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Welcome to WIND ENERGY DENMARK 2019

These years, wind energy is charging new territory and breaking new ground. Innovations and stateof-the-art technology developments have pushed wind energy to new heights and paved the way for a fossil free future that is already within our grasp.

The industry has accomplished a lot so far, but the work is far from done – to stay ahead in the fierce, global competition the industry must have a keen focus on both strengthening the competitiveness of wind energy through a reduction of LCoE and increasing the value of wind through broader utilization of the wind resource in other sectors, developing new storage concepts, and exploring and testing new, innovative Power-to-X concepts.

Being the very cradle of wind energy, Denmark has a long history of breaking new ground and trailblazing new innovations. We are gathered here in the middle of hi Tech & Industry Scandinavia – the largest industry fair in Scandinavia to take the all-important discussions on where to move the industry next and how to fully harvest the potential of the close collaborations between industry and research world here in Denmark.

Let us make the most of it!



Jan Hylleberg CEO Wind Denmark



Peter Hjuler Jensen Consortium Manager Danish Research Consortium for Wind Energy



Glenda Napier CEO Energy Innovation Cluster



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The Conference

WIND ENERGY DENMARK merges technology, research and product development focusing on the long-term development of wind energy and creating a strong network for the participants.

Through more than 20 sessions with both panel discussions, high-level presentations and workshops, you get new insights and in-depth analysis of the core themes that will shape the future of the wind industry.



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Danish Wind Export ... 5 fuldtræffere i 2020

Asia-Pacific Wind Energy Expo, Kaohsiung, Taiwan 03.03-05.03, 2020

Australia Delegation Tour, Melbourne and Adelaide, Australia 30.03-03.04. 2020

Lifte Maintenance & Retrofit in Portugal, Lisbon, Portugal 14.05, 2020

Windpower, Denver, Colorado, USA 01.06-04.06, 2020

Global Offshore Wind, Manchester, UK 16.06-17.06, 2020

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Conference program

	Main Stage	Workshop 1	Workshop 2	Workshop 3	Innovation Zone
08:30	Registration Coffee Exhibition				
09:30	Opening session: Exploiting the full business potential of the green transition	Closed	Closed	Closed	Closed
10:15	Ways to sustain the value of wind – improving, expanding and looking beyond the electricity market	Standardisation in the wind sector – update on progress	Diversity & Inclusion – the road to attract & develop the right competences in wind (part I)	Wind Resource As- sesment: The latest news! (part I)	Decommissioning and recycling as a Danish position of strength
11:20	Coffee break Exhibition				
11:50	Upscaling – the game changers	Decarbonization of the European energy system	Diversity & Inclusion - the road to attract and develop the right competences in wind (part II)	Wind Resource Assesmemt: The latest news! (part II)	Digital trends transferred to the wind industry
13:00	Lunch				
14:00	Megavind stra- tegies - what are the coming R&D priorities in the sector?	How can Machine Learning help you reach your goals?	The potential of new materials	Local & Social ac- ceptance (part I)	Pecha Kucha: Power, Integration and Storage
15:15	Coffee break Exhibition				
15:45	Power to X – from electrons to hydrogen-based electrofuels	Global Market Outlook	Blades – the future challenges	Local & Social acceptance (part II)	Show me your game changer: New innovative solutions for the wind industry
17:00	Drinks Exhibition Game: Become CO ₂ neutral in 30 minutes				
18:30	Networking dinner				

Vindtræf 2019

Tirsdag den 5. november Vestas Wind Systems A/S i Aarhus

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Opening session: Exploiting the full business potential of the green transition

Time: 9:30 – 10:15 Place: Main stage

This session marks the opening of WIND ENERGY DENMARK 2019. The opening session will revolve around that a new government in Denmark has increased its ambitions for green transition and the use of renewable energy, and we fortunately see this trend around the globe as well. This means increasing market opportunities for the entire wind energy supply chain. Our vision for the opening session is to focus on how the interaction between industry and research across the supply chain can support these ambitions, increase competitiveness, create new business opportunities and secure a continued global Danish leadership in wind.

Speakers:

Lars Bondo Krogsgaard, Co-CEO, MHI Vestas Offshore Wind Henrik Bindslev, Dean, University of Southern Denmark Dorte Kamper, Vice President, Sales & Marketing, LM Wind Power

Moderator:

Jan Hylleberg, CEO, Wind Denmark

Ways to sustain the value of wind – improving, expanding and looking beyond the electricity market



Time: 10:15 – 11:20 Place: Main Stage

The world needs a lot more wind energy to reach climate goals and the industry is ready to scale op deployment and increase penetration levels. But how can we continue the deployment while sustaining a value of wind that is low enough to beat competing technologies but high enough to sustain a profitable business case for turbine owners? The session explores and debates different ways of sustaining the value of wind.

Speakers:

Søren Dupont Kristensen, CEO Electricity System Operator, Energinet Improving the electricity market – A market design fit for Renewables

Ulrik Stridbæk, Vice President and Head of Regulatory Affairs, Ørsted Wind across borders and sectors – Expanding the electricity market and looking beyond

Anders Bauditz, Director of Power & Gas Origination, Centrica Securing the value of wind – Roads to market and beyond

Moderator:

Martin Risum Bøndergaard, Head of Policy, Wind Denmark



Standardisation in the wind sector - update on progress

Time: 10:15 – 11:20 Place: Workshop 1

At Wind Energy Denmark 2018, 3 leading OEMs presented topics for standardisation that can be processed together. This session gives a status on commenced activities and examples of how the standardisation activities are handled in the sector.

Speakers:

Agnar Gudmundsson, Senior Director Modularisation, Vestas Wind Systems Per Hessellund Lauritsen, Research Manager, Siemens Gamesa Renewable Energy Lars L. Møller, Senior Product Specialist, MHI Vestas Offshore Wind Hot or not list – current status

Glenda Napier, CEO, Energy Innovation Cluster *Standardisation – results so far*

Christian Munk Jensen, Project Manager, Energy Innovation Cluster Common lifting guidelines

Moderator: Edit Nielsen, Senior Advisor, Wind Denmark

Diversity & inclusion – the road to attract & develop the right competences in wind – what's the problem? (part I)



Time: 10:15 - 11:20 Place: Workshop 2

For business leaders committed to changing the diversity agenda, Denmark and the wind sector is at a turning point. Now is the time to break the cycle that limits the ability of companies and society as a whole to profit from the full talent pool of a highly educated population. Companies that build diverse teams and maintain an inclusive culture will be positioned to make better and more nuanced business decisions that drive value creation and growth. So how do we do that in wind?

Jan Hylleberg, CEO, Wind Denmark Why is D&I important and what happens if we don't take the subject serious.

Inger Askehave, Pro-Rector, Aalborg University Setting the scene for the workshop

Anette Papuga, Global HR Director, LM Wind Power What do we know? – Kahoot quiz

Ghita Wolf Andreasen, CEO, Engineer the future. *Perspectives on diversity & inclusion*

Short table talks - what would be the most important question to ask Ghita

Q&A with Ghita Wolf Andreasen

Sum up and bridging to part II

Moderator: Inger Askehave, Pro-Rector, Aalborg University

WIND ENERGY DENMARK



Wind Resource Assessment: The latest news! (part I)

Time: 10:15 - 11:20 Place: Workshop 3

The two sessions on Wind Resource Assessment will give an update on the latest developments within the following topic areas: AI and Big Data, flow modelling, uncertainty, wakes, blockage, forestry, Lidars, Reanalysis data, and Wind Atlases. The aim of the sessions is that the participants will leave with the latest knowledge of these important areas.

Speakers:

Mark Zagar, Senior Specialist, Vestas Wind Systems Flow modelling – the latest news

Ebba Dellwik, Senior Scientist, DTU Wind Energy *Forestry – the latest news*

Wiebke Langreder, Head of Wind Consulting, EMD International *Uncertainty – the latest news*

Hans E Jørgensen, Head of Section, DTU Wind Energy Wakes – the latest news

Moderator: Lars Landberg, Director, DNV GL

Decommissioning and recycling as a Danish position of strength

Time: 10:15 – 11:20 Place: Innovation Zone

Most wind farms have an effective lifespan of 20 to 25 years. Subsequently, they must be replaced by modern components or dismantled in an environment-friendly way. Denmark was the first country to install offshore wind turbines, and naturally Denmark will be first to retire offshore wind turbines. Together with the European wind industry, Denmark is focused on both the environmental impact and potential market in decommissioning offshore wind turbines. Balancing a cradle-to-cradle approach to offshore wind turbines is a responsibility as well as the chance to build the next offshore business adventure. Green energy from offshore wind turbines is a Danish position of strength. Can we bid a worthy goodbye to end-of-life turbines in such a way that the green fairytale gets a happy ending? What gaps need to be closed and can decommissioning activities create innovation, business and export for the European energy industry?

Speakers:

Theis Gisselbæk, COO, Port of Grenaa Ports – playing a central role in decommissioning activities

John Korsgaard, Senior Director of Engineering Excellence, LM Wind Power Blade life cycle – today's reality and tomorrows demand

Nina Vielen-Kallio, New Business Manager, Virol From wasteD to feedstock. Can chemical recycling bring solution to decommissioned blades?

Moderator:

Pernille Skyt, Project Manager, Energy Innovation Cluster



Upscaling – the game changers

Time: 11:50 – 13:00 Place: Main Stage

This session aims to highlight the main challenges for strengthening the competitiveness in the onshore market. The market is governed by a request of increasing MW size, rotor size, hub height and park lay out effectiveness. At the same time, a decrease a decrease in product series lifetime and product series volume is happening. Several design, installation, and service solutions will be presented and discussed. Some are of game changing character and others being more incremental, but all enabling further upscaling.

Speakers:

Morten Pilgaard Rasmussen, Head of Offshore Technology, Siemens Gamesa Renewable Energy Offshore wind – Technical perspectives

Ion Arocena de la Rúa, Project Manager, NabraWind New self erecting Tower & New Blade joint solution

Per Fenger, CEO, Liftra Smart Installation and Service tool solutions

Martin Skov Jensen, Chief Specialist R&D, Vestas Wind Systems The new EnVentus WT product solution

Moderators:

Anders Rebsdorf, Wind expert and consultant Flemming Rasmussen, Head of Section, DTU Wind Energy

Decarbonization of the European energy system



Time: 11:50 - 13:00 Place: Workshop 1

The systemic role of wind energy during the decarbonization of the European energy system with strong sector-couplings will be discussed. Based on the newest energy system modeling, eyeopening results on the techno-economical decarbonization pathways will be presented.

Speakers:

Marta Victoria, Assistant Professor, Aarhus University Decarbonization of a European energy system with strong sector couplings

Carsten Vittrup, Energy Strategic Consultant, Energinet *Energy Strategies*

Ulrik Stridbæk, Vice President and Head of Regulartory Affairs, Ørsted *Regulatory, public and governmental affairs management*

Mikael Skou Andersen, Professor, Aarhus University *Carbon price regulations*

Peter Enevoldsen, Assistant Professor, Aarhus University *European Socio-Technical Wind Atlas*

Moderator:

Martin Greiner, Professor, Aarhus University



Diversity & inclusion – the road to attract & develop the right competences in wind – What to do? (part II)

Time: 11:50 - 13:00 Place: Workshop 2

For business leaders committed to changing the diversity agenda, Denmark and the wind sector is at a turning point. Now is the time to break the cycle that limits the ability of companies and society as a whole to profit from the full talent pool of a highly educated population. Companies that build diverse teams and maintain an inclusive culture will be positioned to make better and more nuanced business decisions that drive value creation and growth. So how do we do that in wind?

Welcome back Inger Askehave, Pro-Rector, Aalborg University

Inspiration talks:

How do we work with diversity & Inclusion? Dorte Kamper, Vice President, Sales & Marketing, LM Wind Power Nicholas Creswell, Global Head of Talent, Ørsted

Break-out session: How D&I can be modelled and encouraged and what should key stakeholders do?

Panel discussion – reflections on the breakout session Ghita Wolf Andreasen, CEO, Engineer the future Dorte Kamper, Vice President, Sales & Marketing, LM Wind Power Nicholas Creswell, Global Head of Talent, Ørsted Henrik Bindslev, Dean, University of Southern Denmark Jan Hylleberg, CEO, Wind Denmark

Jan Hylleberg, CEO, Wind Denmark Closing remarks

Moderator: Inger Askehave, Pro-Rector, Aalborg University

Wind Resource Assessment: The latest news! (part II)



Time: 11:50 - 13:00 Place: Workshop 3

The two sessions on Wind Resource Assessment will give an update on the latest developments within the following topic areas: AI and Big Data, flow modelling, uncertainty, wakes, blockage, forestry, Lidars, Reanalysis data, and Wind Atlases. The aim of the sessions is that the participants will leave with the latest knowledge of these important areas.

Speakers:

Maziar Golestani, Head of Department, DHI *Reanalysis data – the latest news*

Mike Courtney, Senior Scientist, DTU Wind Energy *Lidars – the latest news*

Jakob Mann, Professor, DTU Wind Energy Wind Atlases – the latest news

Lars Landberg, Director, DNV GL Al and Big Data – the latest news

Moderator: Lars Landberg, Director, DNV GL



Digital trends transferred to the wind industry

Time: 11:50 – 13:00 Place: Innovation Zone

Drones, virtual reality, robotics and AI are redefining the way we work with energy production from wind turbines. This workshop focuses on how digital trends are shaping the wind industry and offers insights from the frontrunners of digital innovation in the energy sector. How can virtual reality optimize staff safety training, and can an automized robot remove marine growth from wind turbine foundations? Join the Innovation Zone at Wind Energy Denmark's exhibition.

Speakers: Søren Eskildsen, CEO, Trifork A/S The fast track to data driven maintenance Digital

Daniel Rothmann, Machine Learning Engineer, Kanda ApS Streamlining the Maintenance Process with Computer Vision

Daniel Holm Kristensen, Managing Partner, Manawell Technologies Convert data into insights that deliver real business value

Lennart Kühlmeier, CEO, FineTune *Al for blade manufacturing*

Moderator: Thomas Vohs-Ahlers, Project Manager, Energy Innovation Cluster Let's create a world that runs entirely on green energy





Megavind strategies – what are the coming R&D priorities in the sector?

Time: 14:00 – 15:15 Place: Main Stage

The strategy platform for the Danish wind sector, Megavind, presents the 2019 Annual Agenda on Research and Innovation as well as ongoing strategy activities on value chain cooperation models and test facilities.

Speakers:

Christina Aabo, Head of R&D, Wind Power, Ørsted and **Peter Hjuler Jensen**, Deputy Head of Department, DTU Wind Energy *Megavind Annual Agenda – 2019 highlights and recommendations*

Torben Jørgensen, Technical Sales Director, Fritz Schur Energy Mapping of competences value chain. What new models of cooperation would benefit the sector?

Bo Svoldgaard, SVP Innovation and Concepts, Vestas Wind Systems and **Per Hessellund Lauritsen**, Research Manager, Siemens Gamesa Renewable Energy Improved test infrastructure in Denmark – why do we need a new test facility strategy?

Moderators: Per Hessellund Lauritsen, Chairman of Megavind Executive Committee Christina Aabo, Head of R&D, Wind Power, Ørsted

How can Machine Learning help you reach your goals?



Time: 14:00 - 15:15 Place: Workshop 1

Machine learning can provide clarity and solve strategic challenges by identifying patterns in data, that otherwise are unclear. But what is machine learning? Where can you apply it? And how do you get started? We will give you insights and tools to get started – and discuss where it can be applied in the wind energy sector.

Speakers:

Alexandros Iosifidis, Ass. Prof. of Machine Learning Dep. of Engineering, Aarhus University What is machine learning and what can you use it for?

Peter Sonne-Holm, Principal Economist, Damvad Analytics How to do a machine learning project and a few selected cases?

Moderator: Peter Sonne-Holm, Principal Economist, Damvad Analytics



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The potential of new materials



Time: 14:00 - 15:15 Place: Workshop 2

The current status, challenges and potentials of new materials for the wind industry are presented and discussed with focus on blade materials, including sustainability, new materials (e.g. bio based) and specific industry challenges (e.g. leading edge erosion). This will be followed by an panel discussion with the speakers on the topic: 'The potential of new materials'

Speakers:

Justine Beauson, Development Engineer, DTU Wind Energy Recycling materials from end of life Wind turbines blades

Ali Sarhadi, Researcher, DTU Wind Energy 3D printing of continuous fiber composites, challenges and future opportunities

Steffen Hawkins, Group R&D Manager, Teknos A/S TEKNOBLADE REPAIR 9000 – a practical approach to leading edge protection for wind turbine blades

Bo Madsen, Associate Professor, DTU Wind Energy *Hybrid composite materials for wind turbine blades*

Michael Drachmann Haag, Principal Engineer, LM Wind Power Challenges of new erosion protection materials for offshore turbines operating at 100+ m/s

Moderator: Lars Pilgaard Mikkelsen, Associate Professor, DTU Wind Energy



Local & Social acceptance (part I)

Time: 14:00 – 15:15 Place: Workshop 3

The deployment of wind and solar energy will create depopulation and decline in rural areas, opponents claim. But perhaps deployment of wind turbines and other renewable energy is an opportunity for rural areas rather than a problem.

In the session, we have invited several people who in different ways work to create support for the green transition, including the deployment of onshore wind and renewable energy different places in Denmark.

How do they handle it? What about the economy? And how about the local support? Finally, we ask the question: Can the deployment of wind turbines and other renewable energies be a driving force for rural development in Denmark?

This session will be conducted in Danish.

Introduction Jan Hylleberg, CEO, Wind Denmark

Speakers:

Preben Nissen, Vice Chairman, The Association for the Advancement of Development in Rejsby, Vodder and Brøns

Christopher Sørensen, CEO, GreenLab Skive

Henrik Engedahl (V), chairman of the committee for technology and environment, lkast-Brande Municipality

Moderator: Anton Gammelgaard, Head of Secretary, VidenOmVind

Pecha Kucha: Power Integration and Storage



Time: 14:00 – 15:15 Place: Innovation Zone

Which technologies are shaping and changing the global energy system in 2019? Innovative companies present their vision at the Energy Innovation Cluster Pecha Kucha-event at the Wind Energy Denmark conference. The Pecha Kucha format allows the companies to present 20 elements x 20 seconds – a total presentation of 6 minutes and 40 seconds. The session is your opportunity to fast track your knowledge and get updated on areas like energy storage, integration and new nuclear technology.

Speakers:

Christopher D. Sorensen, CEO, GreenLab *Green energy systems*

Søren Bødker, CEO, VisBlue, *Flow Batteries*

Søren Knudsen Kær, CEO, Re::Integrate Energy storage with Power-to-methanol technology

Rasmus Rode Mosbæk, CEO, Hybrid Greentech Investment decisions on energy storage made simple

Peter Jensen, Division Director, Aalborg CSP A/S *Thermal energy storage & reuse of power plant assets*

Sarah Thomas, Head of Research and Development, Floating Power Plant De-carbonisation of Oil and Gas Production – by cost effective Floating renewable Technologies

Moderator: Henrik Böhmer, Project Manager, Energy Innovation Cluster



Power to X – from electrons to hydrogen-based electrofuels

Time: 15:45 – 17:00 Place: Main Stage

Electrofuels from electrolytic hydrogen based on electricity from wind power are envisaged indispensable in a future energy system based fully on renewable energy. Electrofuels can be used for storing intermittent electricity from renewable energy sources and be used in for example aviation, shipping, heavy-duty road transport and industry. 3 representatives from industries that could be potential offtakers for electrofuels discuss the following questions:

- 1. What is the role for electrolytic hydrogen in the Danish energy system by 2030 and 2050?
- 2. Which sectors could be first short-term offtakers for electrofuels and how soon can technologies be ready if the cost of electrolytic hydrogen is reduced?
- 3. How can production and use of electrofuels best be demonstrated in next decade?
- 4. Which regulatory measures and policies are needed to promote electrofuels (reduced tariffs, support schemes, roadmaps & targets etc.)?

Speakers:

Michael Finch Pedersen, Director, Head of Machinery, Maersk Lars Andersen, Direktør, Public Affairs & Infrastructure, SAS Michael Mücke Jensen, Manager Engineering and Environment, Drivkraft Danmark

The presentations will be followed by responses from:

Niels Vinther Voigt, Concept Development Engineer, Vestas **Ignacio Marti**, Program Manager Offshore Wind, DTU Wind Energy and Executive Secretary, IEA Wind TCP

Moderator: Stefan Krüger Nielsen, Senior Advisor, Wind Denmark REDUCE CARBON FOOTPRINT FOR A BETTER FUTURE

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Global Market Outlook



Time: 15:45 - 17:00 Place: Workshop 1

This session introduces the global energy transition outlook and dives deep into the global wind market developments. The market movement from the traditional/conventional wind markets to emerging and offshore markets. How most markets are shifting to auctions as a standard mechanism to deploy wind/renewable technologies. Participants will be able to understand the dynamics in some of the emerging markets and assimilate the additional demand side drivers for new wind build.

This session will also provide a global market update from the supply side. It will present the overview of turbine OEM market consolidation that took place in the global market in the past five years, then it will address the impact of such consolidation on the global supply chain – examples will be presented for key components.

And we round up with a look towards the export opportunities and where to go already here in 2020?

Speakers:

Shashi Barla, Principal Analyst – Global Wind Supply Chain and Technology, Wood Mackenzie *Global market outlook: Offshore and emerging markets to offset the slowdown in conventional markets*

Feng Zhao, Strategy Director, GWEC Global Wind Market Supply Side Update – Impact of market consolidation on global supply chain

Søren Rasmussen, Managing Director, Danish Wind Export Export opportunities 2020

Moderator: Søren Rasmussen, Managing Director, Danish Wind Export



Blades – the future challenges

Time: 15:45 – 17:00 Place: Workshop 2

To continue the reduction of levelized cost of energy, innovation is needed in the entire value chain to make use of digitalization and industry 4.0. This session provides insight into some of the most recent efforts and development directions in blades design, test, manufacture and service.

Speakers:

Jeppe Funk Kirkegaard, Head of Blade Design, Siemens Gamesa Renewable Energy Large Offshore blade design innovation challenges

Kim Branner, Senior Scientist, DTU Wind Energy *Test innovation needs for large blades*

Roman Braun, Research Associate, Fraunhofer Institute for Wind Energy Systems *Costs and trends in modern rotor blade manufacturing*

Hans Laurberg, CEO, Rope Robotics ApS Blade service innovation using robotics

Moderator: Peter Fuglsang, Head of Offshore Blades and R&D, Siemens Gamesa Renewable Energy

Local & Social acceptance (part II)



Time: 15:45 - 17:00 Place: Workshop 3

The deployment of wind and solar energy will create depopulation and decline in rural areas, opponents claim. But perhaps deployment of wind turbines and other renewable energy is an opportunity for rural areas rather than a problem.

In the session, we have invited several people who in different ways work to create support for the green transition, including the deployment of onshore wind and renewable energy different places in Denmark.

How do they handle it? What about the economy? And how about the local support? Finally, we ask the question: Can the deployment of wind turbines and other renewable energies be a driving force for rural development in Denmark?

This session will be conducted in Danish.

Speakers:

Jens Jørgen Birch, Nissum Brednings Vindmøllelav How we do it?

Panel debate

Can the installation of wind turbines become a driving force for rural development in Denmark? All speakers participate in the panel debate – including J**an Hylleberg**, CEO, Wind Denmark and **Karl Sperling**, Ph.D., Aalborg University.

Steffen Damsgaard, Chairman, Rural Joint Council (Landdistrikternes Fællesråd) Can the installation of wind turbines become a driving force for rural development in Denmark?

Moderator:

Anton Gammelgaard, Head of Secretary, VidenOmVind



Show me your game changer: New innovative solutions for the wind industry

Time: 15:45 – 17:00 Place: Innovation Zone

WIND ENERGY DENMARK invites companies to pitch new/tomorrows innovative solutions for experts within the wind industry. This session is an unique opportunity to get the experts' view on new ideas and their potential, challenges, applications, and technology readiness.

Ideas, projects, or products are evaluated and selected for "elevator pitch". An elevator pitch is a short, pre-prepared speech that explains what the new innovative solution does clearly and succinctly. After each pitch, the audience and the experts will ask questions, and the experts from the wind industry will evaluate the idea. At the end of the session, the experts will reflect on all of the presented solutions.

Among others you can hear about a new wind turbine redesigned for more flexibility, LCOE and suitable for both on- and offshore locations. Or what about a new bolt fixation technology that allows you to control the bolt-tension and minimize the risk of incidents and maintenance? At the Game Changer workshop you will get new inspiration and learn more about new, exciting technologies with great potential.

Panel of experts:

Flemming Rasmussen, Head of Section, DTU Wind Energy Kenneth Thomsen, Head of Section, DTU Wind Energy Thomas Buhl, Wind Expert

Moderator: Alex Moreno, Project Manager, Energy Innovation Cluster

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