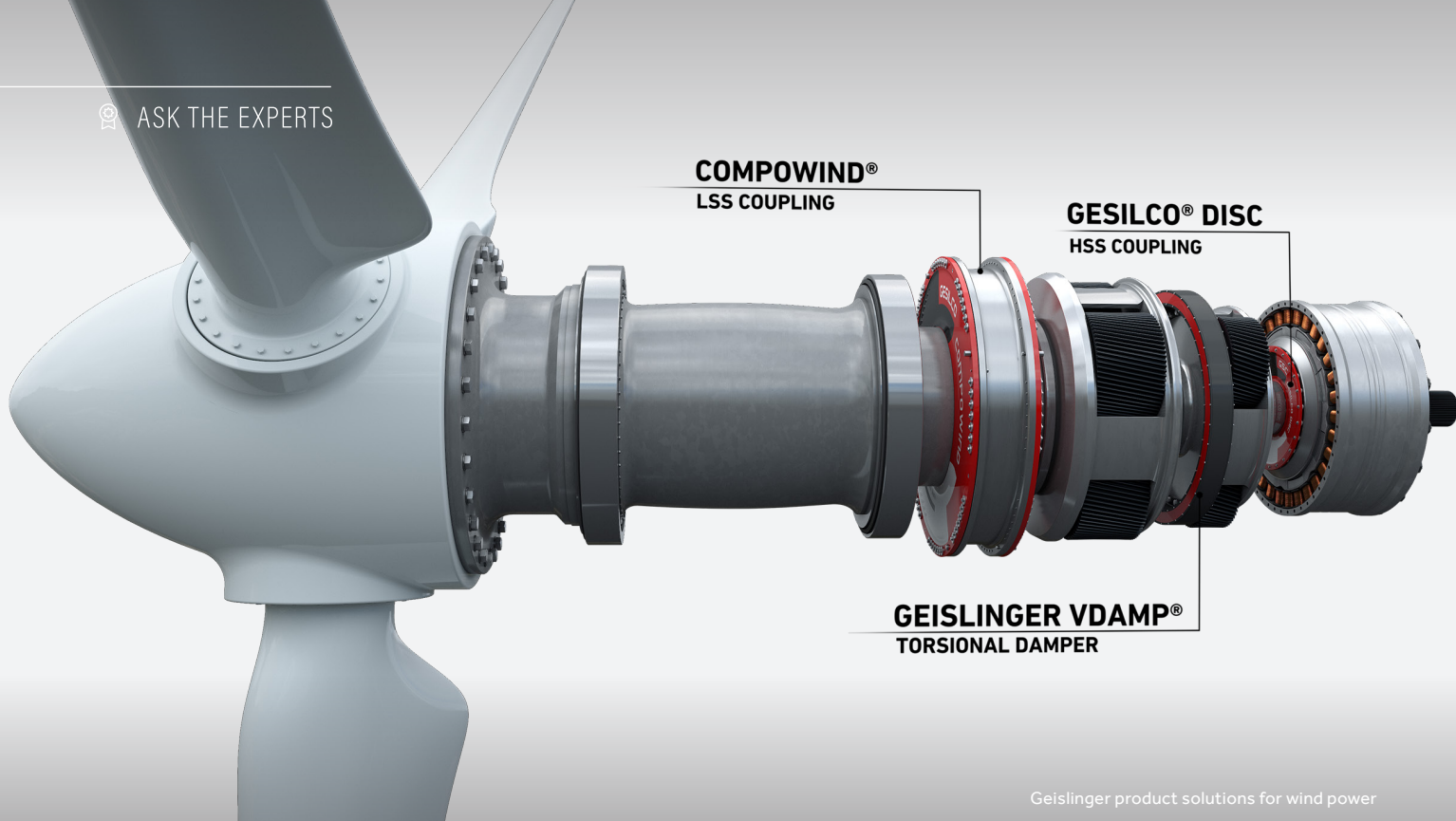




Geislinger product solutions for wind power

Driving drivetrain innovation in a changing wind industry

Geislinger CEO Torsten Philipp discusses the challenges and opportunities shaping wind drivetrain technology, from increasing torque density and supply chain resilience to the role of digital monitoring in improving turbine performance and uptime.

PES: Torsten, welcome, and thank you for joining us. Geislinger has long been recognised for drivetrain innovation, but your role in the wind industry appears to be evolving. To set the scene, tell us a little about what that evolution looks like today and where you see Geislinger creating the biggest impact.

Torsten Philipp: Thanks a lot for inviting me! And you are right: the wind industry is evolving, and so is Geislinger. We started our journey in the wind industry more than 10 years ago and, from the beginning, have contributed to increasing torque density and enabling larger wind turbines by developing groundbreaking technologies: the first mass-produced low-speed shaft coupling, the first gearbox-integrated vibration damper and the all-new carbon fibre sun shaft for planetary gearboxes to actively reduce tonalities. We continue to build on this heritage as a solution provider.

However, we have added two additional pillars to this. First, we understand that

robust and reliable supply chains are just as important as new technologies for our wind energy customers. With our global production footprint, we can now also offer more standardised components, such as hydraulic shaft couplings and friction discs, to all major markets.

Second, wind turbines are now an important part of our energy supply and must be considered critical infrastructure and high-value assets with significant commercial impact. Therefore, uptime is key, and we support this by introducing our proven monitoring and digital solutions to the industry.

PES: The wind sector is under pressure to deliver more capacity, greater reliability and lower costs, all at the same time. From your perspective, what are the biggest challenges the industry is facing right now, and where do you see the greatest opportunities?

TP: There are, of course, many challenges resulting from external factors such as geopolitics, national regulations and permitting processes. To me, one of the key

challenges for our industry is finding the right balance between growth and the ability to industrialise on the one hand, and the pressure to continuously improve and develop new technologies on the other. Too many new developments put pressure on industrialisation and profitability. Too few developments will lead to a loss of competitiveness in global markets.

The greatest opportunity for our industry clearly lies in global energy demand. Wind energy has proven to be a reliable and cost-attractive energy source. From a European perspective, I still believe that the strong European ecosystem of world-class research institutes, OEMs and key component suppliers provides a significant advantage when developing solutions for global markets.

PES: Supply chains have become a major talking point across the energy sector. Talk us through why building stronger local supply chains has become such an important priority, and how Geislinger is approaching that challenge while maintaining consistent quality worldwide.

TP: A reliable energy supply is the backbone of our society, and we see how vulnerable today's interconnected world can be when it comes to energy and supply chain stability. For Geislinger, this means global execution must go hand in hand with regional supply chains. We operate three plants in Europe, three in Asia and one in the US.

All of them need to be as independent as possible, while technology, processes and quality control must be overseen and coordinated by our headquarters in Austria.

PES: There is often a balance to strike between global standardisation and local flexibility. How do you ensure customers benefit from both rapid local delivery and proven, high-quality components?

TP: The wind energy market is a global market. Serving a global market means acknowledging regional requirements in terms of project execution, response times and localisation needs. This can be achieved through strong local teams and local supply chains, which is

why Geislinger continues to invest heavily in its global production footprint.

Nevertheless, product quality and reliability need to remain consistent worldwide, which means a strong headquarters function is essential.

PES: When it comes to drivetrain and powertrain technology, it is easy to focus on engineering. How do these innovations translate into tangible benefits for turbine operators, whether that is reliability, performance, noise reduction or compliance?

TP: Every development starts with the question: 'What is the added value for our customers or operators?' Technology without a significant impact on product performance will not be successful, whether the benefit comes from direct or indirect cost savings, strengthening the supply chain or complying with tonality regulations.

At the same time, I believe it is important to introduce new technologies to encourage discussion and design thinking. Only by



Torsten Philipp

remaining open to new technologies can we continue to drive innovation within our industry.

PES: Geislinger has always placed importance on working closely with customers and partners. Share how these collaborative development projects shape innovation, and perhaps an example of how working together has delivered a better outcome than working alone.

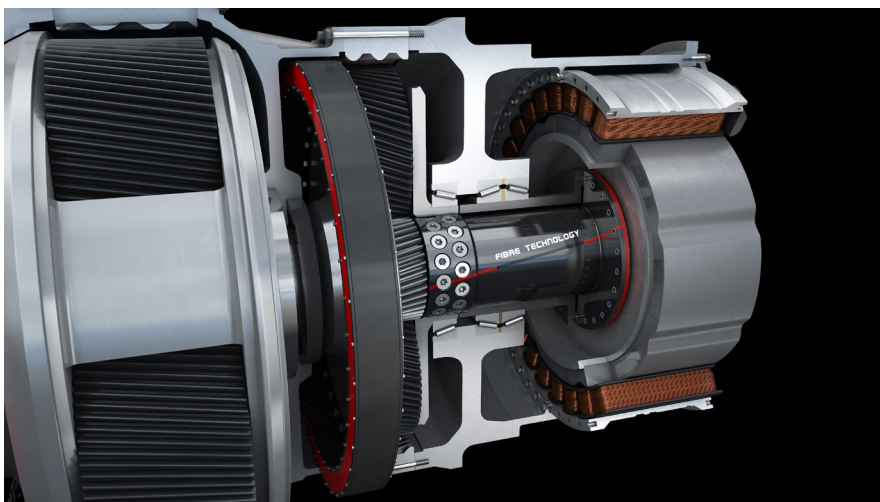
TP: Many of our product developments are highly integrated into turbine or gearbox architectures. These products need to be developed through close cooperation between OEMs and their strategic suppliers. Research institutes such as the CWD in Aachen can also play an important role in this process.

One example is our carbon fibre GESILCO® Silentshaft Coupling for large planetary gearboxes. The overall goal of reducing tonality and noise emissions from turbines led to joint developments that actively influenced the flexibility of the sun shaft through material and design modifications.

PES: Digital technologies are reshaping asset management across renewables. Tell us about Geislinger's AI-enhanced torsional vibration monitoring and why you believe this represents the next step in understanding the health of wind powertrains.

TP: The Geislinger Monitoring System and its cloud-based analytics platform build on more than 25 years of experience in vibration monitoring across various types of heavy rotating machinery.

With the significant increase in torque density over recent years, loads on powertrains have increased considerably. With the introduction of plain bearings in modern gearboxes, this trend will continue. Based on this development and discussions with operators, we see a clear need to monitor powertrain behaviour much more closely than is currently done.



Geislinger GESILCO® Silentshaft Coupling

Geislinger uses robust, easy-to-install sensors to gather high-frequency data directly from rotating components and feed it into our cloud infrastructure, where analysis, benchmarking and data sharing with other condition monitoring systems (CMS) are possible.

PES: Operators are increasingly looking beyond reacting to failures and towards predicting them. Explain how better monitoring and data insights can improve maintenance strategies, extend component life and ultimately maximise turbine uptime.

TP: You are right. Preventing catastrophic failure is mandatory for every CMS, but it is not enough. This is exactly what we address with our high-frequency datasets and corresponding cloud infrastructure. Using machine-learning algorithms, we can run anomaly detection, benchmark all assets within a wind farm and identify problems at an early stage.

In this respect, we have learned a lot from our second-largest industry sector: shipping. Unplanned downtime of vessels causes an immediate financial impact, and the industry is extremely sensitive to this. The same is true for the wind industry, where the business model depends on maximum uptime and maximum turbine output.

However, uptime is not everything. Operators also aim to maximise the lifetime of their assets, thereby optimising asset utilisation. In the future, anomaly detection



Geislinger headquarters in Hallwang, Salzburg, Austria

combined with benchmarking across an entire wind farm could enable further optimisation of energy production, as well as more accurate prediction and extension of wind turbine lifetimes.

A comparable approach is already employed by the Geislinger Monitoring System, whose

cloud-based analytics platform enables performance monitoring, predictive analytics and maintenance strategies for specific components in the maritime industry.

PES: As turbines continue to grow in size and torque density increases, how do you see drivetrain technology evolving over the next five to ten years? What should the industry be preparing for today?

TP: I guess the path towards higher output and increased power density is quite clear. From a technology perspective, this will certainly go hand in hand with more plain bearings, more compact gearboxes and therefore stiffer and more sensitive designs.

These designs are typically not only more highly loaded but also more prone to noise emissions. Intense front-loading, collaboration between partners and thorough validation will be key to successfully introducing new technologies.

PES: Finally, what message would you like to leave with turbine manufacturers, operators and industry partners about the importance of collaboration and innovation in shaping the future of wind energy?

TP: The European wind energy industry in particular has an impressive and unique landscape: world-class research institutions, key component suppliers and leading OEMs. We need to use this network much more effectively to develop technologies that are both technically superior and competitive in global markets.



Geislinger production facility in Bad St. Leonhard, Carinthia, Austria

[geislinger.com](https://www.geislinger.com)