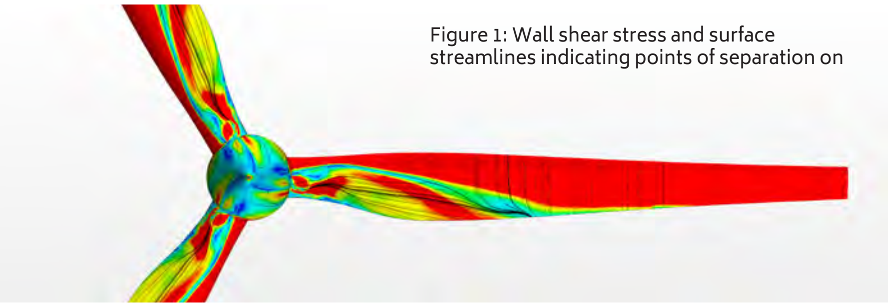


Figure 1: Wall shear stress and surface streamlines indicating points of separation on

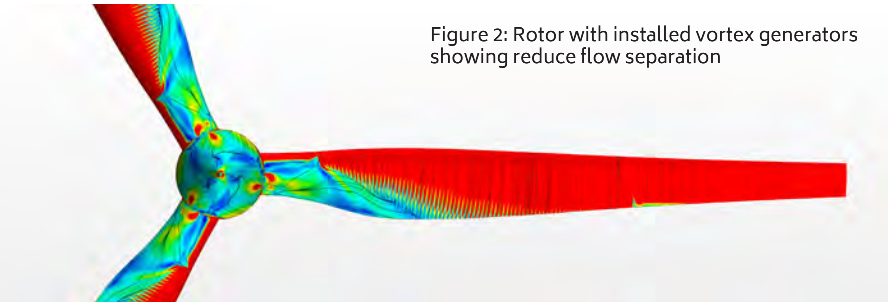


Figure 2: Rotor with installed vortex generators showing reduce flow separation

Modelling a 3D rotor requires a large number of computational resources - this is critical to producing valuable insight into complex 3D flow phenomena such as the separation occurring at the root sections of a wind turbine blade. Understanding the 3D flow allows for the design of aerodynamic solutions such as vortex generators (VGs) which can reduce flow separation and increase power generation. Being able to visualize the full 3D flow allows PowerCurve engineers to find the optimal placement and geometry of VGs to maximize the power output of the wind turbine giving its customers a higher generation yield from their assets.

PowerCurve puts atNorth Gompute HPCaaS platform at the heart of its aerodynamic innovation

“Implementing the Gompute HPCaaS technology has been a huge success for PowerCurve. With atNorth’s Gompute HPCaaS platform, we can run larger, more complex cases, which improves the accuracy of our results and provides deeper insight that we can leverage to make even greater improvements to wind turbine performance.

The consistent performance and sheer scalability of the Gompute HPCaaS platform has helped us to drive productivity improvements by reducing simulation runtime and increasing throughput, helping us to grow and scale workloads accordingly. It’s also meant that we can continue to put our customers first knowing we can deliver the very best solutions and services to support their turbine needs long-term

Nicholas Gaudern

CTO, PowerCurve

PowerCurve also uses CFD for small scale airfoil examinations. Examining individual airfoils can be used for preliminary design considerations before testing new aerodynamic solutions in expensive wind tunnel test campaigns. PowerCurve has used this strategy before when designing new VGs, which allowed a larger variation of designs to be assessed than would have been possible using only a wind tunnel given cost and time constraints.

Figure 3: Velocity field of a thick airfoil at high angle of attack with and without an installed vortex generator.

Cluster bursts boost RoI with the Gompute platform

To support its business computation needs, PowerCurve sought an HPCaaS platform capable of delivering the necessary HPC bursting capacity required for simulation and visualization projects. atNorth's award-wining Gompute HPCaaS platform delivers High Performance Computing, either as a Private Cloud service with bare-metal compute nodes for HPC workloads or as Bursting Clusters, reducing total cost of ownership while ensuring ultimate time to market, great performance, and a sustainable approach.

The variation in scale and style of the design can lead to a high variation in the requirements for computational resources. The flexibility of the bursting cluster from atNorth's Gompute HPCaaS platform has enabled PowerCurve to rapidly scale its computational resources up and down as required, ensuring it can cater for immediate needs as well as future proof its computing resources for tomorrow. PowerCurve immediately realized the benefits of using atNorth's Gompute HPCaaS platform. By enabling the team to complete a full rotor CFD analysis in a matter of hours, it became possible to carry out multiple high-fidelity iterations of aerodynamic upgrade pack design, leading to increased turbine energy gains.

PowerCurve estimates that by using atNorth's Gompute HPC platform, it has been able to increase the resulting wind turbine annual energy production realized from their products by at least 10%. The flexibility of the bursting cluster has also enabled PowerCurve to increase company revenue by enabling the company to take on more CFD consultancy projects knowing that the required computational resources will be available as and when required.

"Our Gompute HPCaaS platform provides true bare-metal performance with the scalability and flexibility needed to accommodate both long-term dedicated and bursting capacity with complete control and transparency. Customers can scale projects easily and quickly in the short-term whilst planning for future capacity needs - all on one platform.

Our work with PowerCurve has been a true partnership, and it has been a pleasure to work with the team to help them continue to be a real leader in aerodynamic innovation and deliver maximum performance to power the next generation of wind energy.

Iago Fernandez

HPC Cloud Sales Director, atNorth

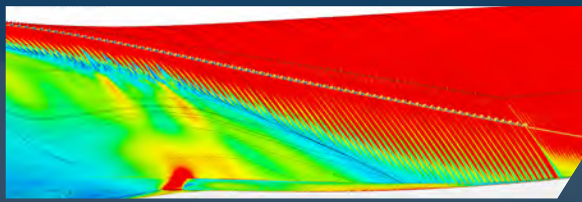
Key benefits

Drive productivity improvements by reducing simulation runtime and increasing throughput

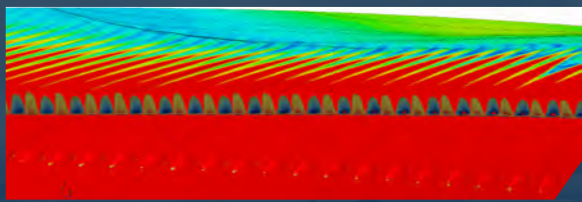
Ability to visualize the full 3D flow around the rotor to provide optimal VGs to maximize the power output

Rapidly scale computational resources up and down as required

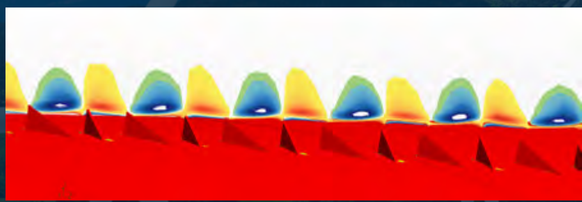
Increase in revenue as a direct result of projects it can now design and run on the platform



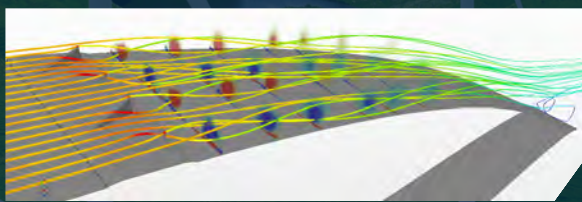
Wall shear stress and surface streamlines indicating points of separation. A vorticity scalar field has been added downstream of the VGs showing the mixing, leading to a re-energization of the boundary layer.



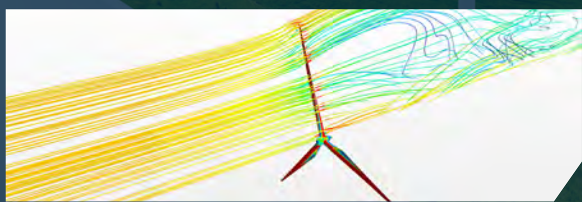
Closeup showing the re-energization of the boundary layer due to the VGs.



Vorticity field highlighting the vortices created by the VGs.



Streamlines with vorticity scalar field, showing the strength of the vortices downstream of the vortex generators and the associated mixing of streamlines.



Streamlines showing complex downstream wake in 3D rotor simulation.

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