

TREND PAPER

# **AI CENTER AT WINDENERGY HAMBURG 2024**

AI.HAMBURG

# AI at work for WindEnergy Hamburg 2024

AI trends and solutions for the future of wind energy production.

# Preface

## Artificial Intelligence is part of WindEnergy Hamburg



"The wind energy industry does play a key role in reducing CO2 emissions from energy production for the world's climate. The WindEnergy Hamburg is the world's biggest and most important wind business platform for exchanging news and views and building networks. Digitalisation and artificial intelligence are key for the further growth of the wind energy industry. At the AI CENTER we show, in cooperation with AI.HAMBURG, the variety of solutions, the innovations and the inspirations that AI has in store for us. The AI CENTER and this trend paper invite exhibitors, visitors and readers to embrace the possibilities of AI for the wind energy industry, individual business opportunities and a more sustainable future.

*Heiko M. Stutzinger, CEO Hamburg Messe und Congress*

## AI solutions transform the wind industry and drive business success



"2024 is the year in which Artificial Intelligence proves again to be one of the most significant innovations in human history. The technology provides previously unimaginable possibilities and innumerable opportunities. WindEnergy is an important pillar of a better future for us all. We are convinced that AI will not only enable this industry to grow its profits, but also to grow its important contribution for clean air and against climate change. This makes us proud to be partnering with WindEnergy Hamburg in presenting a new generation of startups at the AI CENTER. The AI CENTER will be a forum for ideas, a springboard for innovations, and last but not least a reference point for the role of AI in the future of wind energy.

Petra Vorsteher and Ragnar Kruse, AI.HAMBURG - Part of AI.GROUP



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# 1. WindEnergy Hamburg 2024: New horizons with AI

Renewable energy is key for successful sustainable development. It can deliver an important contribution to achieving the Sustainable Development Goals of the United Nations<sup>1</sup>. Wind energy is an important source for renewable energy. In Germany, wind is already the most important source of energy. And it sees strong growth in the future. In 2023 22 % of the electricity in Germany was wind energy that was produced onshore. And the trend shows even more potential: In the first quarter of 2024, more wind energy plant projects have been approved in Germany than in the entire years of 2017 and 2018 combined. In the same year, the approved new capacity for future offshore energy production exceeds the current total capacity.<sup>2</sup> Wind energy is a globally used energy source and many countries aim to grow its contribution to the energy mix. For example, the US DEPARTMENT of Energy issued a target of 35% of US energy coming from wind in 2035 - a little more than 10 years from now.<sup>3</sup>

The technology of producing wind energy has seen steady progress. That is important because, as we all know, the wind is a dynamic force that challenges us whenever we want to use its energy. To unlock the full potential many factors have to be included into the equation. The effectiveness and efficiency of plants have to step up. Ecological challenges like bird protection ask for new and more effective answers. Power outputs have to be predicted more precisely for wind energy to become a more reliable part of the energy mix.

The integration of wind energy and other renewable sources of energy that depend on the weather is becoming increasingly important with their growing shares in the total energy mix. Many of these challenges can be addressed by using Artificial Intelligence (AI) in ways never seen before. One example for a start: Recently developed AI methods support feed-in forecasts and help to incorporate numerical weather model data, meteorological measurements, satellite data etc. into one transparent prediction model.<sup>4</sup>

AI has of course been used before in agriculture, manufacturing and many industries. But the recent developments in computing power, model development and especially the application of generative AI have created a completely new chapter for wind energy, one of fascinating new possibilities and business opportunities.

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<sup>1</sup> <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>

<sup>2</sup> ("Habeck: „Wir erleben eine ganz neue Dynamik beim Erneuerbaren-Ausbau“ 2024)

<sup>3</sup> ("A New Era for Wind Power in the United States" 2015)

<sup>4</sup> ("ZSW: AI in Wind Energy")

## 2. The power of AI for wind turbines, wind farms and the energy grid

Digital transformation brings change to the wind industry as to other industries. The ability to capture and manage data becomes a key success factor in improving operations of turbines, wind farms and managing the energy grid as a whole. Digital transformation today is nothing without the application of AI. And one thing is for sure: AI is more than ChatGPT. AI offers a palette of opportunities to bring wind energy production to the next level.

### AI to identify and manage wind turbine maintenance issues

Contemporary wind farms consist of great numbers of turbines. Locations become ever more remote. Many sources of data and an ever-growing amount of data need to be included in the equation. Machine data, drone images, weather etc. The amount and nature of data can overwhelm a traditionally working operation. Advanced analytics and computer vision help to identify faults and filter issues by severity, type or location. Critical factors like the conditions of blades or the turbine brakes become ever more transparent once the power of AI is harnessed to the full extent.<sup>5</sup>

AI can even help to minimise the threats wind turbines can pose to flying animals like birds and bats. With the help of AI-enabled image recognition cameras that monitor the space around the turbine's blades can detect approaching species early on and might in the future be able to shut down or slow down the relevant turbines in time.<sup>6</sup>

### AI-enhanced digital twins to better manage turbines and farms

Digital twins are reshaping the way wind turbines are operated. These digital representations of reality provide data-driven insights for informed decision-making that leave yesterday's approaches behind. The digital twin becomes even more powerful in a team. The combined digital twins of one or even many wind farms offer comprehensive insight into the status and performance of the whole portfolio.<sup>7</sup> AI helps to make digital twins more powerful. It can increase the speed of analytics. This will help to identify patterns that should be avoided because they provoke system failures, or find patterns that increase efficiency or signal maintenance issues.

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<sup>5</sup> (Croning 2023)

<sup>6</sup> ("BirdRecorder: preventing protected species of birds from colliding with wind turbines")

<sup>7</sup> (Croning 2023)

## AI make the “smart grid” possible

The MIT Technology Review describes the power grid system as the most complex machine ever built. It is so vast, that any one person can ever fully grasp everything happening within it at a given moment.<sup>8</sup> Many governments have recognized the importance of including AI in the future management of energy grids. The US Department of Energy announced in November 2023 to make \$3.9 billion in funding available for programs for grid resilience and innovation partnerships.<sup>9</sup> The challenges are manifold and some may come as a surprise: Electric vehicles are responsible for a growth in energy demand at a scale similar to when air conditioning became ubiquitous in the United States.<sup>10</sup>

One factor is the prediction of feed-in. The relationship between the energy grid as a whole and the contribution of highly volatile energy production based on wind and sun can be complex. The precise prediction of energy feed-in would be a major step ahead. Different approaches are being researched at the moment. The latest AI methods are used to achieve higher accuracy. Some AI systems deliver probabilistic wind power forecasts for up to 180 hours, for certain usage types and even for up to more than 380 hours.<sup>11</sup>

Another factor is the prediction of energy demand. A grid operator in the United States that serves 15 US states and parts of Canada tested machine learning models to reduce the time needed to calculate and predict energy for the next day. With AI the calculation could be done 12 times faster than before.<sup>12</sup>

Intelligent grid management is still in its infancy today, but AI will help to bypass a rocky time of adolescence and help to achieve a fast maturation. While some may think of fully automated grids in the future, the truth will certainly be even more complex still. AI is a more than welcome ally to help to overcome the many challenges that lay ahead.

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<sup>8</sup> (Kim 2023)

<sup>9</sup> (“Grid Resilience and Innovation Partnerships (GRIP) Program”)

<sup>10</sup> (Kim 2023)

<sup>11</sup> (“ZSW: AI in Wind Energy”, n.d.)

<sup>12</sup> (Kim 2023)

### 3. Solutions, innovations, inspirations:

## The AI CENTER at WindEnergy Hamburg

The AI CENTER at the WindEnergy Hamburg provides solutions available today, innovations for the future and inspiration of what will be possible with the application of AI. Here AI.HAMBURG showcases a diversity of startups and speakers. Visitors will experience AI productivity tools and their possibilities for Wind-Energy and the Energy-Sector as a whole. Visitors are invited to embrace the fascination of Artificial Intelligence technology and make it work for the growth of the wind energy industry.

The companies listed in this Trend Paper present their solutions and products at the AI CENTER:



## Delfos' AI-Driven predictive and intelligent management platform ensures maximum asset performance

Delfos is redefining the management of renewable energy assets with a sophisticated solution tailored for wind, solar, and hydro sectors. This innovative platform offers predictive maintenance, asset performance modules, energy production tracking, and customised alert systems, specifically designed to enhance the efficiency, reliability, and performance of renewable energy assets.

Operating on a global scale, Delfos monitors more than 12GW across various energy sectors, showcasing its capacity to handle extensive data and improve operational efficiencies. The platform's advanced predictive maintenance technology is a cornerstone, engineered to foresee potential issues and optimise the maintenance schedules of wind turbines and other renewable assets. This proactive approach not only extends the lifespan of the equipment but also ensures maximum energy output and operational reliability.

Targeting Independent Power Producers (IPPs), utilities, service providers, and investment funds, Delfos offers a comprehensive AI-driven technology solution that transforms the way renewable energy assets are managed. By integrating key performance indicators and real-time data analytics, Delfos empowers stakeholders to achieve peak performance and substantial energy production efficiency.

In an industry driven by the need to adopt sustainable and efficient energy solutions, Delfos stands out by delivering a platform that not only supports the operational needs of renewable energy providers but also aligns with global sustainability goals. Through its intelligent management platform, Delfos ensures that renewable assets operate at their optimal capacity, making it a pivotal player in advancing the renewable energy landscape.

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## LATODA's groundbreaking AI innovations improve rotor blade maintenance

LATODA stands at the forefront of integrating artificial intelligence into the wind energy sector, specialising in precise image recognition and object detection solutions that revolutionise wind turbine maintenance. With operations rooted in Germany and Japan, this expert AI service provider leverages sophisticated algorithms to meticulously analyse rotor blade damages and detect leading-edge rain erosion, quantifying associated Annual Energy Production (AEP) losses across expansive turbine fleets with unmatched accuracy.

At the core of LATODA's offerings is LATODAEssentials, a bespoke data platform designed to support blade inspection companies in managing and interpreting large volumes of inspection data. This platform delivers AI-driven assessments and precision analytics for inspected rotor blades, significantly enhancing the accuracy and reliability of maintenance decisions.

Dedicated to advancing predictive maintenance through ongoing research and development, LATODA's team of expert AI developers and data scientists delivers services on a global scale. Their work primarily benefits wind turbine operators and owners, inspection companies, manufacturers, blade repair businesses, insurance firms, and investors in wind energy infrastructure.

LATODA is recognized for using artificial intelligence not only to achieve optimal results in rotor blade maintenance but also to empower stakeholders with the data needed to make informed decisions. This approach significantly boosts the sustainability and operational efficiency of wind energy assets, ensuring LATODA's role as an essential partner in advancing the industry's maintenance standards.

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# Kavaken elevates the efficiency of renewable energy operations with AI

Kavaken, a trailblazer in the Software as a Service (SaaS) sector, is redefining the operational, financial, and insurance aspects of renewable energy plants. Based in Newcastle, UK, this innovative platform simplifies and streamlines asset management, making it a cornerstone for sustainability in the renewable energy ecosystem. Kavaken's commitment to enhancing how renewable energy assets are handled resonates across its diverse clientele, including power generation and energy companies, asset management and operator companies, operations and maintenance service providers, insurance companies, banks, financial institutions, M&A advisors, and technical due diligence service providers.

By offering tailored solutions that integrate cutting-edge technologies, Kavaken empowers stakeholders to optimise their operations without the typical complexities associated with asset management. This approach not only improves operational efficiency but also supports robust financial management and insurance processes, vital for maintaining asset value and ensuring continued investment in the sector.

In a rapidly evolving industry that demands both agility and precision, Kavaken stands out by delivering solutions that enable stakeholders to effectively manage the complexities of renewable energy operations. The platform's capacity to adapt to the unique needs of each client ensures that all aspects of asset management—from operation to financial oversight—are conducted with the highest standards of efficiency and sustainability.

Through its innovative SaaS offerings, Kavaken is not just participating in the renewable energy market; it is actively driving its evolution, making renewable energy operations more efficient, sustainable, and economically viable for all stakeholders involved. As the industry grows, Kavaken's role in shaping the future of renewable energy management becomes increasingly indispensable.

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## Ogre AI delivers highly accurate AI-powered forecasts for market trends and energy demands

Ogre AI is at the forefront of revolutionising the energy sector with cutting-edge artificial intelligence solutions. Specialising in wind and solar farm energy production forecasts, Ogre AI's platform provides unparalleled forecasting and aggregation capabilities for renewable energy producers and asset managers. By utilising proprietary algorithms and advanced weather models, Ogre AI delivers the most accurate forecasts available in the market, helping clients optimize their operations and maximize efficiency.

Targeting key players such as wind and solar farms, suppliers of energy, grid and EV charging operators, Ogre AI's technology is essential for those involved in asset management, grid operations, and energy aggregation and sale. The platform is designed to meet the specific needs of these stakeholders, providing them with the insights and data necessary to make informed decisions that enhance both sustainability and profitability.

Ogre AI's commitment to innovation is evident in its continuous development of new products and technologies. The company's focus on research and technological advancement ensures that its clients always have access to the latest tools and information. As the global shift towards renewable energy accelerates, Ogre AI stands out by offering solutions that not only improve operational efficiency but also contribute to a more sustainable future.

In a rapidly evolving industry where precision and reliability are critical, Ogre AI's AI-driven generation forecasting is a game-changer. The company's ability to integrate seamlessly with existing infrastructure allows for quick and efficient deployment, ensuring minimal disruption and maximum benefit. By providing the most accurate and reliable forecasts, Ogre AI empowers its clients to stay ahead of the curve, navigate the complexities of the energy market, and achieve their sustainability goals.

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## SAMAWATT revolutionises the way renewable energy is being sold to the markets

SAMAWATT is at the forefront of the renewable energy industry with its innovative SAMA-Asset™, an AI-driven Software-as-a-Service solution designed to optimise renewable energy and battery storage trading. This technology aligns the intermittent power generation of wind and solar assets with the dynamics of the power market prices, significantly enhancing profitability for renewable energy producers.

Focusing on wind and solar park operators who often grapple with the unpredictability of energy production due to fluctuating weather conditions, SAMAWATT provides a critical service that transforms this variability into a strategic advantage. By leveraging advanced artificial intelligence, SAMA-Asset™ not only predicts market behaviours but also adjusts energy production strategies in real time. Additionally, it optimises battery usage by strategically bidding in the day-ahead, intraday, and ancillary markets, ensuring maximum efficiency and revenue generation.

SAMAWATT's mission statement: "Power-Full AI-Trading: Engineered to Outperform Market Benchmark by 50%," reflects its dedication to delivering exceptional performance. This approach demonstrates how SAMAWATT's technology goes beyond keeping pace with market trends to set new standards for success in renewable energy trading.

In an era where optimising energy resources is crucial, SAMAWATT stands out by enabling wind, solar and battery operators to navigate the complexities of the energy market with unprecedented precision. This capability is vital for maintaining competitiveness and sustainability in a sector driven by both technological innovation and the imperative to reduce environmental impact.

Through its SAMA-Asset™ platform, SAMAWATT is not just participating in the energy market; it is redefining how renewable energy is traded globally.

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## Mesh Engineering applies digital twins to push the boundaries of harnessing wind energy

Mesh Engineering stands at the cutting edge of technology in the renewable energy sector, specializing in the analysis of dynamic systems and spearheading the development of the Renewable Energy Communication Network (MesH REcon). This advanced software platform is designed to revolutionize the application of digital twins within energy systems, enhancing scalability, modularity, and transferability.

The MesH REcon platform enables seamless data processing between physical assets and their virtual counterparts, optimizing integration into complex energy systems. This innovative approach allows for the creation of detailed, dynamic simulations that mirror real-world conditions, facilitating improved decision-making and efficiency for wind farm operators, wind park planners, and Original Equipment Manufacturers (OEMs).

Through its pioneering MesH REcon platform, Mesh Engineering leverages artificial intelligence to provide sophisticated digital twins for interconnected complex energy systems. This technology not only supports the operational needs of renewable energy providers but also pushes the boundaries of what can be achieved in energy system management.

For wind energy stakeholders, the MesH REcon platform offers a transformative solution that ensures precise monitoring, control, and predictive maintenance capabilities, thereby enhancing both the sustainability and operational efficiency of energy assets. Mesh Engineering's commitment to innovation is reflected in their provision of tools that enable energy systems to operate more reliably and efficiently in a rapidly evolving market.

In an industry driven by technological advances and the need for environmental stewardship, Mesh Engineering's MesH REcon platform positions itself as a critical enabler of future energy solutions. By bridging the gap between physical and digital realms, Mesh Engineering is not only responding to current industry challenges but is also shaping the future of renewable energy management.

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## Aevy simplifies the oversight of large scale renewable energy assets with its Virtual Asset Manager

Aevy is revolutionizing the management of renewable energy assets with its state-of-the-art Virtual Asset Manager. Tailored specifically for the solar and wind power sectors, Aevy's innovative platform utilizes its deep domain experience and cutting-edge technologies to transform the traditional paradigms of commercial management in renewables. This shift not only streamlines operations but also enhances the financial and operational efficiency of renewable power plants.

Primarily serving asset owners such as Independent Power Producers (IPPs), utilities, and infrastructure funds, as well as asset operators including third-party asset management service providers, Aevy's solution is designed to meet the unique needs of the renewable energy sector. The platform provides a comprehensive management system that simplifies the oversight of large-scale renewable assets, integrating crucial functions like performance monitoring, predictive maintenance, and financial oversight into a single, user-friendly interface.

Aevy's commitment to innovation is evident in its company mission to build a Virtual Asset Manager that stands as a beacon in the renewable energy industry. By offering a robust digital solution, Aevy ensures real-time data accessibility and actionable insights, which empower stakeholders to make informed decisions that optimize asset performance and enhance sustainability.

In an industry increasingly focused on reducing environmental impact and maximizing energy output, Aevy's Virtual Asset Manager provides a crucial tool. It not only supports the operational and financial goals of renewable energy providers but also contributes significantly to the broader objectives of energy sustainability and efficiency.

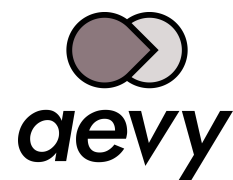
With its visionary approach, Aevy is not just participating in the renewable energy landscape; it is actively shaping the future of how energy assets are managed, paving the way for more resilient, efficient, and sustainable energy solutions.

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## 4. AI contributes to a better availability of renewable energy and better future for all of us

2024 is the year that AI solves real-world problems. The technology has moved on from delivering surprise and awe to become a quiver of productivity tools and business opportunities. Renewable energy is just one industry of the many that benefit from AI. But, it may be one of the most important industries for a better future for all of us. The AI CENTER at WindEnergy Hamburg provides insights into real solutions of applied AI and inspiration for future applications.

### AI for improved management and production of Wind Energy

AI contributes to managing and improving the production and availability of renewable energy. AI helps to detect damage to assets. It supports not only predictive maintenance to minimise downtime, it also helps to monitor and optimise production.

### AI for a greater share of Wind in the Energy Mix

Thanks to improved management and production AI is contributing to maximise revenues of Wind Energy. AI is also improving the ways renewable energy is traded. Production volumes become more predictable and the whole energy grid becomes better manageable and more resilient - thus allowing for a greater share of renewable energy that depends on the weather. All over the world, wind energy production overcomes many of the challenges it faces. And while headwind is what drives the blades of the wind energy plants, AI brings with it a tailwind for us on our road to a better future.

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## About AI.HAMBURG and AI.GROUP

The AI.GROUP, headquartered in Hamburg, promotes successful AI innovations from Europe and their use in business. Founded in 2019 by Petra Vorsteher and Ragnar Kruse, the group is committed to ensuring that the economy and companies use the great innovations, opportunities and possibilities that AI offers as a new technology for a better future.

Within the AI.GROUP the not-for-profit initiative AI.HAMBURG offers a portfolio of activities to promote the use of AI and machine learning, including workshops, training courses and networking events. In addition the AI Accelerator AI.STARTUP.HUB is operated as part of a consortium. Together with Hamburg Messe und Congress, AI.HAMBURG has regularly organised AI CENTERS at trade fairs since 2023. The early-stage venture capital fund AI.FUND is investing in the best European AI start-ups. The latest member of the AI.GROUP is AI.IMPACT, an AI venture studio to create positive impact through projects and products with AI, from the idea to product to global scaling. More at <https://ai-group.ai/>

# AI CENTER



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