

ReFoPlan

Development of Dismantling and Recycling-Standards for Rotor Blades

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Project duration: 01.07.2020 – 28.02.2022

Project Partners:

- Karlsruhe Institute of Technology (KIT)
THINKTANK Industrielle Ressourcenstrategien (Coordinator)
Institute for Technical Chemistry (ITC)
Institute for Industrial Production (IIP)
- Fraunhofer-Institute for Chemical Technology (ICT)
- Baumeister Rechtsanwälte
- Composites United e.V.

The share of renewable energies with respect to gross electricity generation in Germany has risen from about 7% in 2000 to about 50% in the first half of 2020 [1; 2]. A significant factor for this increase is attributable to the expansion of wind energy plants, an important part of the energy transition in Germany. The number of onshore wind turbines has increased from about 9,300 in 2000 to about 29,500 in 2019 [3]. This increase is predominantly due to the EEG (German Renewable Energy Sources Act), which came into force in 2000 and took all wind energy plants existing at that time into consideration. After having acquired 20 years of sponsorship from the EEG, a large number of wind energy plants will be gradually phased out over the coming years and the dismantling of these plants is expected to rise. A study published by the Umweltbundesamt (UBA) in 2019 identified a need for recycling of rotor blades [4] and this project was initiated by the UBA.

In addition to an increase in the number of wind energy plants, there is also a continuous increase in its size, specifically in terms of the hub height and the rotor blade diameter (Figure 1). As a consequence, rotor blade designing have to meet much higher requirements today, which in turn has led to more complex material compositions. Rotor blades mainly consist of composite materials, especially glass fibre reinforced plastics (GFRP). To a lesser extent and in particular, the highly stressed area of the rotor blade is reinforced with so-called CFRP belts, made of carbon fibre composites. Such complex rotor blade constructions require conclusive dismantling and recycling concepts, which this UBA-funded project aims to identify and evaluate technically, economically and legally with regard to high-grade recycling. In light of this, the aim of the UBA-funded project is to identify high-grade recycling methodologies from a technical, economic and legal point of view.

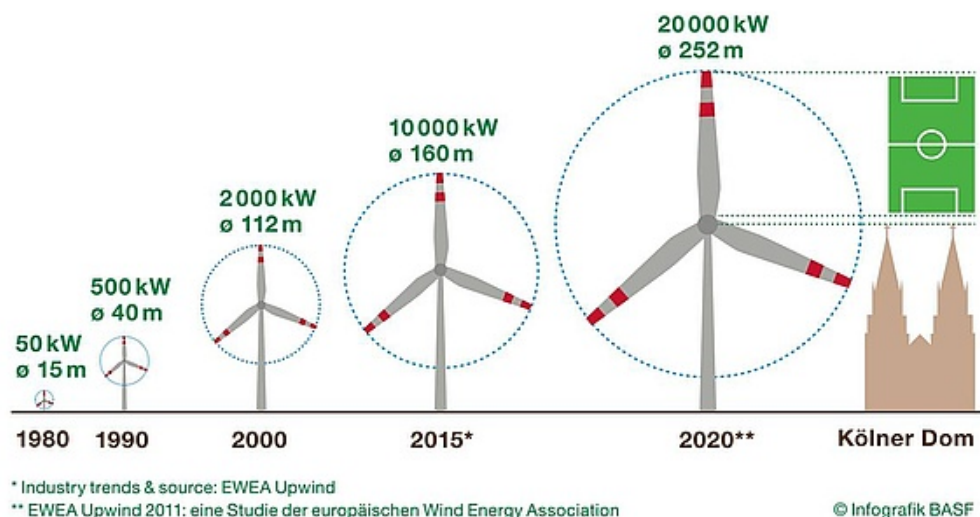


Figure 1: Temporal development of the sizes and outputs of wind turbines [5].

The objective here is to recycle as many components of a rotor blade as possible in a high-grade and damage-free manner, taking into account the legal aspects, organisational responsibility, health and environmental aspects.

This project is divided into six scientific work packages (WP) (Figure 2). In WP1, a complete overview of existing rotor blade constructions in Germany (on- and offshore) are given, which also includes the determination of the expected mass flows and material compositions of the rotor blades from the dismantling of wind turbines up until the year 2040. In WP2, a risk assessment is carried out on the basis of the hazardousness and harmfulness of health-endangering substances released during the dismantling and disposal of rotor blades, especially dust and fibres. In WP3, processes for on-site rotor blade disassembly and processing are identified and described, and the promising methods are analysed in detail. In WP4, the processing of rotor blade waste is considered and subsequently, in WP5 the recycling of this processed rotor blade waste. Legal aspects of the dismantling and recycling of rotor blades are dealt with in WP6.

In addition to the project partners, an advisory board consisting of representatives from industry and the scientific community as well as federal offices and federal authorities support this project.

DEVELOPMENT OF DISMANTLING- AND RECYCLING STANDARDS FOR ROTOR BLADES						
WP1	WP2	WP3	WP4	WP5	WP6	WP7
Rotor Blade-Construction	Risk Assessment of Fibres and Dust	On-site Waste Management	Processing of Rotor Blade Waste	Recycling of Processed Rotor Blade Waste	Organisational Responsibilities	Summary
KIT Fraunhofer ICT Baumeister Rechtsanwälte	KIT Composites United e.V. Baumeister Rechtsanwälte	Fraunhofer ICT KIT Baumeister Rechtsanwälte	Fraunhofer ICT KIT Composites United e.V. Baumeister Rechtsanwälte	KIT Composites United e.V. Baumeister Rechtsanwälte	Baumeister Rechtsanwälte	KIT Fraunhofer ICT Composites United e.V. Baumeister Rechtsanwälte

Figure 2: Work plan of the project with leadership and participation of the project partners in the respective work packages

Contact persons at KIT-ITC:

Prof. Dr.-Ing. Dieter Stapf

Tel.: 0721 - 60829270

E-Mail: dieter.stapf@kit.edu

Werner Baumann

Tel.: 0721 - 608 22927

E-Mail: werner.baumann@kit.edu

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- [2] <https://de.statista.com/statistik/daten/studie/779784/umfrage/monatlicher-anteil-erneuerbarer-energien-an-der-stromerzeugung-in-deutschland/> (last accessed 17.07.2020)
- [3] <https://de.statista.com/statistik/daten/studie/20116/umfrage/anzahl-der-windkraftanlagen-in-deutschland-seit-1993/> (last accessed 17.07.2020)
- [4] UBA-Texte 117/2019: Entwicklung eines Konzepts und Maßnahmen für einen ressourcensichernden Rückbau von Windenergieanlagen.
- [5] <https://www.energie-experten.org/erneuerbare-energien/windenergie.html> (last accessed 17.07.2020)