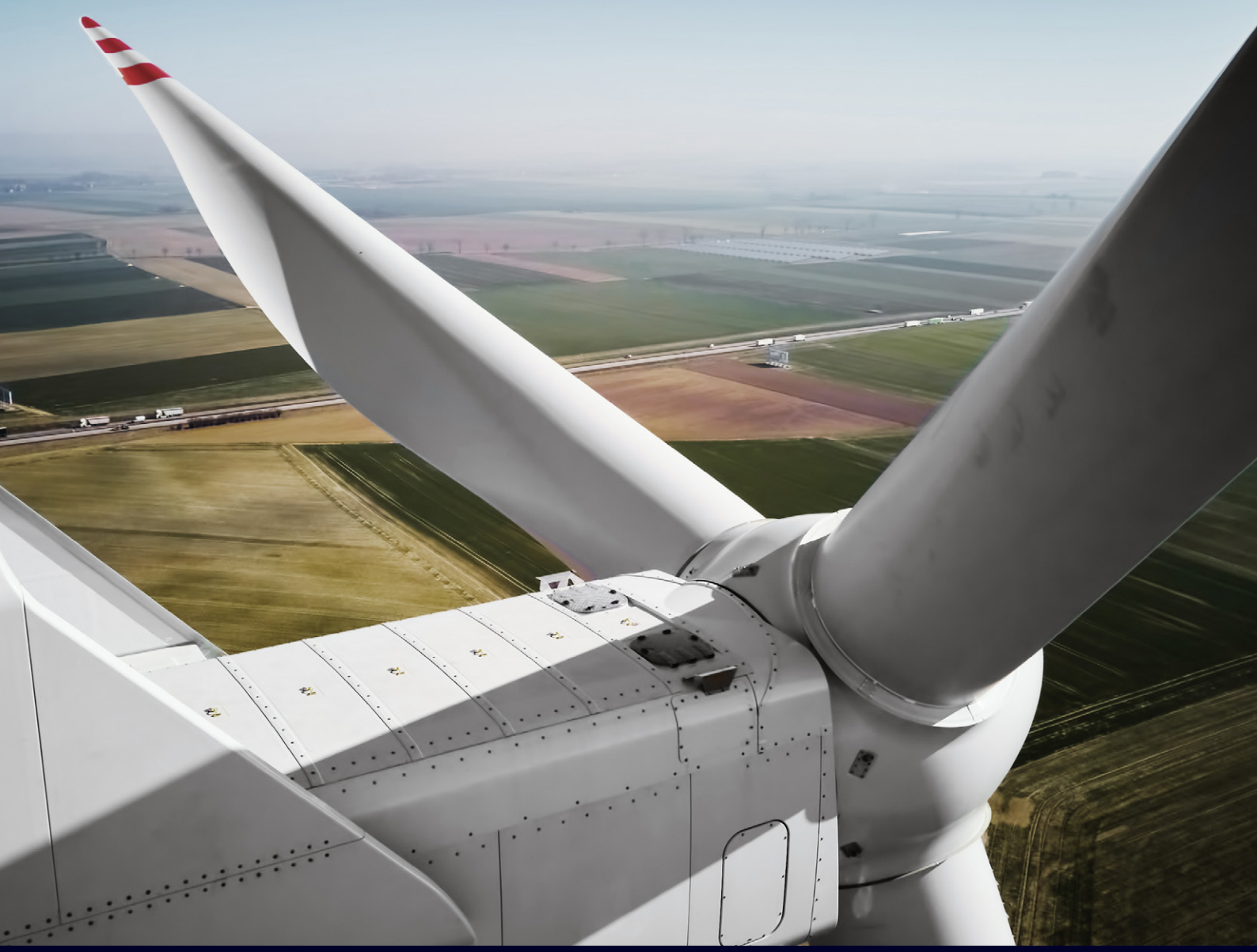

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Advanced Engineering Simulation

Accelerate innovation with advanced engineering simulation for wind power

The International Energy Agency (IEA) predicts, global energy requirements to increase until through 2040. As worldwide decarbonization efforts boost renewable energy usage, wind power is forecasted to play an increasingly prominent role in global energy. With average annual growth of more than 20%, wind power is the second-largest renewable energy source behind hydroelectric, and the industry is expected to receive trillions in investments in the coming decades in efforts to improve performance while lowering costs. To achieve these goals and become a leading global energy source, wind power companies can accelerate innovation by incorporating advanced engineering simulation into their development processes.

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Traditional prototyping: slow and steady used to win the race

Wind power companies need continuous improvement. Across the supply chain, the need to reengineer assets and systems of all sizes and shapes is nothing new. Perhaps blade lengths needed to increase. Maybe a design change was required to reduce warranty claims that were eroding gross margins. Regardless of the need, engineers were typically able to resolve the issue using the day's traditional methods. Over time, performance improved.

They accomplished this using proven methods such as physical prototyping, complex calculations on spreadsheets and early computational modeling tools. Users could imitate reality and manipulate their systems' potential behavior to suit their needs. The new design candidates were produced under controlled conditions, and their performance levels were assessed and iterated until the new requirements were met.

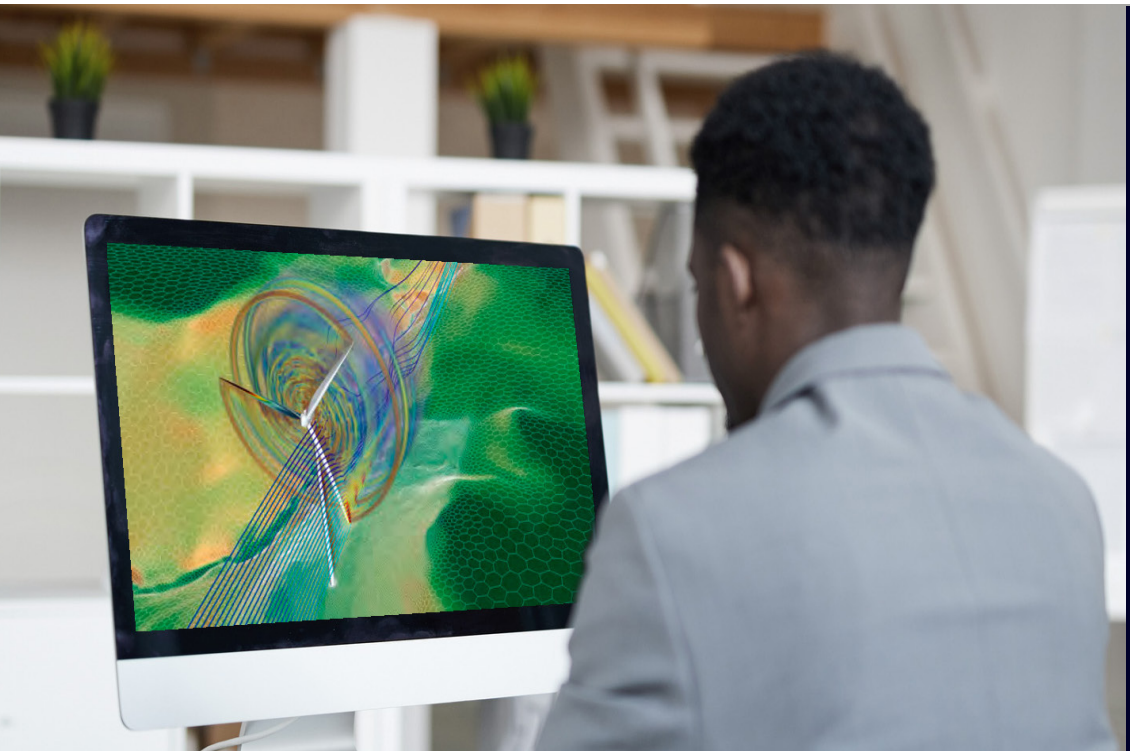
Full-scale models could then be made and tested in the field until they performed as predicted in advance of full-scale operation.

Regaining the lead requires a new approach

Today, every wind power business is being driven to increase power generation, deploy at scale with a competitive levelized cost of energy and reduce waste. That hasn't changed. What's new is the incredible pressure to do more of it, faster and at a time when industry profit margins are tight. Local regulations for decarbonizing and reducing emissions are also creating new barriers for some businesses and opportunities for others. Unfortunately, those who cannot add and leverage new capabilities to improve their processes will struggle to survive.

Time spent on simulation is seldom wasted

What's needed is a closed-loop approach to innovation that enables the systematic improvement of intricate equipment designs and processes along with a corresponding improvement in operations. An innovative way to do this is to combine advanced engineering simulation tools with high-performance computing (HPC) systems that seamlessly connect with cloud platforms. These tools improve your engineers' understanding of the complex physics within mechanical systems like wind turbines and wind farms. These insights can be applied to correct performance deficiencies, improve operations and reduce manufacturing costs.



Identify and remedy risks to system integrity before they become critical.

Faster prototyping

Advanced Engineering Simulation helps wind turbine companies accelerate product development processes. A key place this occurs is in producing prototypes for evaluation.

Historically, in traditional prototyping, physical models were produced and tested. This process was labor-intensive and cumbersome, and it often took significant time to produce satisfactory results. The prototyping process can now be accelerated using multi-physics simulation software and a digital twin to more accurately predict design behaviors before prototyping.

With current cloud-based technologies, it's possible to integrate the modeling results from multiple disciplines and suppliers onto one unified platform to produce more accurate real-world results. New designs validated this way have a much higher probability of performing as expected during physical testing. Furthermore, connecting simulation with the cloud and IoT closes the loop with insights from a deployed fleet of assets. This brings operational data and insights to an engineer's desk in an effective way.

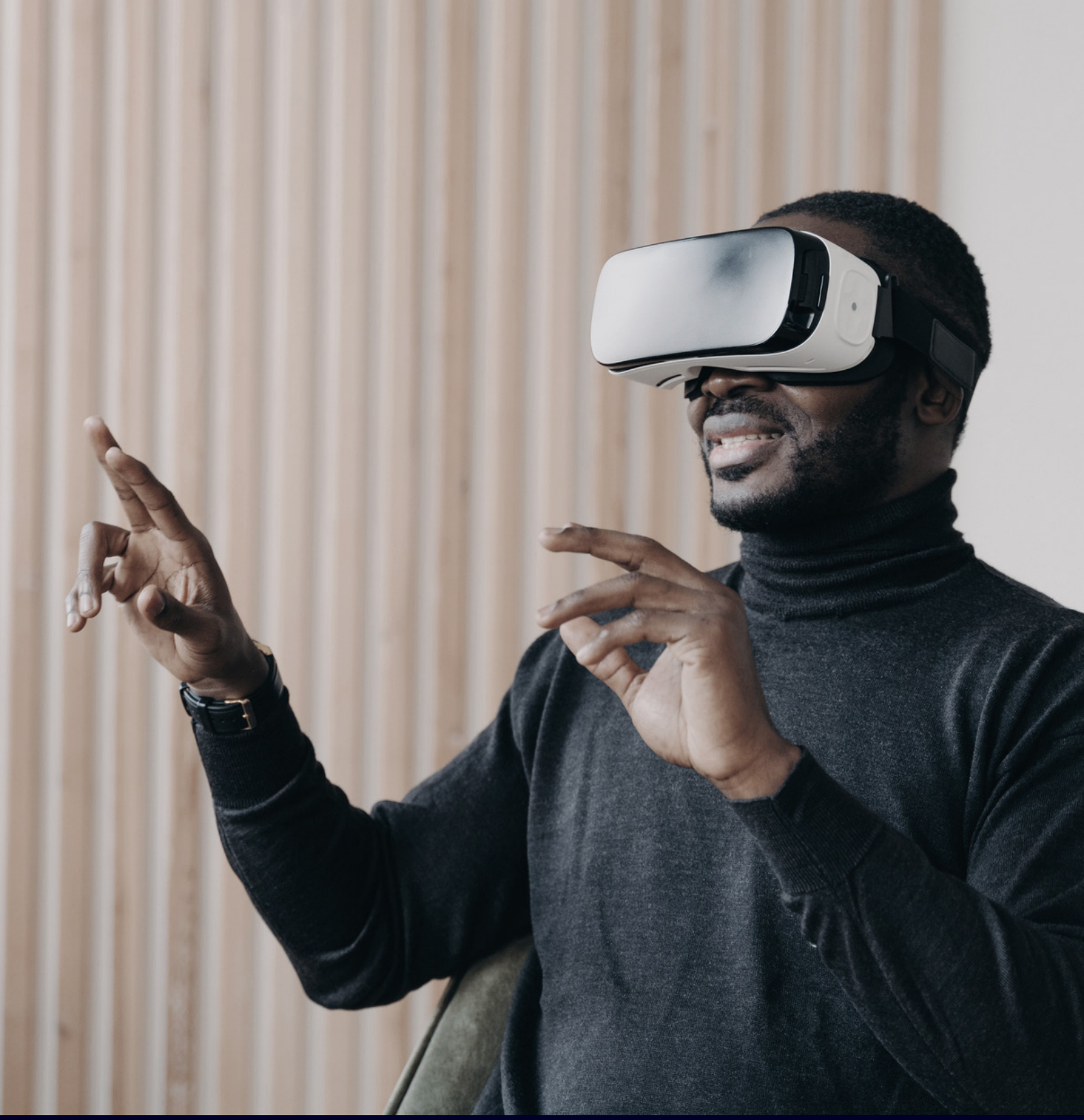
Arriving at a final design sooner using simulation also lowers costs by reducing expensive iterations and accelerating the deployment schedule. Energy and utilities companies that mastered this technique can connect their design and simulation teams to accelerate the create-simulate-iterate process. In fact, a 2017 study conducted by the Aberdeen Group found best-in-class engineering teams that adopted simulation-based design processes decreased their development times by 29 percent. By taking advantage of the integration capabilities between their design and multi-physics simulation tools, they built 27 percent fewer prototypes for significant savings in cost and time.

Innovative new designs

Combining engineering simulation and design exploration empowers wind power engineering teams to develop disruptive new turbine and system designs that stand out in competitive bids. For example, engineering service contractors and engineering, procurement and construction (EPC) firms can simulate turbine processes to produce offshore wind farm designs with lower ownership costs and reduced maintenance requirements. Owner-operators can troubleshoot specific wind farm areas to improve performance and reliability or develop proprietary process technology that gives them a competitive advantage.

Exploring the design space: the new frontier

Some of today's most exciting developments are in the emerging area of design space exploration. When multiphysics simulation results feed into mathematical models to explore and suggest new designs that automatically satisfy all constraints, engineering teams can achieve revolutionary new turbine designs, configurations and layouts that significantly improve energy production. The number of successful outcomes increases by eliminating the unintentional human biases that strongly influence and limit design output. Even new arrangements that were previously possible but not manufacturable can now be 3D printed, taking advantage of the latest high-performance materials. Furthermore, cloud-based 3D printing can add a new level of sophistication to workflows. For example, users can upload, edit and print their designs from any device, at any time. In combination, these exciting new capabilities fuel disruptive innovations that solve the wind power industry's most challenging problems.



Conclusion

Advanced engineering simulation helps wind power companies increase innovation possibilities while accelerating business revenue. With the massive number of changes forced on every business, the ability to empower your teams with next-generation engineering and simulation tools has never been more critical. Regardless of your challenges, disruptive innovation tools can improve how you grow your business.

Are you ready?

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