Winterwind
INTERNATIONAL WIND ENERGY CONFERENCE 2020

WINTERWIND
INTERNATIONAL WIND ENERGY CONFERENCE 2020
Feb 3-5 2020, Åre, Sweden

WELCOME

to this year's Winterwind conference in Åre!

WITH THIS TWELFTH world leading meeting point on wind energy in cold climates, we put some special focus on operation and maintenance in cold climates during the last day. Winterwind is the place for anyone who wants to find out the state of the art to optimize production and streamline operation and maintenance in cold climates.

With experience from eleven previous conferences, we are constantly developing this venue and making it even better. This year, among other things, we can present the news that, through the B2match-tool, we want to facilitate and encourage better matchmaking and more rewarding meetings. We urge you all to create your profile and use this networking opportunity!

We would also like to thank Vasa Vind for welcoming us with the field trip to their new impressive wind farms Åskälen och Munkflohögen.

See you in the crowd!

Jakob Economou, Coordinator, Winterwind 2020

Jeanette Lindeblad, Chairwoman of the Board, Swedish Windpower Association

Swedish Windpower Association

ABOUT

Swedish Windpower Association represents all producers. The association has over 30 years of experience. It started with the visionary entrepreneurs, landowners and others, who invested in one or a few turbines, but today we represent everything from the smaller to the big actors. We are an established referral body and a committed party in energy Sweden who believes in the power of collaborations.

Our main purpose is to promote the development of wind power at reasonable economic and financial conditions. We are involved in wind power related projects and educations, we inform about research results and technological development, often in close collaboration with authorities, organizations and the business community.

MEMBERS BENEFITS

We have contract partners for specially made member benefit offers for example a customized wind power insurance developed by the broker Marsh, specially written to cover a wind turbine and its special activities. Last year we jointly with Marsh launched a new insurance for decommissioning guarantees.

For electricity trading we offer a framework agreement via Bixia. By negotiating an agreement for our members as a group we can offer an agreement that is at the top of the market.

Also, in collaboration with MAQS, we offer our members an hour of free advice in connection with having a case you want to discuss, and a discount on following hours, if needed. MAQS has many years of experience in handling wind power projects that span all phases.

And if you have an interest in the Nordic renewable market, don't miss this opportunity to take part of the most important price effecting news and forecasts. Bodecker Partners electricity certificate report contains the latest updates on politics, growth and price forecasts in Sweden and Norway. This comprehensive report is much appreciated among wind power owners, banks and energy companies. It is available in English and published 5 times per year. As a member you have a discount on the report.

THE MAGAZINE

We publish the magazine: Tidningen Svensk Vindkraft. The magazine aims to work for continued development and dissemination of knowledge-enhancing information on wind power – to nuance the debate, to convey research findings and information on technical development, to monitor and review the wind power industry as well as the work of government and politicians. As from this year, we will publish an English summary of each magazine.

We are an experienced conference organizer. We annually arrange conferences and informative seminars as:

- **Winterwind International Wind Energy Conference.** Winterwind found early its own niche in wind energy in cold climate and gathers every year the world's wind energy professionals. Organized by Swedish Windpower Association since 2008.
- **RE-Scandinavia**. A conference about energy power purchase agreements, corporate PPAs. Organized by the Swedish Windpower Association in cooperation with the Danish Wind Energy Association who collectively represent more than 5,000 MW of operating wind power capacity. In partnership with Re-Source.

Members of the Swedish Windpower Association receive a discount on standard prices at our events. The association is open to everyone. Among our members are besides producers, both private individuals, suppliers and wind power developers among others.

More about members benefits and the association at: www.svensk-vindkraft.org/eng

ORGANIZER

Swedish windpower association

SUPPORTIVE PARTNER

Swedish Energy Agency

MEDIA PARTNER

Svensk vindkraft

b2match

B2match will be the tool for match-making at Winterwind 2020 hosted by Enterprise Europe Network (EEN). It will help you request, manage and schedule meetings efficiently!

Winterwind

INTERNATIONAL WIND ENERGY CONFERENCE

Winterwind is an international must-go for everybody that is working with issues related to wind energy in cold climates. Winterwind gathers every year the world's wind energy professionals in Sweden to discuss the challenges of generating wind power in cold climates. Parallel to the conference there is a fair. Winterwind is organized by Swedish Windpower Association since 2008.

Read more: *winterwind.se*

FREE WI-FI: use the Telia wi-fi and log in with your e-mail address

SWEDISH ENERGY AGENCY SUPPORTS RESEARCH

AS SWEDEN'S PRIMARY wind power R&D funding agency, the Swedish Energy Agency finances research conducted by universities and industries through several R&D programmes.

We also help companies to develop and commercialize energy technology. The overarching goals are to achieve Sweden's targets and national objectives for a renewable energy system, contribute to business development, and increase jobs and export.

The Swedish Energy Agency deals with many different issues that affect the wind energy expansion. We host the web portal vindlov.se, which gathers the regulations regarding the permit process, and we also finance research on wind power's environmental effects through the R&D programme Vindval. The initiative *Nätverket för Vindbruk* is a network that aims to increase knowledge about wind power and to work for local development where wind power is being expanded. The R&D programme VindEl and the Swedish Wind.

Power Technology Centre support technology-oriented research within prioritized areas defined in Sweden's strategy for wind power. We support larger demonstration projects through our programme *Pilot- och demonstrationsprojekt*. The agency also provide specific support to SMEs to promote Swedish energy technology and energy innovations both nationally and internationally.

The agency has also, together with the Swedish Environmental Protection Agency, initiated the work to define a national strategy for a sustainable wind energy expansion in Sweden.

Internationally, the agency is active within IEA Wind TCP and supports the Swedish involvement in the European project NEWA.

Swedish Energy Agency

ROXX

Production: Roxx Communication Group, www.roxx.se.

Publisher: Jakob Economou. **Editor:** Peter Wiklund.. **Cover photo:** Vattenfall. **Ad seller:** Magnus Nordén, Winterwind. **Graphic designer:** Caroline Adolfsson. **Print:** Åtta.45, 2020

MONDAY FEB 3

	OUTSIDE SESSION	SOLSKOG
9:00		**Workshop by Swedish Windpower Association and RISE** Wind Farm Blockage Effect Onshore – workshop on definition and way forward (By invitation and application only.)
10:00	**Field Trip**	
11:00		
12:00		
13:00		**Task 19:** Performance warranty guidelines for wind turbines in icing climates workshop at Winterwind 2020. (By invitation and application only.)
14:00		
15:00		
16:00		
17:00		
18:00	**Registration and Poster Setup**	
19:00		**Introduction to Winterwind 2020** Program and networking
20:00		

TUESDAY FEB 4

	ARENAN	SOLSKOG	SNÖLJUS
8:00	**Registration, Exhibition and networking**		
9:00	**1 Opening session – Welcome!** Moderators: Jeanette Lindeblad and Fredrik Lindahl, Swedish Windpower Association Open Innovation Contest		
10:00	**Break and networking**		
11:00	**2 Modelling** Chairs: Daniela Roeper, René Cattin	**3 Forecasting** Chairs: Sandra Grauers, Sven-Erik Thor	**4 Icing losses and ice throw** Chairs: Sarah Barber, Anders Wickström
12:00			
12:30	**Lunch and networking**		
13:00			
14:00	**5 Modelling and forecasting** Chairs: Ifrah Mussa, Johan Revstedt	**6 Uncertainties – development, life cycle, end-of-life** Chairs: Helena Wickman, Hamid Sarlak	**7 Testing and innovation** Chairs: Åsa Abel, Rolv Erlend Bredesen
15:00			
15:30	**Break and networking**		
16:00			
16:30	**8 Structural monitoring** Chairs: Tanja Tränkle, Till Beckford	**9 Ice detection** Chairs: Frida Godet, Øyvind Byrkjedal	**10 Ice Protection Systems I** Chairs: Jenny Longworth, Finn Daugaard Madsen
17:00			
18:00 – 19:30	**Mingle, poster presentations in Exhibition Hall and networking**		
19:30 – 24:00	**Dinner and entertainment**		

WEDNESDAY FEB 5

	ARENAN	SOLSKOG	SNÖLJUS
9:00	**11 O&M + Open Innovation Contest** Chairs: Anne Mette Nodeland, Martin de Maré		
10:00	**Break and networking**		
11:00	**12 Manufacturers** Chairs: Åsa Elmqvist, Stefan Söderberg	**13 Ice protection systems II** Chairs: Emilie C. Iversen, Jan-Åke Dahlberg	**14 O&M activities and strategies** Chairs: Liselotte Aldén, Lars Jacobsson
12:00			
12:30	**Lunch and networking**		
13:00			
13:30	**15 What do we need now?** Moderator: Tomas Kåberger Keynote speakers *		
14:00			
15:00			

TOPICS AND LECTURERS

1 Welcome!

Moderators: Jeanette Lindeblad and Fredrik Lindahl, Swedish Windpower Association

A short introduction – Göran Ronsten, Program coordinator

A European Outlook on the prospect of Onshore Wind - Global importance with regional benefits – Sandra Grauers, Vattenfall (51)

Open Innovation Contest – Tanja Tränkle, RISE (50)

2 Modelling

Chairs: Daniela Roeper, René Cattin

Large Eddy Simulation of Icing Conditions Impacting Wind Farms in Heterogeneous Land Use – Erik Janzon, Department of Earth Sciences, Uppsala Universitet, Sweden (11)

Predicting production loss due to ice accretion – Johan Revstedt, Dept. of Energy Sciences, Lund University, SE (16)

Parametric analysis of wind turbine icing in cold regions – Ifrah Mussa, Kingston University, United Kingdom (45)

Improved flow modelling at cold climate sites through novel land-surface data from satellite sources – Morten Lybech Thøgersen, EMD International A/S, DK (40)

3 Forecasting

Chairs: Sandra Grauers, Sven-Erik Thor

Improvements to the WRF microphysics – Emilie C. Iversen, Kjeller Vindteknikk (5)

Forecasting of icing for wind energy applications – Øyvind Byrkjedal, Kjeller Vindteknikk, NO (38)

How might climate change affect repowering? – Charles Godreau, Nergica, CA (8)

Riskminimera med egen strategi för biologisk mångfald – Åsa Abel, Ecogain, Sverige (55)

TOPICS AND LECTURERS

4 Icing losses and ice throw

Chairs: Sarah Barber, Anders Wickström

The impact of liquid water content on thermal ice protection systems efficiency – André Bégin-Drolet, Université Laval (18)

Task19 – Ice Loss Tool, Timo Karlsson, VTT (15)

windThrow: an open source toolbox for ice throw simulations – Hamid Sarlak, Denmark (23)

On the communication of the ice throw hazard to the public – Rolv Erlend Bredesen, Kjeller Vindteknikk, NO (44)

5 Modelling and forecasting

Chairs: Ifrah Mussa, Johan Revstedt

Validation of turbine specific modelled ice losses – Stefan Söderberg, DNV GL, SE (31)

Validation of, and findings from, the IceLoss 2.0-project – Johannes Lindvall, Kjeller Vindteknikk, SE (36)

A CFD benchmark study of ice accretion on a wind turbine blade and a comparison to the ice accretion of a rotating blade cylinder model – Johannes Lindvall, Kjeller Vindteknikk, SE (37)

Offshore wind farm at icy conditions – Tahkoluoto, Jaakko Kleemola, Suomen Hyötytuuli Oy, FI (54)

6 Uncertainties – development, life cycle, end-of-life

Chairs: Helena Wickman, Hamid Sarlak

Cost of uncertainty in project development – Jenny Longworth, Kjeller Vindteknikk AB (29)

Circular streams from GFRP composite waste – Richard Sott, RISE (14)

Improve Wind Project Lifecycle Cost of Energy in Cold Climates – Albert Bosch, VORTEX FdC, SL (6)

Wind farm blockage onshore: what drives the loss? – Till Beckford, DNV GL, UK (28)

7 Testing and innovation

Chairs: Åsa Abel, Rolv Erlend Bredesen

Climatic chamber testing and verification in cold climate – Mattias Viktorsson, RISE (12)

Pile Foundation Prototype Execution and Applicability for Scandinavia – Miguel Turullols, Nabrawind Technologies SL, ES (13)

Ice and snow management innovations for critical infrastructure – Ville Kaikkonen, University of Oulu (32)

Storage of electricity in molecules – Finn Daugaard Madsen, Siemens Gamesa Renewable Energy A/S (3)

8 Structural monitoring

Chairs: Tanja Tränkle, Till Beckford

Blade defect forecasting – Anders Røpke, Wind Power LAB (4)

Towards tracing a rotor surface's 3D trajectory over time – Michael Moser, eologix sensor technology gmbh (42)

Effect of heavy rotor blade icing to life-time consumption of tower and foundation – Carsten Ebert, Woelfel Wind Systems (46)

Siemens Gamesa effective blade repair solution at cold temperatures – Mert Satir, Siemens Gamesa Renewabe Energy, Ireland (30)

9 Ice detection

Chairs: Frida Godet, Øyvind Byrkjedal

Icing intensity and ice removal algorithms for automatic turbine restart – Jarkko Latonen, Labkotec Oy, FI (43)

The impact of light ice masses on expected wind power production – Florian Rieger, fos4X GmbH (21)

Blade based ice detection IDD. Blade – efficient operation in cold climate – Bernd Wölfel, Wölfel Wind Systems GmbH (47)

Optimizing Windturbine heaters with blade based ice detection Systems – Nils Lesmann, Phoenix Contact, GER (1)

10 Ice Protection Systems I

Chairs: Jenny Longworth, Finn Daugaard-Madsen

Experimental investigation of an infrared de-icing system for wind power application in cold climate – Sofia Sollén, Luleå University of Technology (48)

Performance Maps for Ice Mitigation Operational Strategies – Dimitar Stoyanov, Coventry University (33)

Measuring the Wind in Cold Climates – a real world summary of Lidar performance – Wulstan Nixon, United Kingdom (10)

Case study; Controlled environment in up-tower blade repairs – Ville Karkkolainen, Bladefence, FI (53)

11 O&M + Open Innovation Contest

Chairs: Anne Mette Nodeland, Martin de Maré

Slowly, slowly, we'll reach our goal! – Sébastien Trudel, EDF Renewables, Canada (52)

Highlights from CanWEA's operations and maintenance summit 2020 – Charles Godreau, Nergica, CA (41)

Open Innovation Contest - Grand Final!

12 Manufacturers

Chairs: Åsa Elmqvist, Stefan Söderberg

Vestas Cold Climate solutions – Karl Gregory, Vestas Wind Systems A/S, DK (27)

Evaluation of Vestas De-icing System, – Alexander Stökl, Energiewerkstatt e.V. (2)

Siemens Gamesa ice accretion modelling and its impact on the aerodynamic performance and AEP – Esteban Belmonte, Siemens Gamesa Renewable Energy, SP (35)

Nordex advanced Anti-Icing System for N149 wind turbines – Konrad Sachse, Nordex Energy GmbH, DE (7)

13 Ice protection systems II

Chairs: Emilie C. Iversen, Jan-Åke Dahlberg

Megaterends in blade heating – Petteri Antikainen, Wicetec, FI (26)

A new type of anti icing system – development/application/demonstration – Sven-Erik Thor, Lindskog Innovation AB (19)

Installation of Retrofit Hot Air De-icing Systems – Daniela Roeper, Borealis Wind, Canada (9)

Ice protection systems and retrofits: Performance and experiences – Charles Godreau, Nergica, CA (39)

14 O&M activities and strategies

Chairs: Liselotte Aldén, Lars Jacobsson

Wind turbine operations in northern Siberia – Masafumi Yamazaki, Kanagawa Institute of Technology, Japan (25)

Control of tower bolt connections and the challenges related to cold climate conditions – Anders Wickström, RISE Research Institutes of Sweden (20)

From Open Innovation Contest

Advanced operational analytics with machine learning – Sarah Barber, DNV GL, UK (34)

15 What do we need now?

Moderator: Tomas Kåberger

Should I heat or should I not? – Smart operation of wind turbines in Cold Climate, René Cattin, CEO Meteotest CH (24)

World Energy Outlook – Yasmine Arsalane, IEA (58)

Dialogue: Yasmine Arsalane (IEA) and Sandra Grauers (Vattenfall)

A decade of expansion ahead – Tomas Kåberger, Renewable Energy Institute, Chalmers (59)

Final words – Fredrik Lindahl

MEET OUR SPONSORS & EXHIBITORS

Photo: Vattenfall

In the exhibit hall you'll meet interesting companies and organizations offering services and products specific to your business within renewables.

These are our sponsors and exhibitors for the 2020 conference. Please visit their stands, websites and social media channels.

SUPPORTING PARTNER

Swedish Energy Agency

The Swedish Energy Agency works for a sustainable energy system, combining ecological sustainability, competitiveness and security of supply.

The Agency finances research for new and renewable energy technologies, smart grids, and vehicles and transport fuels of the future. The Agency supports commercialization and growth of energy related cleantech.

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 assessment and wind modelling for all stages of the wind farm project.

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 for several large manufacturers and has supported in warranty discussion connected to anti and de-icing systems.

Kjeller Vindteknikk has more than 20 years of experience with wind energy in cold climate.

modity

MODITY is one of Sweden's leading energy traders, with customers and partners consisting of large and small energy companies, businesses within several segments of industry as well as energy producers, located all over the Nordics. Our experts have vast knowledge and experience in all key aspects surrounding energy trading and managing energy facilities.

The development and expansion of wind power is something we are especially passionate about. Many of our solutions are tailored specifically for optimizing management of wind power facilities and creating the most favorable conditions to maximize the revenue generated.

eit InnoEnergy
Knowledge Innovation Community

EIT INNOENERGY accelerates sustainable energy innovations across Europe. Since our creation in 2010, we have invested in over 400 products and services across the entire energy value chain, invested €500 million and accelerated more than 230 start-ups. As a result, we provide access to commercially attractive technologies, at lowered levels of risk and complexity for end-users.

EIT InnoEnergy's pan-European network resources include 460+ business, academic and research partners with access to 150 million energy consumers across the European Union and beyond.

SPONSORS

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 2020 we present you our "Blade Intelligence" . It is a modular rotor blade monitoring system that combines the ice detection, lightning measurement and load monitoring functions in one system.

DNV GL delivers world-renowned testing and advisory services to the energy value chain including renewables and energy efficiency. Our expertise spans onshore and offshore wind power, solar, conventional generation, transmission and distribution, smart grids, and sustainable energy use, as well as energy markets and regulations. Our experts support customers around the globe in delivering a safe, reliable, efficient, and sustainable energy supply. Our testing, certification and advisory services are delivered independent from each other.

VTT TECHNICAL RESEARCH CENTRE OF FNLAND is a visionary research, development and innovation partner. We drive sustainable growth and tackle the biggest global challenges of our time, turning them into growth opportunities. We go beyond the obvious to help the society and companies to grow through technological innovations. We have over 30 years of cold climate wind energy experience, and a successful commercialization of blade ice prevention technology. Wind energy activities cover the value chain from resource assessment, system integration, turbine technology to O&M. We serve our customers through direct contract research, but also through national and transnational R&D collaboration.

UL WORKS to help the energy industry mitigate risk and navigate complexity associated with renewable resources. A global trusted advisor providing access to proven science and expert engineering, by offering innovative solutions to meet the unique challenges of the renewable energy industry. Services encompass expert advice from project inception to decommissioning, testing, inspection, certification, verification and auditing. www.ul.com/renewables

NORDEX GROUP offers reliable and high efficient multi-megawatt wind turbines for nearly all geographical regions. Also part of the Nordex Group's offer are solution-driven innovations, a dense service network, preventive maintenance, an anti-icing system with warranted performance, and end-to-end modernization. Nordex Group has installed more than 22 GW worldwide and has offices in more than 25 countries around the world. The Swedish subsidiary is located in Uppsala.

As an independent research institute **RISE** offers a wide range of cutting-edge research and innovation services. Customers and partners will find us dedicated in developing value-creating future solutions within a range of technology areas. Our test and demonstration facilities are important for innovations before entering the market –so is the full-scale test station in northern Sweden. Focusing on measurements, test, validation and certification activities for the cold climate wind industry we offer the arena for technology verification in demanding conditions.

NORDEX

acciona Windpower

EXHIBITORS

EOLOGIX produces flexible, retrofittable smart sensor solutions. Founded in 2014, today a team of 20 is dedicated to the development and deployment of energy self-sustaining, wireless sensors. eologix' key product – installed on more than 320 turbines – is designed for ice detection and temperature measurement on rotor blades, minimizing downtimes caused by ice accretion or de-icing.

DEKRA is working for increased safety in a variety of industries through independent inspection, testing and certification. DEKRA is Europe's leading expert organization with 45 000 employees in more than 50 countries. With our long experience from the wind energy industry, we can support the customer to reach high safety both during construction of a new plant and in operation of existing plants.

LABKOTEC Ice Detectors are designed for detecting icing conditions on the rotor blades. Ice detector improves turbine production reliability and reduces risks caused by ice formation. Warning light system warns people by detecting icy conditions and providing ice alarms. Protection package SG protects ice detectors against lightning and over voltage.

DEUTSCHE WINDTECHNIK AB, provides complete maintenance, ranging from basic service agreement to individually tailored full-service agreements for nearly 150 wind turbines manufactured by Vestas, Siemens, Gamesa, Nordex and Enercon in Sweden.

The Deutsche Windtechnik group has over 4,500 turbines totally in Europe, USA and Asia. The company operates both onshore and offshore.

ROPE ACCESS SVERIGE AB provides engineering at height, inspections, preventive maintenance and advanced repair work at wind power plants, in confined spaces and in demanding industry environments as well as related trainings and consultancy. We have offices in Solna (Stockholm), Gothenburg and Helsingborg.

BIXIA is one of the leading energy companies in Scandinavia. We are the largest buyer in the Nordic region of locally produced, renewable electricity. Our long experience of conducting successful electricity trading is a security for you as a customer. We act directly on the Nordic electricity exchange market with our own power trading unit. This means that we can offer long-term, sustainable, cost-effective solutions where your wishes and needs are at the core.

As a global leader 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.

TENSAR International can provide cost-, carbon- and time-saving solutions to any wind farm project. We are a world-leading manufacturer and provider of subgrade stabilisation and soil reinforcement solutions to overcome common ground engineering problems in construction and civil engineering. With expert technical services and an international network of partners, Tensar provides professional support and impartial advice for projects, from product selection and engineering design, to on-site construction guidance.

Tensar's innovative and high-performance geogrid and geotextile products offer professional methods that have benefitted thousands of access-roads, working platforms, crane hard standings, embankments, railways and other infrastructure projects around the world.

EXHIBITORS

OPATINA works with safety. We work as safety or HSE representatives in different projects, heavy construction and windcraft. Opatina help you in planning or execution of your project as HSE and BAS P/U and HSE manager. We have a wide range of experience and we work to give you the full range of expertise in your project.

UPPSALA UNIVERSITY CAMPUS GOTLAND provides capacity building and research communication in the Swedish National Wind Utilization Network, and offers a large selection of multi-disciplinary wind power courses and a Master programme in Wind Power Project Management.

VINDVAL collects a nd provides scientific knowledge of wind power's impacts on humans and nature. The program is a cooperation between the Energy Agency and the Swedish EPA.

VINDFORSK is a technical research programme run by Energiforsk – the Swedish Energy Research Centre and financed by the Swedish industry. The aim is to hoard and share knowledge to strengthen the knowledge base of the Swedish wind power industry and the energy sector.

STV'S business area includes the manufacturing of new Tracked vehicles, upgrading of tracked vehicles, leasing of tracked vehicles and supply of accessories such as fixed trailer, cranes and load exchangers. STV designs and builds tracked vehicles for all operations where there is a need for off-road vehicles. The electric power industry, oil and gas, exploration, logistics, rescue services are just a few examples.

BLADEFENCE is a specialist for wind turbine blade condition analysis, repairs and maintenance. The company utilises advanced skylift equipment and UV-curing blade repair method in its operations. In combination, these enable operations in harsh weather conditions, cutting-edge efficiency and minimise turbine downtime. The company was certified by Germanischer Lloyd for blade repairs in 2012 as the first company in the Nordic countries.

WICETEC OY is wind turbine blade heating technology provider. Our technology prevents ice to accumulate on blade surface and therefore enables continuous turbine operation throughout the winter when the winds are high and energy demand and price is peaking. The patented technology is available for new turbines as well as retrofit to existing turbines with field proven lifetime of 20 years. Wicetec staff consists of highly skilled professionals with firm experience of wind power in cold climate environment.

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.

CUE DEE was founded 1978 and since 2001 we have been supplying masts to the wind energy sector. Cue Dee has been a market leader in the Nordic countries for many years and developed a complete range of masts and accessories quality designed to be the best choice for the wind industry.

NIBE ELEMENT WIND SOLUTIONS

NIBE ELEMENT WIND SOLUTIONS, NEWS, are supplying heating solutions for turbines erected in cold climates.

It means, heating of all critical applications in the nacelle to make it possible to start up, after a stand still situation. We make de-icing systems based on hot air as well as heating blankets for curing of blade repair.

FT TECHNOLOGIES

FT TECHNOLOGIES are the leading manufacturer of ultrasonic wind sensors for turbine control. At Winterwind we are introducing our new FT742 wind sensors with, enhanced measurement range & accurcy now available with acoustic air temperature output.
The FT sensors are easily heated, which helps to improve AEP and reduce LCoE.

sommer MESSTECHNIK

SOMMER is focusing on environmental measuring for the past 30 years. Our IDS-20 / IDS-30 Ice Detection Systems for the recognition and measurement of icing conditions and our RHD Rain and hail distrometer help to optimize the operation and reduce maintenance costs on wind turbines.

EVVA access to security

EVVA is a family-owned business and has always stayed true to its fundamental values, innovation and quality. From its establishment in 1919, the first lock in 1937 and modernisation measures in the 1970s, Evva is now one of Europe's leading security companies in mechanical and digital locks.

CONNECTED WIND SERVICES

CONNECTED WIND SERVICES – Welcome to a truly connected world where you get everything you need from one professional, experienced and service-minded Independent Service Provider. Our highly skilled service technicians provide you with unrivalled knowledge and dedication. For more than 25 years, we have focused on getting the best possible yield for the full lifetime of your assets. We apply best practices gained from decades of work with operators and owners at a wide array of locations.

EnBW Sverige AB

ENBW is one of the largest energy suppliers in Europe. EnBW aims to make renewable energies one of the main businesses by 2020. EnBW offers planning, construction, operation, maintenance and servicing for wind turbines from one source. EnBW plans to invest more than five billion euros by 2025 in the further expansion of renewable energies, and Sweden is among the target markets for onshore wind.

eta DYNAMICS

ETA DYNAMICS is a wind energy specialist engineering service provider. The three divisions, monitoring services , inspection services and engineering services combined offer a complete set of independent offerings for the operation of wind power plants. Eta Dynamics focus on data driven operations, condition monitoring, SCADA, digital inspection tools etc. in order to reduce downtimes and increase efficiency of the clients wind turbines.

LINNOVATION

LINNOVATION is an innovation company with several patents related to among others money handling.
A spin off of is the anti/de-icing system for wind turbine blades which has been developed in co-operation with Skellefteå Kraft AB and with financial support from The Swedish Energy Agency. The second demonstration phase is currently running on a wind turbine in the northern part of Sweden.

Skellefteå Kraft

MEDIA PARTNERS:

SVENSK vindkraft

SVENSK VINDKRAFT
The industry's leading magazine on Swedish windpower – published 5 timers a year by The Swedish Windpower Association.

Making accurate predictions of ice formation, and being able to calculate the likely associated loss of production, is advantageous both during the operation of existing wind farms and when planning new projects. Here, we take a closer look at the methods used by Kjeller Vindteknikk and DNV GL respectively.

Predicting ice formation – and its consequences

Kjeller Vindteknikk has been addressing the problem of ice formation on cold-climate wind farms for over 15 years. During recent winter seasons, they have conducted and validated short-term forecasts at 22 different wind farms throughout the Nordics in a project called IceLoss 2.0, supported by the Swedish Energy Agency.

"These forecasts, which extend 48-hours ahead, are conducted continuously and updated four times a day," explains Øyvind Byrkjedal, Kjeller Vindteknikk.

Meteorological data on parameters such as cloud cover, temperature, humidity and precipitation are used to calculate expected ice formation.

"The method of calculation is based on existing research standards for ice formation on building structures, which we implemented for the conditions affecting wind turbines. In order to validate the forecasts, we have compared them with periods of time during which icing has been found to impact on energy production according to operational data compiled by the operators' own systems."

ACCORDING TO KJELLER Vindteknikk, the results demonstrated that the forecasts correctly predicted 70-90% of icing situations on the most vulnerable wind farms.

Øyvind Byrkjedal.

"So, the results are pretty clear; however, in the wind farms with less icing the forecasts were less likely to agree with the operational data," says Øyvind Byrkjedal.

On one of the wind farms, two different instruments for ice detection are installed on nacelles. The IceLoss 2.0 project revealed both that these instruments failed to register all incidents of ice formation that could be identified in the operational data and that they registered several icing situations that did not affect production.

ACCORDING TO KJELLER Vindteknikk, the studies have several benefits; firstly, they increase the ability to predict future production losses and help to prevent them by providing advanced warning that turbine blades require heating and,secondly, they can be useful to network owners and others who want to continuously predict the supply of energy to the grid.

Kjeller Vindteknikk has also made its forecasts for three other wind farms that are not included in IceLoss 2.0 available to the public via the Norwegian operator's website.

"As an example, reindeer herders and others may find it useful to know when it is or isn't safe to enter a wind farm."

CONSULTANCY DNV GL working in fields such as renewable energy, is represented in over 100 countries and is one of the most widely employed wind power consultants in the Nordics for project development and due diligence.

In the field of deicing wind turbines, they offer services such as production-loss forecasts and evaluations for both existing and planned wind farms. They also evaluate various deicing systems.

They study historical meteorological data as a basis for planning new wind farms.

"We use an advanced mesoscale atmospheric model* and calculate data for the site dating back over 17 years. We prepare detailed site-specific weather conditions," says Stefan Söderberg, meteorologist and principal engineer at DNV GL.

Stefan Söderberg

THESE METEOROLOGICAL DATA, along with the calculated icing on turbine blades, are fed into a machine-learning system

that calculates the likely extent of the ice-related production loss..

"This may vary greatly from one wind farm to the next and from year to year, which is why we work site-specific and with such long time series."

DNV GL recently conducted a blind test for Nordisk Vindkraft's parent company, RES, which selected six wind farms in various parts of Sweden to achieve a large geographical span. DNV GL then predicted the ice-related production loss at the wind farms.

"RES gave us the coordinates along with data on hub heights and turbine types. We then delivered a year of hourly data for each turbine," explains Stefan Söderberg.

THE LOSSES PREDICTED by DNV GL were then compared to the production losses that RES itself was able to calculate from its operational data.

"This generally demonstrated a good level of conformity; both we and RES were satisfied with the results. The test shows that this is a good method for predicting production loss, not only at wind-park level but also variations from turbine to turbine. There can be considerable differences between individual turbine locations within a single wind farm."

There is still room for improvement in the method; however, as it is developed and refined, Stefan Söderberg believes that there will be increasing opportunities to use it to optimise wind farm designs.

"One of the aims is to be able to predict which turbines require deicing systems and which don't. This method may also provide a better basis for deciding were the turbines themselves should be located." ✱

**In meteorology, the term mesoscale refers to intermediate scale phenomena with a horizontal extent from approximately 1 kilometre to 10 kilometres.*

Meet Øyvind Byrkjedal and Stefan Söderberg at Winterwind!

Øyvind Byrkjedal will be speaking on Tuesday 4 February 11:00-12:30 on forecasting of icing for wind energy applications. Stefan Söderberg will be speaking on Tuesday 4 February 14:00-15:30 on validation of turbine-specific modelled ice losses.

Looking for new ideas

Competing in improvisation theatre is a way for Canadian Charles Godreau, part of the Winterwind program committee, to develop his skills as a research project manager at Nergica.

TEXT: PETER WIKLUND

A happy winner – Charles Godreau after a match in improvisation theatre.

Charles Godreau has been interested in science since he was a kid in Quebec, Canada. He got into renewable energy during his bachelor program, and then graduated at master's degree in wind energy involving CFD (Computational Fluid Dynamics) and hilly or mountainous terrain.

After graduation he quickly came across TechnoCentre éolien – TCE, which became Nergica in 2018 – and has now been working there for five years. As a project manager at Research and Innovation, Charles Godreau specializes in wind turbine performance assessments in cold climates and icing detection/protection systems.

"I like the challenges of applied research, where every project is different, and where there's always a new issue to solve or improve", he says.

"When it comes to wind, I specifically like the science behind the machine and how it integrates a lot of different subjects – meteorology, aerodynamics, materials as well as mechanical and electrical engineering."

IN CANADA THE opportunities and challenges for wind power vary from province to province. In Quebec and Ontario, where most of the installed capacity is, the development has slowed down over the last few years.

Most of the development is now in the Western provinces (Alberta and Sakatchewan), where the latest wind projects came out as low as 2.9 Euro cents/kWh (corresponding).

"For these provinces, wind is a competitive solution to decarbonize electricity", Charles Godreau says.

There are also a lot of community projects in Canada and these are very good examples of sustainable development, where the wind farms become a development tool for smaller or remote communities.

CHARLES GODREAU CAN see both similarities and differences, related to wind energy, between Canada and Northern Europe:

"The major similarities are the mix of electricity generation with a large fraction of hydro, wind projects in harsh winter conditions and the mix of project scale – from small to very large projects in remote areas", he says.

When it comes to differences, he points out that Northern Europe is much more energy efficient than Canada, mainly due to district heating and incinerators that generate electricity.

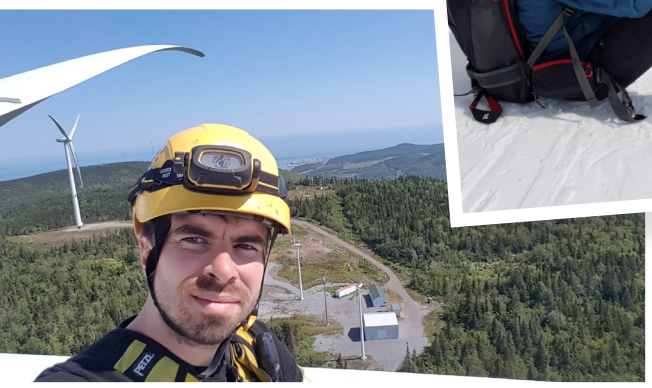
"Canada is still one of the countries where we consume the most energy per capita. The electricity market is however more complex in Europe than in Canada. I believe – not being an expert in this – that European and national level policies are more encouraging the development of wind and renewables than in Canada right now."

ANOTHER DIFFERENCE IS that in Europe in general, due to the proximity and density of population, managing the risks related to ice throw is more of concern than in Canada.

"This is something interesting from an outsider's perspective. In Canada, the focus of wind farm operators is really to optimize the production in icing conditions and reducing icing induced losses. A lot of operators are trying different strategies and technologies to recover more MWh during icing hours", Charles Godreau says.

For the Canadian markets, he thinks that retrofit technologies such as Wicetec and Borealis are interesting in ice-prevention and de-icing because a lot of projects would benefit from being able to retrofit an IPS on a turbine.

"I am also interested in seeing some coatings emerge as a durable option, as



”In Canada, the focus of wind farm operators is really to optimize the production in icing conditions and reducing icing induced losses.”

some sites with milder icing climates could benefit from them.”

32 YEAR-OLD CHARLES Godreau, who represents Canada in the International Energy Agency’s Task 19 working group on wind energy in cold climates, has participated in the Winterwind-conference before. He thinks it is “the reference event for wind energy in cold climates in the world”.

“You have experts from every part of a wind project life – development, operation – as well as research. I like the mix between scientific and industrial professionals which well reflect what the cold climates wind community is. From previous experiences, I have always come back with new ideas and innovative products that can improve the performance of wind farms in cold climates”, he says.

GROWING UP IN Quebec City, Charles Godreau had a chance to practice a lot of outdoor activities, like whitewater canoe and snowboarding.

“Now living in Gaspé, I can practice these activities only a few minutes from the office. In Sweden, I will not have much time but I do intend to go snowboarding in Åre on the Sunday before the conference if all my travel goes well”, he says.

Another free time activity of his, with a more cultural touch, is improv (improvisation theatre).

“In Quebec, we have a form of improv show inspired from ice hockey – we are Canadian you know – where two teams meet in a match format. The public votes at the end of each improv and there is a winner at the end of the match.”

He started playing it back in high school and has kept it up for the last 16 years.

“IT IS GREAT fun, but it also helps with public speaking, listening and leadership. I believe it helps me in my role as a project manager in Research and Innovation”, he says. ✱

Meet Charles Godreau at Winterwind!
He will be speaking on 5 February, 9:00-10:00 and 11:00-12:00 respectively.

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The route to the summit

In many ways, developing and improving wind farms in cold climates is like gazing up at an 8,000-metre peak from basecamp. So says Sébastien Trudel, manager of offshore wind power at EDF Renewables Canada – and a dedicated mountain climber.

The industry has been working for many years to improve wind turbine operation in cold climates and, along the way, obstacles, challenges and unexpected results have paved the way for technological breakthroughs and new, improved solutions. This is reminiscent of the members of a Himalayan expedition, determined to reach one of the highest peaks on earth: the scope of the task can seem overwhelming and the only way to reach the overall objective is to break it down into smaller goals.

This is according to Sébastien Trudel, who has spent the last 15 years developing onshore wind power in North America. He develops the parallel:

"In both cases, the exact route you should take and the obstacles you will meet along the way remain unknown when you begin your journey. Perhaps you only have a general direction of travel or a vision of where you are heading and how to get there. When you develop new technology, some of the routes you try may not provide the desired results or they may even lead you down a blind alley. You then have the choice to retrace your steps, or to begin again from square one with an entirely new strategy."

SÉBASTIEN TRUDEL IS often reminded of this during his work in the wind power industry.

"How many times does one find oneself faced with a project that, during development, construction or operation, has reached an apparent dead end or critical situation? On several projects we developed in eastern Canada, icing and ice-related production losses were much greater than we anticipated."

He explains that they have investigated and tested a number of different deicing techniques; in certain cases, leading to a change of strategy, in others to a change of technique and in yet others to replacing the turbines themselves and their implementation.

"Many of our turbines are now equipped with functioning deicing systems and we continue to search for possibilities and alternatives to reduce our production losses."

SÉBASTIEN TRUDEL, WHO has worked in the wind power sector since 2004, has successively begun to devote himself to forecasting and preventing ice-related production losses.

"A great deal has happened since I began working on the problem in 2012. These days, all manufacturers offer some form of deicing system or ice-prevention technology; however, as yet there is no standardisation so it is difficult to compare the various manufacturers' systems with one another, or to assess how the various technologies will work on different wind farms under differing conditions. This is where I see an obvious need for development," he says.

AS A MOUNTAIN climber, Sébastien's most recent expedition took place in September, taking him to the peak of Mount Manaslu in Nepal, which at 8,163 metres is the world's eight highest mountain. From the basecamp at 4,800 metres, all climbing was on glaciers with the risk of both fissures and avalanches.

What drives you to go on these expeditions?

"Good question: I have always had an interest in hiking in the mountains and over time the hikes got longer and longer until, eventually, my interest grew into outright mountaineering. Many people don't like the cold climate up in the mountains but for a Canadian, or a Swede for that matter, the cold is just a part of the natural order." ✱

Meet Sébastien Trudel at Winterwind!
He will be speaking on 5 February 9:00-10:00: "Slowly, slowly, we'll reach our goal!"

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