

Report 2021

Task 45

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Recycling wind turbine blades

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The issues related to wind turbine blade recycling are broad and range from technical challenges to legislation disparities and lack of information on the materials to be recycled.

RECYCLING WIND TURBINE blades is a process with a complex value chain involving several stakeholders with different interests. To address the issues related to blade recycling, this Task brings the key stakeholders together to identify the barriers and mitigation strategies for the implementation of large-scale wind turbine blade recycling solutions. The main

objectives are to recommend best practices for the successful recycling of wind turbine blades and identify new research areas within the topic of wind turbine blade recycling that is still not covered by any projects.

In May 2021, the IEA Wind Task 45 was kicked off successfully with 45 participants from 9 different countries. Due

Table 1. Task 45 Participants in 2021

	COUNTRY/ SPONSOR	PARTICIPATING INSTITUTIONS		COUNTRY/ SPONSOR	PARTICIPATING INSTITUTIONS
1	Denmark	- DTU Wind & Energy System - Aarhus University - Port of Aalborg - Vestas - Siemens Gamesa Renewable Energy - ErhvervsShus Nord - SDU	6	Germany	- Fraunhofer IWES - Fraunhofer ICT - TPI Composites - DNV - NEOWA - VDMA
2	United States - DNV	- NREL - Georgia Tech	7	The Netherlands	- TNO - TU Delft - ECHT Community
3	United Kingdom	- National Composite Center (NCC) - ORE Catapult - University of Leeds - University of Strathclyde	8	Sweden	- RISE research center - Vattenfall - Chalmers University
4	Ireland	- University College Cork (UCC) - Wind Energy Ireland - Munster Technological University	9	France	- EDF Renouvelable - Arkema - IRT Jules Vernes - Engie Laborelec
5	Norway	- NVE - Greenergy - Gjenkraft AS	WindEurope		

to Covid restrictions, the meeting was held online and over 2 days to accommodate the different time zones. Since May 2021, the members involved in the work packages have been working on establishing the state of the art on the 3 key topics of this Task. These topics are the technical aspects of recycling, the analysis of the blade lifecycle and value chain, and the standards and legislation framing the end of life of wind turbine blades.

The industries participating in this Task are, for example, wind turbine blades manufacturers, wind farm owners, or recycling industries. Universities, as well as wind energy associations from several countries, are also participating.

Progress and Achievements

The activities in the IEA Wind Task 45 are divided among the three recurring themes at the center of the challenges of wind turbine blade recycling. These are the technical aspects of recycling (WP2), the analysis

of the recycling value chain (WP3), and the standards and legislations framing the end of life of blades and the recycling activities (WP4).

The National Composite Center, NCC (GB) and Fraunhofer IWES (DE) are leading WP2. The technical aspects of blade recycling addressed in this WP both look at existing blades and future blades. In 2021, NCC, together with the RISE Research center and [...] [DW1], reviewed the available recycling methods for existing blades as well as the applications for recycled materials. The outcome of this review will form one of the deliverable of WP2. Future discussions will look at how to scale-up promising recycling processes and identifying technical and economic mitigation strategies. Regarding future blades, Fraunhofer IWES, together with TU Delft and TPI Composites, are currently discussing new materials for blades and design for recycling strategies. The outcome of this discussion will form guidelines for re-design, answering questions such as: what elements of design

(material and structure) could ease the repurposing or recycling processes?

The University College of Cork, UCC (IE), is leading WP3. This WP is dedicated to the analysis of the recycling value chain and its environmental, social, and economic impact. The Task will also look into the value chain of end of life wind turbine blades and try to understand logistics, stakeholders' interests, and how to implement circular business models. Traceability is another topic discussed in WP3 with questions such as how to track materials and material information to ensure complete recycling at end-of-life? In 2021, UCC worked towards establishing the overview of studies related to the assessment of environmental impact, social impacts, and the economy of recycling solutions. This content will form one of the deliverable of the WP.

DNV (US) is the leading WP4 dedicated to the standards, certification, and legislation framing the activities

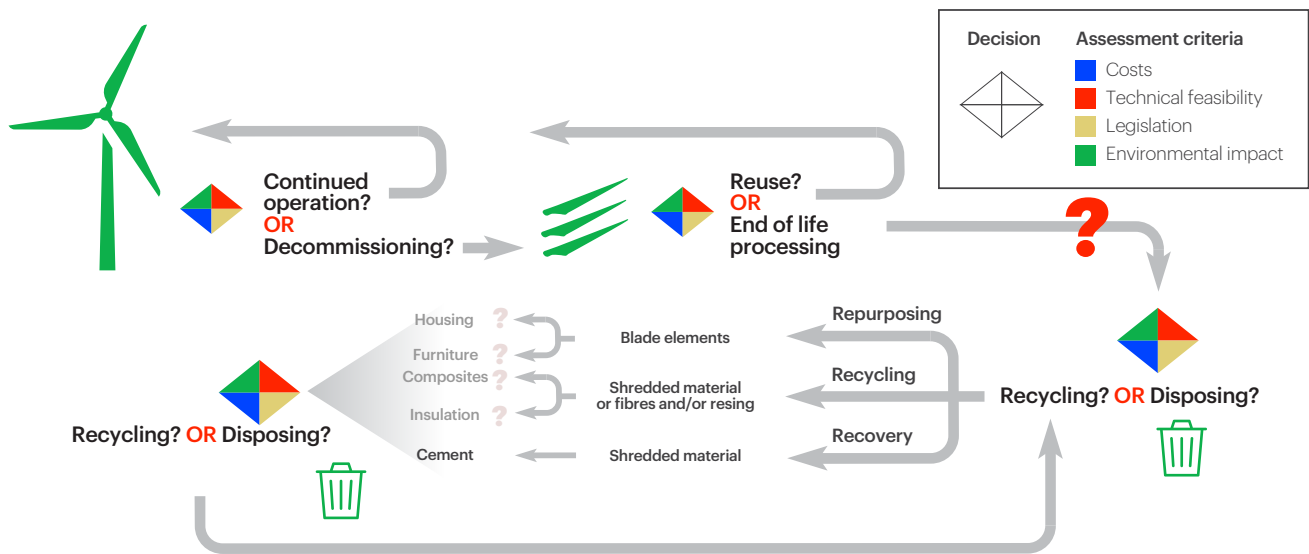


Figure 1. Value chain of the end-of-life of wind turbine blades. <https://doi.org/10.1016/j.rser.2021.111847>

related to recycling wind turbine blades. In 2021, DNV, together with the University of Leeds and Vattenfall, worked on establishing an overview of the standards and legislation existing nowadays. This input will form one of the deliverables of this WP and serve as input for the other WP to reflect on how can legislation, standardization and certification help in the implementation of large scale recycling solutions?

Highlights

- In May 2021, the IEA Wind Task 45 was kicked off successfully with 45 participants from 9 different countries. Despite being held remote and a large number of participants, a good interaction between all the participants, was achieved.
- A network of collaborating organizations was established to analyse the current state of blade recycling technologies, value chains along the blade lifecycle, and standards and legislation.

Outcomes and Significance

With the review of the current state of the art, the outcome of the Task

should provide recommended and best practices for wind turbine blade recycling. These recommended and best practices should be relevant to public authorities interested in implementing recycling solutions for wind turbine blades on a regional or country level, industrial stakeholders interested in developing a recycling business from wind turbine blades, researchers developing new blade designs, and new composite materials or new recycling processes. Based on the analysis of the recycling value chain and its related impact (economic, environmental and social), the outcome of the Task should also provide the framework to support modifications or development of new standards.

Next Steps

The participants of Task 45 meet twice a year for general meetings. In 2022, the first one will take place online on the 10th and 11th of May. An update on the Task will be presented, and key results will be discussed. The second meeting is likely to take place in December. A first physical meeting is considered in September for the preparation of a conference session,

publication, and communication materials with a view to embedding the identified solutions into practice. In November, the IEA Wind Task 45 will be presented at the International Conference on Sustainable Wind Turbine Blades: New Materials, Recycling, and Future Perspectives.

References

- [1] J. Beauson, A. Laurent, D.P. Rudolph, J. Pagh Jensen, (2022). *The complex end-of-life of wind turbine blades: A review of the European context, Renewable and Sustainable Energy Reviews, Volume 155, 111847* <https://doi.org/10.1016/j.rser.2021.111847>

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