Åre, March 27th-29th 2023

# Winterwind

## INTERNATIONAL WIND ENERGY CONFERENCE

**Meet Jämtkraft**
Local player with a history

**The impact of climate change**
Greenhouse effect vs. ice risks

**Ice protection**
Optimization with new algorithms

Scan the QR code to watch a video presentation about the Swedish Windpower Association on YouTube.

Organizer

SWEDISH WINDPOWER

**Winterwind is an international must-go for everyone working with issues related to wind energy in cold climates. Every year, the world's wind energy professionals meet at Winterwind in Sweden to discuss the challenges and solutions of generating wind power in cold climates.**

Photo: Jann Lipka

SVENSK VINDKRAFT

# Welcome to a new year with Swedish Windpower!

We can now summarize 2022 as an eventful year on the energy market with both highs and lows intrinsically connected.

• Record prices on electricity, but significantly negative electricity prices on several occasions

• A continued rapid expansion of windpower, but few new investment decisions for new wind farms

• Large project portfolios at companies who want to construct new wind power, but few projects that are ready to be sold and built

Cecilia Dalman Eek
Chairwoman
Swedish Windpower

Per Olofsson
Vice Chairman
Swedish Windpower

To summarize, the industry reached a record level in annual production of electricity form wind power. The fact that wind power is now Sweden's second largest energy source is an accomplishment, but also comes with a responsibility. To ensure that the market has stable conditions in the long run benefits all owners of wind power.

For Swedish Windpower, this means that our focus as an industry association is placed on spreading knowledge. We work to facilitate knowledge about wind energy's general benefits, that are both economic and environmental. We also facilitate knowledge on how wind power is a part of the energy mix and what supporting services that are needed in the energy system of the future.

Our work with spreading knowledge, and our membership benefits, is divided into three parts:

**1. Unique, innovative, and instructive conferences.**

*Winterwind*, the world's only international conference about wind power in cold climates. In this year's edition the theme is "Wind power in cold climates onshore and offshore" – because offshore wind power in cold climates is only at its beginning.

*Operations and maintenance days*, the only event you as an owner of wind power needs to gather knowledge and network with representatives from the wind industry. As a delegate, you should get what you need to fulfil your responsibility as an owner of a wind power plant and take advantage of the further opportunities that wind power provides.

*RE-Scandinavia* is arranged together with our counter-part in Denmark – Green Power Denmark. At this conference, everything form macro trends to how you as an owner of wind power can get the best possible return on your investment.

**2. We publish Sweden's best wind power magazine** – Swedish Windpower. A unique magazine that is published in five Swedish editions annually, with separate English summaries. We talk about the latest developments in the industry and shed light on the trends and market conditions that you as an owner have the most benefit from.

**3. Membership benefits** that make a difference. We have negotiated with, and chosen the best suppliers in in the industry to help you as an owner with a favourable arrangement for your wind power plant. We offer solutions for insurance, energy trading, law, education and much more. There will be new membership benefits announced in the coming year – so stay updated by visiting our website and social channels.

***We think all of the above is important, which is why the Swedish Windpower association and the community that the membership provides are of great value. Together we get the chance to develop our association to continue our role as a natural gathering point for those who work with and towards the wind industry.***

# WELCOME

## to Winterwind conference 2023

**AT A TIME** when demand for renewable energy is soaring, the wind power industry rise to the challenge to meet the demand even in less than ideal surroundings. At Winterwind 2023, this challenge is reflected in the program, with a range of issues from construction of components to managing parks in a way that increase and secure delivery in cold climate. And a lot more, including offshore wind for the first time.

The number of research projects presented has decreased over the years, which doesn't mean that the challenges are fully mastered. Quite the contrary, as balance of power has become an expensive issue for the owners of iced up wind turbines. So, the key question to the OEMs will still be: Is your ice protection system reliable and sufficient?

This year we meet in Åre, a classic Swedish winter holiday resort which offers excellent opportunities for getting new contacts, new knowledge and new business possibilities!

**Cecilia Dalman Eek**
Chairwoman of the Board, Swedish Windpower Association

**Mari-Louise Wernersson**
Coordinator, Winterwind 2023

## Swedish Windpower Association

Swedish Wind Power was founded in 1986 and is an industry organisation for wind energy producers, with approximately 650 members, ranging from smaller wind power owners to large-scale energy companies. With more than 35 years experience we are an established referral body and stakeholder in the Swedish wind energy sector, working to promote efficient development and economic conditions for wind power in Sweden.

One of the areas that define Swedish Wind Power is the exchange of knowledge, both as a referral body and provider of courses, seminars, and conferences. The seminars and conferences work as meeting points for the wind industry in Sweden. Being a member of Swedish Wind Power has several advantages and we are continuously working to develop new membership benefits to find attractive solutions that provide real and practical value to our members.

Every year Swedish Windpower association arranges international conferences like Winterwind, Operation- & Maintenance Days and RE-Scandinavia. For our members we offer a wide range of attractive benefits, such as member rebates, inspiring webinars and the magazine "Swedish Windpower".

More about members benefits and the association at: **www.svenskvindkraft.com**

### Membership benefits

| | Private | Company * | Company ** |
|---|---|---|---|
| Annual subscription to out magazine Swedish Windpower | ● | ● | ● |
| Discounts on advertisements in the magazine | ● | ● | ● |
| Discounts on tickets to our conferences and events | ◖ | ● | ● |
| Beneficial wind power insurance (MARSH) | | | ● |
| Discount on decommissioning insurance (MARSH) | | | ● |
| One hour free legal advice (MAQS) | ● | ● | ● |
| Discount on additional advisory fees (MAQS) | | | ● |
| A negotiated framework agreement for electricity, electricity certificates and guarantees of origin as well as advice on binding agreements | | | ● |
| Discounts on various market analysis reports | | ● | ● |
| Rebate for ESA Principles education (Rabbalshede) | | ● | ● |
| Rebate for Security Assessment for Windpower (W3 Energy) | | | ● |
| Cyberinsurance & advice (MARSH) | | | ● |

* Company without production  ** Company with production

Scan the QR code for enlarged version of the membership benefits table shown above.

Produced in cooperation with Roxx Communication Group. Printed by Åtta.45 Tryckeri.

Photo: Jann Lipka

# MEET OUR SPONSORS & EXHIBITORS

In the exhibition you'll meet interesting companies and organizations offering services and products specific to your business within renewables. These are the sponsors and exhibitors for the 2023 conference.

*Please visit their websites and social media channels.*

## GigaWatt Sponsors

Jämtkraft

Östersunds Elektriska Belysningsaktiebolag (Now Jämtkraft) was founded in 1889 and worked mainly to obtain electricity for lighting. The grid that was built was sufficient for lighting in a small number of homes and shops, as well as simple street lighting in the city center. In 1974, Åre, Krokom and Östersund municipalities became the main owners.

The company currently operates within Electricity grid, District heating, Energy production with wind, solar, bio fuel, water. The group also delivers Energy solutions for private and business customers. The group currently manages 9 wind farms from Norrbotten to Dalarna with an annual energy of 1TWh.

NEINICE

Phazebreak Coatings has made its name in renewables by encouraging the wind energy sector to reframe the conversation from "ice removal" to "ice prevention." With its patented icephobic coating, NEINICE, Phazebreak has revolutionized how owners and operators respond to the environmental challenges that threaten their turbines (and their bottom line). Phazebreak's cost-effective, safe, and modular installation methods have allowed wind farms to thrive in even the harshest of environments, increasing energy output during storms, decreasing recovery time afterward, and reducing maintenance costs on 6,000 blades worldwide.







## MegaWatt Sponsors

KJELLER VINDTEKNIKK Part of Norconsult

Kjeller Vindteknikk is one of the leading consultancies within meteorological wind and ice modelling in the Nordics. We provide services such as wind measurements, energy yield assessments, icing loss estimations, post production reviews and icing forecasting for all stages of wind farm development.

Kjeller has carried out icing loss assessments for over 150 wind farms, been involved in third party performance assessment of de- and anti-icing systems and have supported in warranty discussion connected to anti and de-icing systems.

Kjeller Vindteknikk has more than 20 years of experience, supporting more than 500 clients within wind energy in cold and icing climates.

PHOENIX CONTACT

Phoenix Contact offers you innovative automation and connection technology for the equipment of your wind turbine or wind farm. Many products have been specially developed for the wind industry and impress with their exceptional robustness and clever functions. A user-friendly operation and a seamless interaction are a matter of course. At Winterwind 2023 we present you our "Blade Intelligence".It is a modular rotor blade monitoring system that combines the ice detection, lightning measurement, structural health monitoring and load monitoring functions in one system.

Weidmüller

As part of the Weidmüller Group, Weidmüller Monitoring Systems GmbH is a powerful partner for wind turbine manufacturers and operators. Since 2004, the Dresden-based company has been using its core competence in the field of multi-dimensional natural oscillation measurement on fiberglass and carbon components. This long-standing know-how is used worldwide in 30 countries for condition monitoring and ice detection of rotor blades on wind turbines. With more than 5,500 monitoring systems in use, we can draw on 20,400 machine years of monitoring experience to provide you with the optimum solution for your turbines.

WICETEC Ice Prevention Systems

Wicetec is the world-leading wind turbine blade heating technology provider. Our solution prevents ice formation on blade surfaces. This enables continuous turbine operation throughout the winter. Our patented technology is available for new turbines and retrofits with field proven lifetime of 20 years. Wicetec staff are highly skilled professionals with firm experience of wind power in cold climate.

Nordic Energy Research

Nordic Energy Research is the platform for co-operative energy research and policy development under the auspices of the Nordic Council of Ministers - The main forum for official Nordic co-operation, which involves Denmark, Finland, Iceland, Norway, Sweden, the Faroe Islands, Greenland and Åland.

Nordic Energy Research supports the Nordics in becoming the most integrated and sustainable region in the world. We enhance regional co-operation, create added value in the Nordic countries, and ensure trust and sustainable collaborative relationships for the benefit of the society.

res power for good

RES is the world's largest independent renewable energy company active in onshore and offshore wind, solar, energy storage, transmission and distribution and green hydrogen. Having developed, built and operated utility-scale renewable energy projects globally for over 40 years, we understand the importance of optimising renewable assets. RES has delivered more than 23GW of renewable energy projects across the globe and supports an operational asset portfolio exceeding 12GW worldwide for a large client base. RES employs over 2,500 people and is active in 13 countries. RES has been active in the Nordics for over 20 years and today we have offices in Gothenburg, Östersund, Lund, Stockholm, Ånge and Oslo.

## KiloWatt Sponsors

As a pioneer of wind energy technology and a partner of the energy transition, ENERCON specialises in the turbine and technology development, production, sales and servicing of onshore wind energy converters. Pursuing its mission of 'Energy for the world', ENERCON has driven sustainable energy generation from onshore wind since 1984. Thanks to its innovative wind energy converter technology, high quality standards and a total installed power of more than 58GW (31,700 WECs in total), it is one of the world's leading manufacturers. Around 13,500 people work at administrative, sales, production and service locations worldwide for the wind energy converter manufacturer with headquarters in Aurich (Germany).

The development, manufacture, project management and servicing of wind turbines in the onshore segment has been the core competence and passion of the Nordex Group and its more than 9,000 employees worldwide for more than 35 years. As one of the world's largest wind turbine manufacturers, the Nordex Group offers high-yield, cost-efficient wind turbines that enable long-term and economical power generation from wind energy in all geographical and climatic conditions.

Modity is one of Sweden's leading energy traders, with customers and partners consisting of large and small renewable energy producers, energy companies and businesses within several segments of industries. We are mainly focusing on the Nordics and its surrounding energy markets. Our experts have vast knowledge and experience in all key aspects and fundamentals surrounding the energy trading. The development and expansion of wind power is something we are especially passionate about where we support and managing the energy facilities by handle risks. Many of our solutions are tailored specifically for optimizing management of wind power facilities and creating the most favorable conditions and maximize the revenue for our customers, generated from the physical and financial markets.

## Exhibitors

Aerones is the world leading robot-enabled wind turbine maintenance and inspections service provider. Leveraging patented robotics technology, Aerones service teams deliver faster, safer, and more effective services for wind operators worldwide. The innovations we provide to the wind industry promote intelligent predictive maintenance of wind turbine blades and towers, helping to maximize the efficiency of wind assets and lower operating costs.

Alpiq is a leading Swiss electricity producer and energy services provider that is active throughout Europe. We offer our customers comprehensive services in the fields of energy generation and marketing as well as energy optimisation. In our daily work for our customers, we develop customised solutions that are reliable and sustainable. We have been generating climate-friendly and sustainable electricity from carbon-free Swiss hydropower for more than a hundred years. Our power plant portfolio also comprises flexible thermal power plants, wind farms and photovoltaic systems in Europe. As an international energy trader, we are active on all major European markets.

Deutsche Windtechnik AB, provides complete maintenance, ranging from basic service agreement to individually tailored full-service agreements for wind turbines manufactured by Vestas, Enercon, Siemens, Gamesa and Nordex in Sweden. The Deutsche Windtechnik group has around 9000 turbines totally in Europe, USA and Asia. The company operates both onshore and offshore.





## Exhibitors

At Connected Wind Services, we're more than just an independent global service partner in the renewable energy market. We've been leading the charge for 35 years, improving our skills and expertise with every project we undertake. Our passion lies in advancing the transition to sustainable energy, and we're constantly exploring new and innovative ways to simplify the operation of wind turbines. Whether you're looking for service projects, O & M, up-tower support, technical management, or full-service contracts, we've got you covered. Our team of experts combines years of experience with a forward-thinking approach to provide the best possible results. So, if you're looking for the best in the business, look no further! Get in touch with us at info.se@connectedwind.com to learn more about what we can do for you.

DNV is an independent assurance and risk management provider, operating in more than 100 countries. Through its experience and expertise DNV advances safety and sustainable performance, sets industry standards, and inspires and invents solutions. For the energy sector, we provide assurance to the entire energy value chain through our advisory, monitoring, verification, and certification services. As the world's leading resource of independent energy experts and technical advisors, we help industries and governments to transition faster to a deeply decarbonized energy system.

Vaisala provides 360-degree solutions to renewable energy companies around the world: proven and reliable WindCube lidar suite, weather forecasting and historical data, lightning data solutions, and weather sensors and systems. We provide you with the actionable intelligence you need to maximize output, performance, profitability and safety at every project stage.

EMD International A/S is a software and knowledge centre supplying companies and institutions worldwide with software, consultancy services, training and know-how within the fields of project design, planning, documentation and operation of environmentally friendly energy projects.

Emerson - Former Mita-Teknik Since the early 1980s, Emerson/ Mita-Teknik has supplied the wind industry with +60,000 control systems that Make Wind Competitive. Our vision is to become the leading control solution provider through-out the life-cycle of the wind turbine. We offer everything in Wind Turbine Control Systems, Wind Farm Control, Electrical Pitch Systems, Condition Monitoring, SCADA, Wind Turbine Retrofit, Optimization and Customer Partnering - all designed to provide our customers with high yield cost-optimized wind turbine operation and maintenance. We drive innovation that makes the world healthier, safer, smarter and more sustainable! www.emerson.com/wind-contacts

eologix sensor technology produces flexible, retrofittable smart sensor solutions for overarching rotor blade monitoring. eologix market proven sensor systems - installed on 700+ wind turbines - are designed for ice detection, temperature measurement and pitch angle monitoring on rotor blades, minimizing downtimes and offering best performance.

## Exhibitors

FT Technologies' ultrasonic wind sensors are designed specifically for wind turbine control and are used by the world's leading turbine manufacturers – both on and offshore. Fitted with a thermostatically controlled heating system, FT sensors are ideal for cold climates and help to improve AEP and reduce LCoE.

With the world's most widely used ice detection system, you can optimise wind turbine operations and reduce risks caused by ice formation. Labkotec ice detection systems detect icing weather conditions on the blades of a wind turbine and send you an alert so you can initiate the necessary actions accurately.

INKOM; Industrikomponenter AB, represents ORGA NL in Sweden. Since 1967, INKOM has provided Nordic industry with components in energy, process, manufacturing, trains and defense electronics. ORGA NL and INKOM works together to help companies and organizations that have flight obstacles so that safety is always in accordance with current regulations. Contact us at: www.inkom.se

Since 2019, MCVE is focused on manufacturing of functionalized GFRP for integration into composite materials. We have proven that our EOPROM® bonding on GFRP is strong enough with a copper metallization to allow a robust connection thanks to its solder ability. Our EopromFlex equipment is using R2R process for mass production for smart GFRP for de-icing application.

As a global expert in speciality lubricants, Klüber Lubrication offers a comprehensive line of lubricants designed to meet the extreme demands of the wind energy industry. Our product portfolio includes high-performance gear oils and greases for all applications.  The solutions we offer for your applications add to your revenue and success. Klüber Lubrication is part of the Freudenberg Group.www.klueber.se

As one of the leading companies in the commercial and technical operation of wind farms and solar projects, wpd windmanager manages a total capacity of over 6,000 MW worldwide and currently employs over 500 people. With its offices in Oulu and Piteå, wpd windmanager possesses many years of experience in the Scandinavian market and handles wind farms with a capacity of more than 370 MW for various investors, expanding by additional 285 MW in 2023. The German company operates worldwide and has offices in various other European countries, in South America and in Asia. More information at: www.windmanager.net



SPONSORS & EXHIBITORS

## Exhibitors

Megger has been a leader in electrical test and measurement globally for 130 years. From power generation to the power outlets in your home, Megger products cover almost every application within the Electrical Supply Industry. Our products are categorised into seven core application segments: cable test and diagnostics, protection relays and systems, circuit breakers, transformer test and diagnostics, low voltage installations, general electrical testing, and motor and generator testing.

Wind Power LAB is a Danish company, founded in 2016 by a passionate group of wind power industry professionals. Our team of experts offer market leading expertise related to Blade Risk Management. Our goal is to deliver the best available and robust solutions to empower our clients with the ability to make decisions to optimize their asset performance.

Ping Monitor. External & Internal Blade Damage, Icing and Lightning Detection - The Ping Monitor is a fully self-contained & low-cost sensor that uses acoustic analysis to continuously monitor the state of your wind turbine blades. Visit us at our stand to learn how blade repair & inspection costs can be minimised.

Linnovation is a Swedish company specialized in developing heating products/solutions for usage in cold climate. One of the products is the anti ice system for wind turbine blades which has been developed in co-operation with Skellefteå Kraft AB and financial support from Swedish Energy Agency and Swedish Energy Agency.

Wölfel Wind Systems is focused on Structural Health Monitoring of the complete wind turbine. We deliver reliable data analysis (Structural Intelligence) for lifetime assessments, increase of energy yield as well as ice and damage detection for rotor blades. Additionally we manufacture systems for reduction of vibrations and structure-borne noise. www.woelfel.de

WPS Sweden was established in 2014 in Piteå, Sweden. WPS offers services to OEM:s and operators in the wind industry. WPS offer services such as: Service & maintenance, troubleshooting, installation, rope access inspections, blade repair, LPS inspections and much more. Our technicians are spread out across northern Sweden, which makes us a cost-efficient service provider with local expertise in a global business.

## Exhibitors

Weather Guard stops lightning from damaging your blades and keeps your turbines turning. We are an engineer-led company and creator of StrikeTape, the most effective LPS upgrade on the market. Strike Tape can be found on wind farms on 5 continents, protecting turbines from all major OEMs.

MTK - Mast and Tower Construction, is the new distributor of the market leading wind-masts and accessories from CUE DEE. We sell complete masts and also sections, wires, foundations, aviation lights, ice repelling paint etc. MTK provides design and calculation services in windload calculations for mast installations and due diligence calculations for mast relocation etc.

Tectyl was first mentioned in the 1930's and since then became the synonym for corrosion prevention. With a comprehensive portfolio to safe-guard nearly every metal surface from corrosion, chipping, peeling and impingent abrasion, Tectyl products can help companies avoid repair and downtime, likely lowering the total cost of owner-ship and ensuring a more effective and profitable operation.





Winterwind
INTERNATIONAL WIND ENERGY CONFERENCE

# Monday March 27th

**08:00 - 17:00** **Field Trip**

**12:30 - 14:30** **Seminar 1**

*Leader: Timo Karlsson*

**Offshore wind in cold climates** 12.30 – 13.45

**Offshore Wind Farm development in Cold Climate risks and considerations,**
Carlo Giesecke, OX2, SE (43)

**Sea ice conditions in the Baltic sea and impact for offshore wind farm foundations,**
Florian van der Stap, Wood Thilsted, DK (14)

**State-of-the art: sea ice and offshore wind foundations,** Timo Karlsson, VTT, FI (45)

**Balance of power in cold climates** 13.45 – 14.30

**The effect of icing on energy trading,** Sten Lillienau, Centrica, SE (46)

**14:30 - 15:00** **Break**

**15:00 - 18:00** **Seminar 2**

*Leaders: Claas Rittinghaus and Charles Godreau*

**Winterwind Workshop - "Performance envelopes of blade heating systems" - A Subtask of IEA Wind TCP Task 54 "Cold Climate Wind Power"**
Claas Rittinghaus, Energiewerkstatt, AT (13)

**Experiences with IPS icing losses**
Simo Rissanen, Kjeller Vindteknikk Oy, FI (17)

**Check the website for the latest updates: www.winterwind.se**

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# Tuesday March 28th

**08:00 - 09:00** — **Exhibition and registration**

**09:00 - 10:00**

## Technology

*Chairs: Franziska Gerber and Bram Cloet*

**Increasing O&M benefits from icing sensors by means of smart data augmentation,** Michael Moser, eologix sensor technology, AT (33)

**Power Curve Tests in Cold Climates on Complex Terrain,** Alice GowardBrown, Wood Renewables, UK (6)

**The Next Generation Ice Detection System – Control System Integrated Software Solution for Substantial Cost Optimization,** Carsten Ebert, Wölfel Wind Systems, DE (9)

## Development

*Chairs: Åse Ervik and Sven-Erik Thor*

**AEP losses - less than half of the truth of the economic icing losses,** Petteri Antikainen, Wicetec, FI (15)

**Case study on vertical variability in icing conditions in Finland,** Timo Karlsson, VTT Technical Research Centre of Finland Ltd, FI (22)

**Experiences with IPS icing losses,** Simo Rissanen, Kjeller Vindteknikk Oy, FI (17)

**10:00 - 11:00** — **Break**

**11:00 - 12:30** — **Opening session**

*Moderators: Cecilia Dalman Eek & Göran Ronsten*

**Sea ice conditions in the Baltic sea and impact for offshore wind farm foundations**
*Florian van der Stap, Wood Thilsted, DK (14)*

**On the performance of ice detection methods used in wind energy: a long-term field study** *Charles Godreau, Nergica, CA (7)*

**Panel dicussion with wind turbine owners**

*Moderator: Göran Dalén*
**Skellefteå Kraft,** Stefan Skarp, Skellefteå Kraft, SE (42)
**Arise, cold climate wind power experiences,** Johan Hansson, Arise AB, SE (39)

**12:30 - 14:00** — **Lunch**



**13:30 - 13:55** — **Poster session 1** *Moderator: Helena Wänlund*

**How to handle the sea ice**
*Erik Almkvist, Viking Supply Ships, SE (35)*

**Innovative technology to increase efficiency and extend the lifetime of gears and bearings**
*Stefan Bill, REWITEC GmbH, DE (5)*

**REQUIM: Improving erosion testing of rotor blades' leading edges**
*Ibrahim Rotich, Eötvös Loránd University, HU (38)*

**14:00 - 15:00**

## Icing

*Chairs: Tiina Kuula and Simon Kloiber*

**Mythbusters: wind energy in cold climate edition**
*Patrice Roberge, Université Laval, CA (2)*

**Modelling ice accretion on a cylinder, simple? Right?**
*André Bégin-Drolet, Université Laval, CA (3)*

**Icing detection with LiDAR**
*Sara Koller, Meteotest, CH (19)*

## O&M

*Chairs: Daniela Roeper and Christoffer Carlsson*

**Addressing lightning risk in cold climates - a swedish case study**
*Andreas Christian Espersen, Wind Power LAB, DK (24)*

**Lightning Monitoring in Cold Climates? Is there any need?** *Nils Lesmann, Phoenix Contact, DE (29)*

**Experiences analyzing operational wind farms in cold climate** *Utku Turkyilmaz, Kjeller Vindteknikk part of Norconsult, SE (18)*

**15:00 - 15:45** — **Poster session 2** *Moderator: Johan Hansson*

**NICE - Reduction of ice formation by nanostructuring of surfaces with an ultrashort pulse laser**
*Claas Rittinghaus, Energiewerkstatt, AT (11)*

**Anti-icing coating from the customer's perspective to technical development**
*Urandelger Tuvshindorj, Mikron.X B.V, NL (28)*

**Multi-fidelity modelling of wakes and blockage for realistic atmospheric conditions in cold climate**
*Narges Tabatabaei, DNV,SE (31)*

**15:45 - 17:00** — **Going Big** *Moderators: Emilie Iversen and Salur Basbug*

**ENERCON E-175 technologies**
*Timo Müller/Moritz Rodenhausen, ENERCON GmbH, DE (30)*

**Turbine performance during icing events,** *Ines Runge, Nordex Energy SE Co. KG, DE (34)*

**Gearing up for cold climate validation testing of 15MW+ wind turbine drivetrains**
*Pieter Jan Jordaens, Sirris, BE (27)*

**17:00 - 18:00** — **Break**

**19:30** — **Dinner**

Winterwind
INTERNATIONAL WIND ENERGY CONFERENCE

# Wednesday March 29th

## 08:30 - 09:30 Performance

*Moderators: Alice Goward Brown and Michael Moser*

**An active/passive coating stack for surface icing mitigation tested under various climatic conditions**
*Bram Cloet, Sirris, BE (26)*

**Challenges for a smart algorithm controlling wind turbines under icing conditions**
*Simon Kloiber, VERBUND Green Power, AT (20)*

**Can we make better use of ice protection systems?**
*Franziska Gerber, Meteotest, AG (10)*

## 09:30 - 10:15 Break

## 10:15 - 11:15 Policy and market

*Chairs: Alli Gallaher and Petteri Antikainen*

**ESS – Energy Storage Systems in cold climates**
*Christoffer Carlsson, INKOM, Industri-komponenter AB, SE (4)*

**Potential and costs for wind power of providing system services to the electricity grid** *Salur Basbug, RISE, SE (25)*

**How to improve area safety at wind farms during icing conditions,** *Tiina Kuula, Labkotec Oy, FI (40)*

## 10:15 - 11:15 O&M

*Chairs: Sara Koller and Pieter Jan Jordaens*

**Proof of concept of using an existing foundation structural health monitoring system to detect icing** *Wout Weijtjens, Vrije Universiteit Brussel, BE (12)*

**The importance of early-stage ice detection**
*Matthew Stead, Ping Services, AU (16)*
**Determining power requirements for de-icing/ anti-icing systems for onshore and offshore turbines,** Daniela Roeper, Borealis Wind, CA (36)

## 11:15 - 12:30 Lunch

## 12:00 - 12:25 Poster session 3

*Moderator: Narges Tabatabaei*

**6-month seasonal forecasting of monthly wind speed anomalies**
*Albert Bosch, VORTEX, ES (23)*

**Icephobic coating solutions for turbine blade icing,** *Don Browning, Phazebreak, US (1)*

**Numerical Tools and Metods for Design of Offshore Wind Turbines in Complex Sea Ice Environments,**
*Åse Ervik, Multiconsult, Norway (44)*



## 12:30 - 14:00 Closing session

*Moderators: Ines Runge and Stefan Skarp*

**Winterwind Workshop - "Performance envelopes of blade heating systems" - A Subtask of IEA Wind TCP Task 54 "Cold Climate Wind Power"**
*Claas Rittinghaus, Energiewerkstatt, AT (13)*

**Climate change impacts on Nordic icing climate**
*Emilie Iversen, Norconsult, NO (32)*

**Summary**
*Lars Tallhaug*

## 14:00 - 15:00 Awards and End of Winterwind 2023

# **Local player** with a long history

Able to trace its history back to the late 1800s, the Jämtkraft energy company enjoys a well-established position in the region. It's now investing in supplementing its existing energy mix with more wind power.

**TEXT:** Peter Wiklund **PHOTO**: Jämtkraft/Håkan Wike

**THE FIRST RENEWABLE** electricity generation at what is now Jämtkraft took place as long ago as 1889, when a network of cables was able to supply lighting to a small number of homes and shops, as well as simple street lighting in the city centre.

Ever since the late 1800s, Jämtkraft has recognised that a high proportion of self-generated renewable electricity is essential for keeping electricity prices low. It's invested in a mix of hydro power, combined heat and power, and wind power.

Just over 20 years ago, it erected its first wind turbine, which is still in operation and producing about 1.5 GWh annually.

"Over the years, it's given us valuable experience and knowledge of how wind power works in upland environments," reports Jens Skoglund, leader of the Jämtkraft wind team.

Jens Skoglund

**BUT IT WAS IN CONNECTION** with the acquisition of the Hornberget wind farm in 2007 that the initiative really took off, and since then its assets have grown steadily. At present, it wholly or partly owns eight wind farms with a total of 85 wind turbines, after completing a major acquisition of three wind farms last summer. In total, production is around 600 GWh per year.

It will shortly be adding another wind farm to its portfolio: Hocksjön in Sollefteå municipality. The project, which it's running in partnership with Persson Invest (which owns 25 per cent), involves an investment of around SEK 1.6 billion and the wind farm was commissioned at the turn of the year.

"Tests and fine-tuning are now under way, and we'll be taking over management of the farm in April. It will be our largest farm in terms of production – and it's the largest locally owned wind farm in this area," says Jens Skoglund.

The project has been granted a permit for 45 wind turbines, but it's a "box permit", which allows developers to use the latest technology available. So while maintaining a total height (230 metres), the wind farm has been reduced to 23 wind turbines. They're using 5.7 MW turbines from Nordex, providing a total capacity of 130 MW. Production is estimated at roughly 430 GWh per year.

**JENS SKOGLUND** confirms that growth in the future is most likely to occur mainly via acquisitions.

"It's fair to say that we're holding back on projects without a permit. Unfortunately, it's clear that it can be difficult to get the go-ahead for new projects when there

The new Hocksjön wind farm has an estimated production of 430 GWh a year.

are competing interests. The municipal veto in particular is a recurring challenge," he says.

The difficulty of achieving local acceptance is something that all wind power project planners know only too well, but Jens Skoglund praises the way this has been managed in the Hocksjön project.

"We've concentrated on transparency and made sure that we're available. Among other things, representatives from the project have visited community centres in Lugnsjön and Fullsjön – and now the newly built service building – once a fortnight to answer questions from concerned members of the public."

Furthermore, Jämtkraft has been meticulous about distributing rural development grants, or wind money, to the local communities in all its projects. In the case of Hocksjön, Jämtkraft has also requested the creation of a wind money association with representatives from all the villages.

"The project spans several municipal and county borders, and we're keen to ensure that the money is allocated in a good way."

**ANOTHER AREA**, in addition to wind power, that Jämtkraft will be actively investing in going forward is energy storage.

"We're currently looking at batteries, and we have a hybrid plant with hydro power and a 1 MW battery in full operation since last year. We can already confirm that this has been very successful, and we're planning to build a 15 MW battery park at our largest hydro power plant, Hissmofors in Krokom."

Skoglund explains that these battery solutions will primarily be used to sell support services to the electricity grid.

"We'll be able to benefit from the experiences we have with these hybrid plants in wind power contexts in the future," he says.

**THIS YEAR** will be the first time that Jämtkraft is sponsoring Winterwind, a conference that Skoglund believes has a clear significance for development in the industry.

"We're a fairly large player, so this is a good way for us to be able to show ourselves to suppliers and potential colleagues."

But first and foremost it's the networking with the other participants that he values.

"We can get to know each other when we meet like this and share our expertise in different ways. It's one of the main advantages with our industry: we're not competitors fighting for customers, so we can be open and share. This is what makes a major conference like Winterwind such an important event," says Jens Skoglund.

**Jämtkraft is a GigaWatt Sponsor of Winterwind 2023. Read more about the company: en.jamtkraft.se**

# The quest for the perfect de-icing algorithm

Forget traditional, rigid systems for preventing ice build-up on turbine blades or for de-icing already iced-up blades. Right now, scientists in Switzerland and Austria are working to find the perfect algorithm for when systems should start and for how long they should be running.

**TEXT:** Joakim Rådström

**Wind & Ice Project** Manager Franziska Gerber works for Swiss company Meteotest. As part of the "Smart Operation of Wind Power Plants in Cold Climate" (SOPWICO) project, she's investigating how to find an algorithm to optimise the time for activation and deactivation of blade heating – thereby maximising energy generation.

Franziska Gerber has previously worked with snow analyses in Antarctica and avalanche research in the Alps. At Meteotest, she and her colleagues are also working on the sister project "Smart Operation of Wind Turbines under Icing Conditions" (SOWINDIC), run by the Austrian energy company Verbund, the University of Vienna and the Austrian Institute of Technology (AIT).

"We employ a physics-based approach. We look at temperature, wind speed, whether there are clouds heading towards the turbine, and so on, and use this data to determine when it would be best to start the heating. The University of Vienna is using machine learning instead," Franziska says.

Franziska Gerber

Within SOWINDIC, a data model is trained and optimised through several years of collected data from previous operations. In both cases, however, the purpose is the same: to determine the best time to start heating.

**Four different** wind farms in Scandinavia and Central Europe are being studied within the scope of these projects.

The aim is to compare the results between the two projects in order to identify the model with the best effect. Verbund is investigating whether some kind of hybrid algorithm of both models might be the better option. AIT, on the other hand, is attempting to develop hardware to be placed inside the turbine in order to collect the data needed to determine and run the algorithms and control the turbine's ice protection system.

The proposed solution will enable preventive heating, avoiding any downtime and subsequent time-consuming de-icing – even if this might also be combined with classic de-icing systems.

"We're trying to make the solution modular. If we have a certain type of heating system, we should be able to use it in combination with the weather forecasts to determine when to initiate preventive heating and de-icing respectively."

Franziska Gerber points out how existing heating systems are frequently based on relatively standard, predefined times for start-up and operating periods. As a result, the systems may be heating the blades when it's inefficient to do so. Conversely, as they may have restrictions on how long they should run, they may be deactivated just when they're needed the most.

**Franziska Gerber will give a talk on the theme "Can we make better use of ice protection systems?" on Wednesday 29 March.**

# **No direct link between** climate effect and ice formation

Climate change is making it difficult to predict future winter weather and ice formation on wind turbines. Although warmer weather should theoretically result in less ice, many other factors are involved. It's an indisputable fact that more measurement and analyses are needed.

**TEXT:** Joakim Rådström

Johan Hansson.

Stefan Skarp.

**IN MANY PLACES**, the winters in recent years have trended towards mild weather, rain, alternating ice formation and thawing, and generally unpredictable conditions for wind power operators. This is what makes it so interesting to hear what a meteorologist has to say about how the climate has affected wind power in recent years – and what we might expect in the future.

Johan Hansson, wind resource analyst at Arise, is a qualified meteorologist. Arise, which owns 139 MW of wind power and manages a further 1,800 MW in Sweden and Norway (with even more external projects under construction), continuously analyses how winter conditions are affecting wind power production.

"In recent years, our focus has shifted from southern to northern Sweden, as the south is more densely populated and there are larger uninhabited areas in the north," reports Johan Hansson.

Yet they soon discovered another problem here – the more severe winters, which result in ice formation and snow, causing operation disturbances.

**THE MAJOR PROBLEMS** of ice losses tend to occur when the rotor is running in clouds while temperatures are below freezing. Since cloud water is in liquid form despite the surrounding cold climate – "pure water can be liquid even at –30°C", as Johan Hansson points out – the problems may persist even at very low temperatures.

"But it's usually not freezing cold when you have these situations with low clouds and low pressure systems passing simultaneously. It's often between zero and –10°C that you get the biggest problems," reports Johan Hansson.

This has led to widespread concern that, as the climate warms, we will also experience greater problems with ice formation due to relatively higher temperatures in northern Sweden.

**MEANWHILE,** there's no linear connection between the greenhouse effect and ice formation on wind turbines, as many other factors also play a role.

"The low-pressure tracks may change, blocks in weather systems may cause the same type of weather to persist for several weeks, resulting in ice forming in ways that are difficult to predict."

Such trends, with prolonged periods of e.g. hot weather or rain, have been a regular occurrence in recent years, and are confirmed by e.g. climate researchers at the renowned University of Potsdam.

"But then we don't know how sea currents will be affected, and how they in turn are affecting the movement of low pressure systems. There's great uncertainty there," adds Johan Hansson.

**IF ICE FORMATION INCREASES** in some places, power generation will obviously decrease, or at least need to be protected and secured with different systems. But could future changes in the weather also affect wind speeds?

"It's windier in the winter than in the summer. But it's not easy to determine whether wind strength will increase or decrease in a future climate," says Johan Hansson.

Admittedly, climate change tends to have a greater impact on higher latitudes than on lower latitudes. As winds are generally driven by differences in temperature, it's conceivable that in the future we'll see a general decline in winds.

"It will certainly look different in different parts of the world. We also don't know which feedback effects in the atmosphere might radically change this."

**STEFAN SKARP** is head of wind power at Skellefteå Kraft. He doesn't see the current weather changes as proof that we're already experiencing more severe icing patterns due to climate change.

"Historically, no two winters have ever been identical. There are normally large variations, and the icing we've seen during winter 2022–23, for example, has been far from the worst we've seen."

That being said, Skellefteå Kraft is very involved in the issue of measuring and monitoring how winter weather affects wind turbines and wind power output. A few years ago, it started developing a project to test that very thing. The "Testbed cold climate for conversion to 100 per cent renewables" project was run in partnership with the RISE Research Institutes of Sweden, with funding from Vinnova, and was to be located at the Uljabuouda wind farm in Arjeplog Municipality in the Norrbotten fells.

**THE SITE WAS WELL-CHOSEN** – Uljabuouda, situated on a bare mountainside 760 metres above sea level, was one of the first wind farms to be built above the tree line. The winds in the area average about eight metres per second. At present, however, these plans have been put on hold.

"We had hoped to set up a centre run by a third party, so that different wind power companies could test their equipment in a cold climate. Disappointingly, the centre hasn't attracted the market interest we'd hoped, and now Skellefteå Kraft will also need to choose the path for Uljabuouda," says Stefan Skarp.

Instead, they'll be looking at opportunities for smaller-scale test activities in combination with wind power generation at Uljabuouda. Stefan Skarp argues that during the development of the test facility, a lot of knowledge has been accumulated, which may come in useful when large-scale test activities become commercially interesting again.

Skellefteå Kraft also has several other development initiatives in progress. Trials of a new technology concept are currently under way via development company Linnovation, involving full-scale tests of a de-icing system on a turbine in Malå.

**IT'S CLEAR THAT THERE'S STILL** great potential for improvement in turbine performance and operating costs during the winter, according to Skellefteå Kraft's ongoing analyses of the performance of their own turbines during the winter months.

"We can separate losses into three categories in our operational follow-up: stoppages, limitations and performance losses. Performance losses due to ice formation are predominant during the winter," says Stefan Skarp.

Losses without de-icing are estimated to be in the order of 10 to 15 per cent of annual production at the most challenging sites, but Skellefteå Kraft claims to be able to halve these losses with existing technology.

**Johan Hansson and Stefan Skarp will be sharing more of their experiences during a panel discussion on Tuesday 28 March.**

# Task force to solve tricky winter issues

When your usual efforts are not enough, you may need to bring in a team of specialists. One such team is the IEA Wind TCP Task 54 of the International Energy Agency, where representatives from numerous countries solve problems and adapt different approaches to ice formation on wind turbines.

**TEXT:** Joakim Rådström

**Claas Rittinghaus** is a project manager at Energiewerkstatt (Energy Workshop) in Austria, a firm of highly specialised technical consultants who have been focusing on wind power-related issues for over 30 years. For some time now, Rittinghaus has been part of the IEA Wind TCP Task 54 work group, where his sub-group investigates the performance of de-icing systems and ice protection systems (IPSs) on wind turbines.

The background to the sub-group that Rittinghaus is working with is the current difficulty of obtaining an objective evaluation of the performance and efficiency of various IPSs.

It has often been left to the manufacturer to specify these values, which have therefore varied widely in terminology and methodology.

"We're attempting to get consensus in the industry on how to evaluate and standardise concepts," reports Claas Rittinghaus.

Within the framework of the Rittinghaus sub-group, a number of "work packages" have been developed, which will deal with terminology and definitions, give example scenarios for ice formation incidents, model different IPS performance, give recommendations on how to validate IPS performance in the field, etc. Further assignments involve collaboration with the sub-group for wind tunnel testing and disseminating the final results of the work.

Claas Rittinghaus.

**Participants** from no fewer than seven different countries are represented in the sub-group: Austria, Sweden, Denmark, Finland, Germany, Switzerland and Canada. Members include manufacturers, consultants, research institutes and universities.

"We want to get feedback from the industry about whether or not they agree with our proposals. We are right at the beginning of our work", says Claas Rittinghaus.

It's not only manufacturers interested in being able to evaluate system performance, but also project developers and operators, states Rittinghaus.

"This is why we need a broadly and easily applicable method on which everyone can agree."

**However,** he doesn't see a need for any kind of international regulation of the sector.

"This is not as technically important as, say, the turbine's power curve. We just want to make recommendations on how to do this, and we'll see if the industry is willing to adopt the strategies we propose."

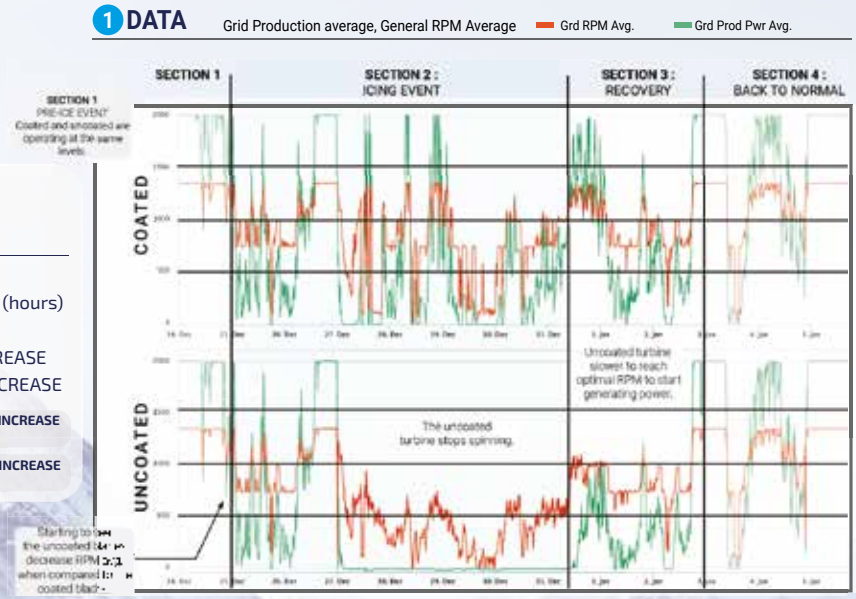
**Claas Rittinghaus will be speaking more about this work at seminars on Monday 27 March and Wednesday 29 March.**

# IMPROVE OPERATIONAL PERFORMANCE DURING UNCERTAIN WINTER CLIMATE WITH:


# NEINICE

**A patented icephobic coating for wind turbines that effectively promotes ice shedding, mitigates ice accumulation and provides protection from a broad range of detrimental conditions.**

## 1 DATA




## 2 RESULTS

EVENT DATE : **February, 2022**
LOCATION : **Midwest USA**

| | |
|---|---|
| **5** | TOTAL TURBINES |
| **144** | DURATION OF EVENT (hours) |
| **$199** | Est. $mW/h |
| **0.109** | AVERAGE mW/h INCREASE |
| **15,696** | Event Total mW/h INCREASE |
| **$3,123.50** | **EVENT REVENUE INCREASE PER TRUBINE** |
| **$15,617.52** | **EVENT REVENUE INCREASE ALL TURBINES** |

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**UPCOMING SHOWS 2023:**

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**WINTERWIND**
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NEW ORLEANS, LA
MAY 22-23
( BOOTH 2923 )