

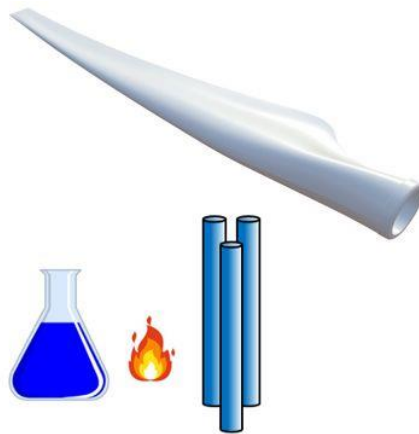


International Conference on

# **Sustainable Wind Turbine Blades: New Materials, Recycling and Future Perspectives**

*November 21-23, 2022*

*Roskilde, Denmark*



## ***Program***

# Overview and Objectives

Sustainability of wind turbine blades, from the selection of materials, to the manufacturing of blades and until the end of life and recycling phase has become a major topic of discussion in the recent years. New development in the field of material sciences, recycling technologies and in the analysis of recycling value chain is shaping future perspectives. This conferences offers lectures, round tables and sessions on a range of topics dedicated to the sustainability of wind turbine blades.

## Symposium Topics

- New blade materials // bio-composites, recyclable thermosets, bio-based resins, bio-based carbon fibres...
- Recycling technologies // Reuse, repurpose, pyrolysis, solvolysis
- Recycling value chain // Estimating and mapping wind turbine blade waste, circular economy, life cycle assessment of recycling processes
- Future perspective // Design for recycling, recycling of recyclable wind turbine blades, and more...

## Contact



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## Venue and Accommodation

The conference will take place at the Niels Bohr Auditorium (building 112) at DTU Risø Campus, Frederiksborgvej 399, 4000 Roskilde. DTU Risø Campus is situated by Roskilde Fjord, 7 km north of Roskilde, and 38 km to the west of Copenhagen. Hotels in Rokilde: Zleep Hotel Rokilde is located in downtown Roskilde, 200 meters from the train station. Scandic Roskilde Park and Comwell Roskilde are located 1.3 km and 2.5 km from train station, respectively.

**Webpage:** <https://www.conferencemanager.dk/recyc>

# November 21, 2022

**9:00- 9:30**      **Registration**

## **OPENING SESSION**

Chairman: Malcolm McGugan (DTU)

9:30- 9:45      Opening, Peter Hauge Madsen (Director, DTU Wind Energy, DK)

9:45- 9:55      Welcome, Ignacio Marti Perez (Head of Division, WMC, DTU)

9:55-10:10      Welcome, Justine Beauson and Leon Mishnaevsky Jr. (DTU)

## **SESSION: Overview and perspectives**

10:10-10:30      Allan K. Poulsen (Head of Advanced Structures and Sustainability, Vestas,, DK), Wind turbines in a circular economy

10:30-10:50      Jonas Pagh Jensen (Sustainability Specialist, SGRE, DK) Sustainable blades for a renewable future: Challenges, experiences and possibilities

10:50-11:10      John Korsgaard (Senior Director, Engineering Excellence, LM Wind Power, DK) TBA

**11:10-11:30**      **Coffee**

## **SESSION: Technologies and processes for the recycling of wind turbine blades**

Chairman: Asger Bech Abrahamsen (DTU)

11:30-11:50      Shashi Barla (Director Renewable Energy, Brinckmann Group, DK) Mounting importance of blades recyclability and circularity - for new installs and repowering

11:50-12:10      Ann-Christine Johansson (Scientist, RISE, SE) (Scientist, RISE, SE) Comparative study of thermochemical recycling technologies pyrolysis and solvolysis/HTL on End of Life wind turbine blades

12:10-12:30      Leon Mishnaevsky Jr. (Senior Researcher, DTU, DK) Recycling of wind turbine blades: Computational modelling and optimization

12:30-12:50      Sergio Costa (RISE, SE) Digitalization of wind turbine blade waste stream to facilitate their re-purpose in new products

12:50-13:10      Stéphane Mouret (Wind S&T - Prototyping and Testing Leader, Owens Corning, France) Recycled blade waste to virgin quality glass fibre

**13:10-14:00**      **Lunch**

## **SESSION: Applications for recycled materials**

Chairwoman: Ana Teresa Macas Lima (DTU, DK)

14:00-14:20      Harald van der Mijle Meijer (Senior Consultant Wind Energy, TNO, NL) Recycling wind turbine blades into recyclable car parts

14:20-14:40      Jakob W Nielsen (CEO Miljøskærm, DK), Products from recycled composites

- 14:40-15:00 Marina Corvo Alguacil (Luleå TU, SE) Retention of mechanical properties of carbon fibers after recovery by thermal treatment
- 15:00-15:20 Liva Pupure (TU Riga, LV) GlassCircle - Exploring full cycle circular economy for glass fiber industry

**15:20-15:50** *Coffee*

### **SESSION: Wind turbine blade and circular economy**

Chairwoman: Lykke Margot Ricard (SDU, DK)

- 15:50-16:10 Lorna Bennet (Energy Transition Alliance's Blade Recycling Project, ORE Catapult, UK), Sustainable decommissioning and circular economy
- 16:10-16:30 James Lightfoot (Senior Technology Programme Manager – Energy, NCC Bristol , UK), SusWIND, delivering a sustainable future for composites in wind
- 16:30-16:50 Anne Velenturf (TransFIRE Technical Programme Manager, U Leeds, UK) Co-producing circular business models for a sustainable circular economy for wind turbines
- 16:50-17:10 Pankaj Ravindra Gode (NTNU, NO) Managerial perspectives on the transition to circular economy in offshore wind industry

**18:30-22:00** *Dinner*

## ***November 22, 2022***

### **PRESENTATION OF IEA TASK 45**

Chairman: Lars Pilgaard Mikkelsen (DTU, DK)

- 9:00-9:20 Justine Beauson (Operating Agent IEA Wind Task 45, DTU, DK) IEA Wind Task 45 Recycling of wind turbine blades

### **SESSION: New polymer resins for improved recyclability**

- 9:20-9:40 Alaitz Rekondo (Head of Polymers & Composites Unit, CIDETEC. SP), Aromatic disulfide based epoxy vitrimer for weldable and recyclable wind blades
- 9:40-10:00 Pierre Gérard (Arkema, FR), Sustainable management of manufacturing wastes and end-of-life wind turbine blades from fully recyclable thermoplastic composite
- 10:00-10:20 Pierre Verge (LIST, LU), Bio-based benzoxazine and vitrimers : sustainable resins for recyclable composites
- 10:20-10:40 Singh Bharat (Joint President and Global R&D Head - Aditya Birla Chemicals Epoxy Division, Aditya Birla, IN). Recyclable epoxy technology for circularity in wind industry

**10:40-11:10** *Coffee*

### **SESSION: Alternative composite materials and blade design**

Chairman: Harald van der Mijle Meijer (TNO, NL)

- 11:10-11:30 Katharina Koschek (Head of Department Polymeric Materials, Project BestBioPLA,, Fraunhofer IFAM, DE), Materials and technologies for sustainable wind turbine blade production
- 11:30-11:50 Derek Berry (Director of Wind Turbine Technology Area, NREL, USA) TBA
- 11:50-12:10 Leon Mishnaevsky Jr. (DTU, DK) Wind turbine blade repair and life extension as an option for sustainability
- 12:10-12:30 Jelle Joustra (TU Delft, NL) Structural reuse by design
- 12:30-12:50 Lars Pilgaard Mikkelsen (Assoc Professor, DTU, DK), A simplified wind turbine blade model for evaluation of sustainable materials systems

**12:50-14:00** *Lunch*

### **SESSION: Material innovations and improved recyclability**

Chairwoman: Lorna Bennet (ORE Catapult, UK)

- 14:00-14:20 Bernhard Krüger (Sr. Engineer, Energy Systems DNV, DE) Recyclable blade materials in certification
- 14:20-14:40 Albert ten Busschen (Windesheim High School, NL) Structural re-use of traditional thermoset composites
- 14:40-15:00 Ana Teresa Macas Lima (Sr. Researcher, DTU, DK) Blades2Build: Recycle, repurpose and reuse end-of-life wind blade composites: A coupled pre- and coprocessing demonstration plant. New Horizon project
- 15:00-15:20 Brandon L. Ennis (Wind Energy Technologies Dept., Sandia National Laboratories, US) Second life opportunities for wind turbine materials in future designs

**15:20-15:50** *Coffee*

### **SESSION: Waste and end-of-life management**

Chairman: Michail Beliatis (AU, DK)

- 15:50-16:10 Fanran Meng, (Research Associate, U Cambridge, UK) Exploring recycling solutions for the looming problem of wind turbine blade waste in China
- 16:10-16:30 Aubryn Cooperman (NREL, USA) Analysis of blade waste in the U.S. and the end-of-life value chain of wind turbine blades
- 16:30-16:50 Lykke Margot Ricard (Assoc. Prof, U Southern Denmark) Trend data on the volume of composite waste from WT-blades in DK up to 2050 incl. drivers and barriers for circular economy
- 16:50-17:10 Asger Bech Abrahamsen (Sr. Researcher, DTU,DK) Estimating the amount of end-of-life wind turbine blade materials in Denmark

**18:30-22:00** *Beer/finger food in the cantine, Risø Campus*

# November 23, 2022

## SESSION: Analysing the end-of-life of wind turbine blades

Chairman: Bernhard Krüger (DNV, DE)

- 09:00-9:20 Paul Leahy (Principal Investigator of Re-Wind project, University College Cork, IE) Lessons learned from a wind turbine blade repurposing project
- 09:20-9:40 Matthew Geraghty (Re:Wind Venture Lead, DNV AS, No) Re:Wind – Accelerating sustainability in decommissioning
- 09:40-10:00 Julien Walzberg (NREL, USA) A spatially resolved agent-based model of end-of-life behaviors and their impact on wind blade circularity
- 10:00-10:20 William Frederic Travia (Ørsted, DK), Decision support for the assessment of end-of-life treatment of wind turbine blades

**10:20-10:40** *Coffee*

## SESSION: Policy questions and life cycle analysis

Chairwoman: Justine Beauson (DTU, DK)

- 10:40-11:00 Nina Vielen-Kallio (ECHT and eWEning star, projects DecomTools and Circular Wind Hub, ECHT NL), The opportunity for policy makers to wear the cape and solve wind turbine blade “waste” issue
- 11:00-11:20 Kristine Wilhelm Lund (SDU, DK) Comparison of end-of-life value chains for decommissioned wind turbine blades
- 11:20-11:40 Alexis Laurent (Assoc. Professor, DTU Environment, DK) Going beyond life cycle assessment for sustainable wind turbines
- 11:40-12:00 Michail J. Beliatis (Assoc Prof. Aarhus University) IoT-Blockchain for materials digital traceability and product life-cycle operations in wind industry
- 12:00-12:20 David Philipp Rudolph (DTU, DK) Social, regulatory and spatial considerations of decommissioning wind farms

## CLOSING SESSION

- 12:30-13:00 Closing Remarks, Justine Beauson and Leon Mishnaevsky Jr. (DTU, DK)