

RecycleWind - a network - self-learning and resilient -

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RecycleWind 1.0



funded by:



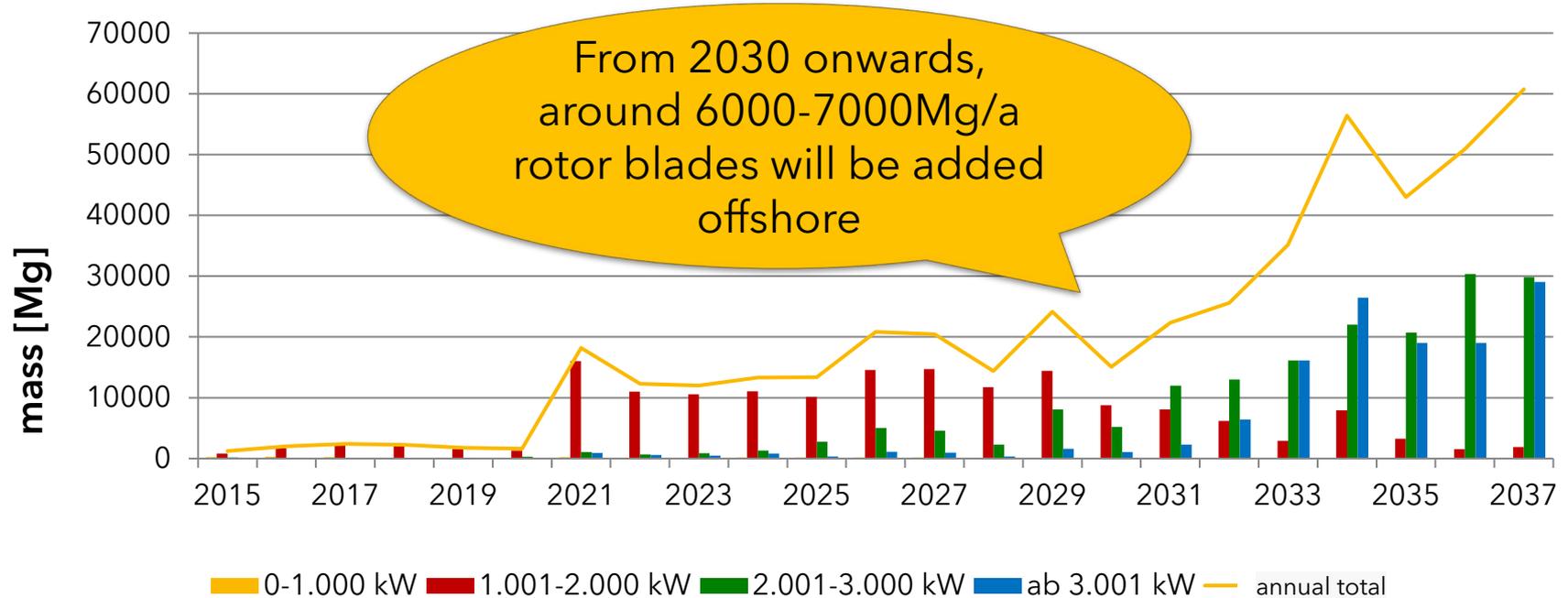
RecycleWind 2.0



Die Senatorin für Klimaschutz,
Umwelt, Mobilität, Stadtentwicklung
und Wohnungsbau



Rotor blade masses arising in Germany, Status from February 2020



assumptions:

- with <1MW repowering 60% after 15 years; 1 to 2MW repowering 10% after 15 years; end after 25 years
- Plants with outputs <1MW with 36% second life; 1 to 2MW at 9% second life
- all other power classes Decommissioning/ repowering after expiry of EEG support (20 years);

Source: own database HSB on all WTGs installed by 31.03.2018 with material-specific allocations

Results in a nutshell

The main research focus was the investigation of **approaches to establish a recycling network** for wind turbines.

Two fundamental aspects have been identified as results:

1. Due to the frequent lack of data on the material composition of the main components in already completed decommissioning projects of onshore wind turbines, the establishment of a standardized product declaration is considered necessary. The use of so-called **Environment Product Declarations (EPD)**, which have already been introduced in Europe as environmental labels, has been proposed here. They are currently mainly used in the construction sector.
2. In addition to the establishment of EPDs, the establishment of a **quality association "RecycleWind"** was also proposed, in order to be able **to ensure high-quality recycling of wind turbines within the framework of this self-organisation.**

Identification of relevant actors

- relevant actors in the process chains
- Tasks, influence, responsibilities, interactions of the actors
- Options for action

→ BPMN = Business Process Model and Notation

Inventory of recycling system

- Masses of components and materials
- Decommissioning, recycling technologies
- Material qualities and values
- Material flow models of the process chains

→ Development of a central database;
→ Sankey diagrams

Definition of indicators & terms

- Recyclability, recyclability
- High quality recycling
- Recycling rate, secondary material rate
- Recovery rate

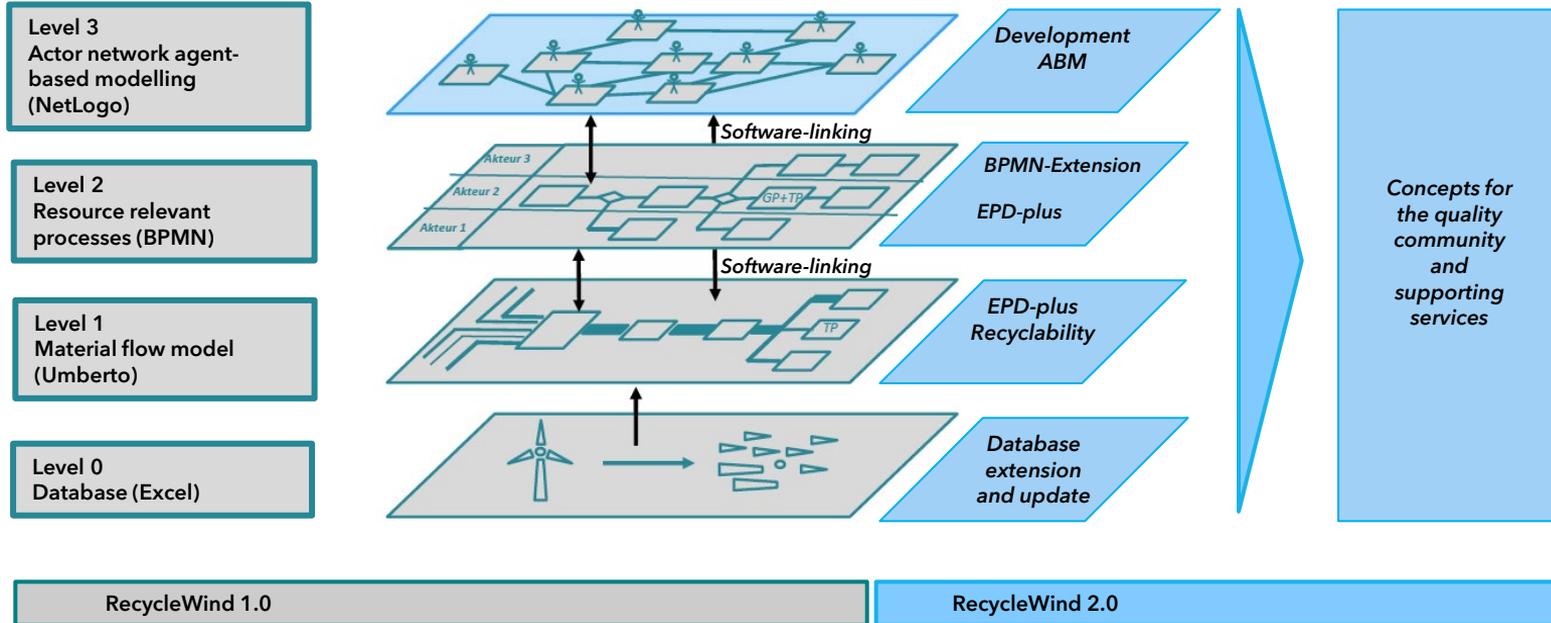
→ Control in the planned recycling network

Concept of recycling network

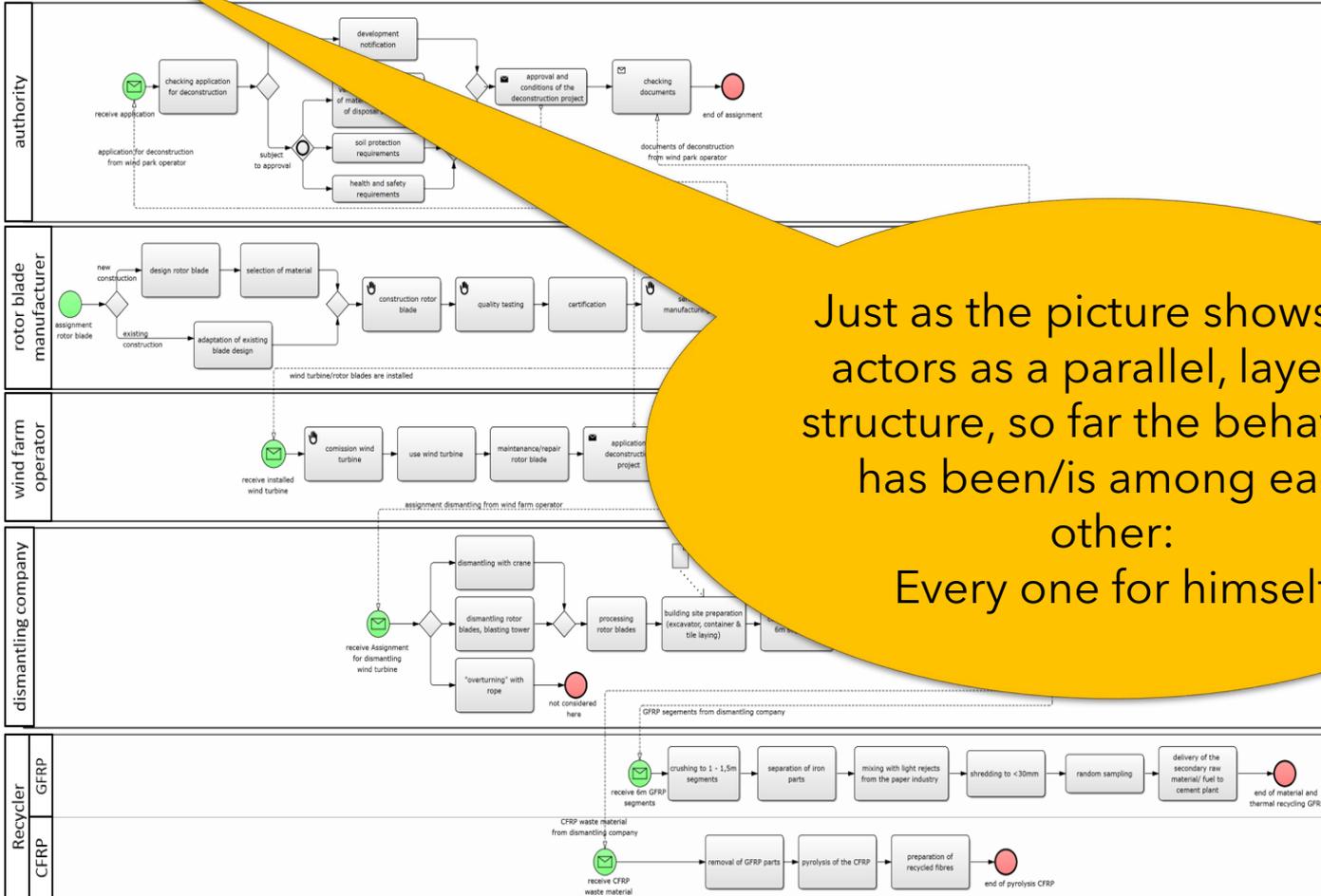
- Design as a quality association*)
- Setting objectives
- Setting standards with regular evaluations

→ self-learning and resilient
*) with representatives of all value chains, R&D, public authorities

Approach and results of the current project



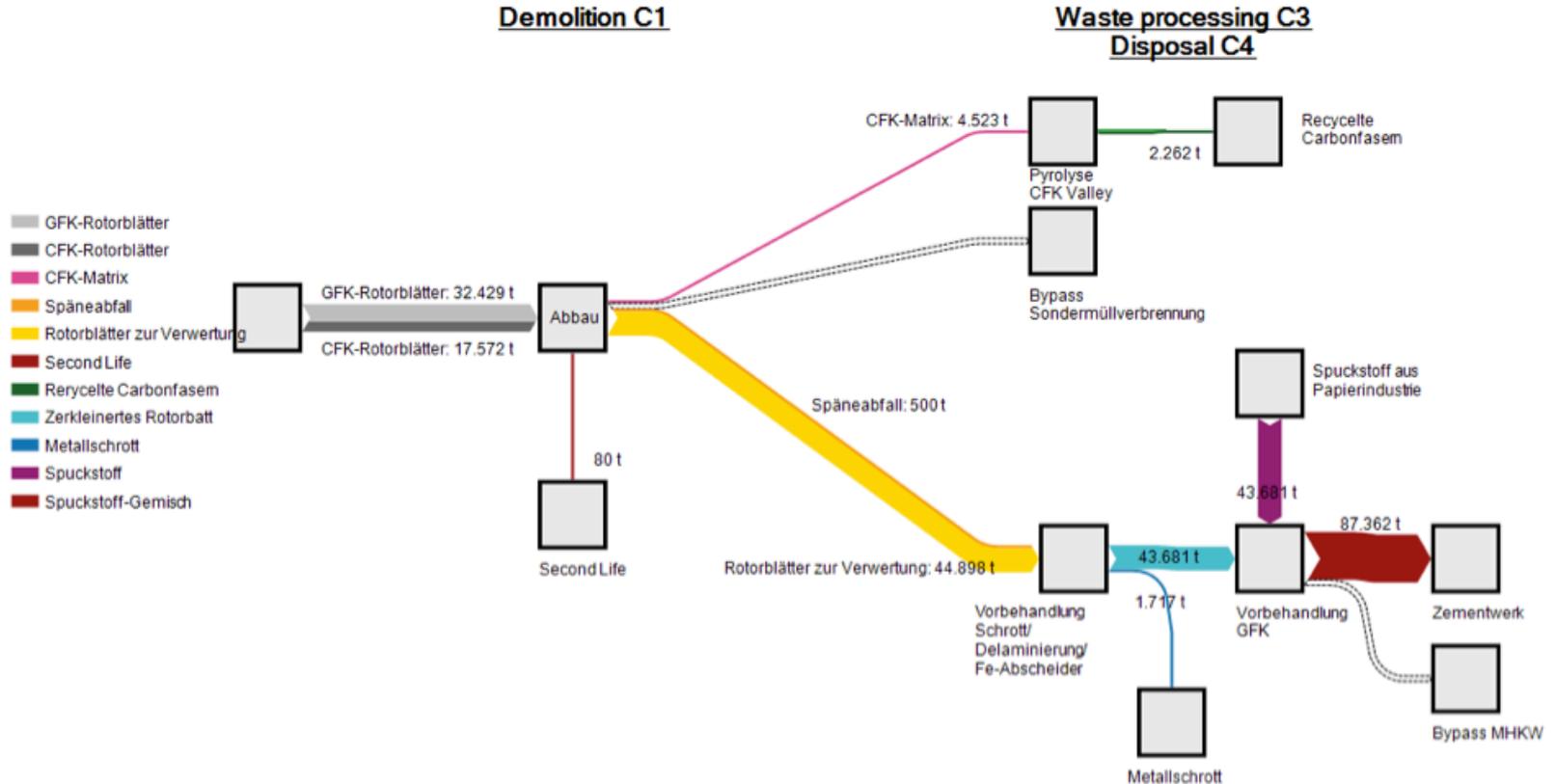
Process Analysis (BPNM): Dismantling and disposal of rotor blades

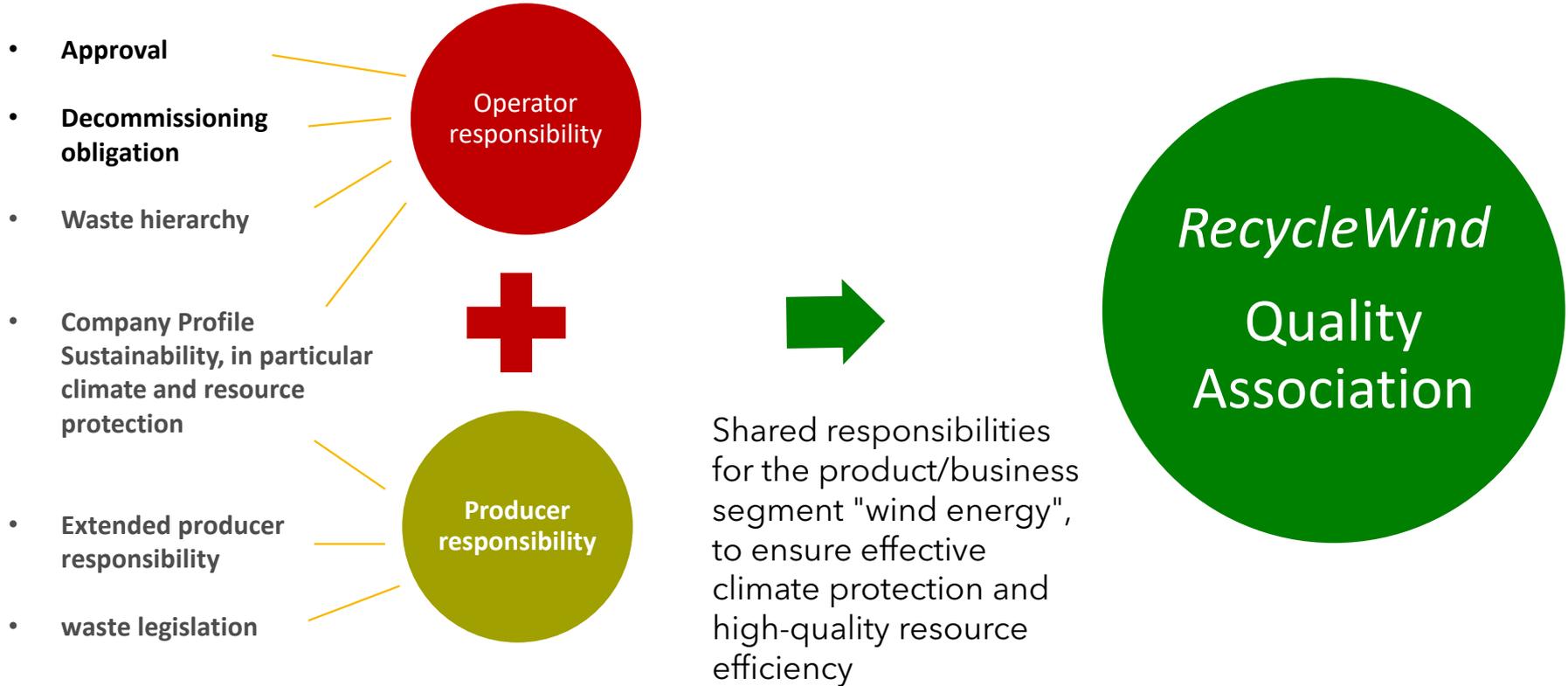


Just as the picture shows the actors as a parallel, layered structure, so far the behaviour has been/is among each other:
Every one for himself

Material Flow Analysis: Forecast waste volume of rotor blades in 2036

RecycleWind - Projected amount of waste in 2036





- **Involvement of all relevant stakeholders necessary**; including operators, manufacturers of WTGs, manufacturers of rotor blades, deconstruction and waste management companies, authorities
- **Coordination of the content of the work by a "neutral body"**, e.g. affiliated institute HSB, using the necessary foundations already created for rotor blades, including definitions, process descriptions, etc.
- **Use of the central database** created as a basis for the work in the Quality Association; service: updating, extension and management of the Database by an affiliated Institute of HSB
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Extended producer responsibility

An "Extended Producer Responsibility (EPR)" has been introduced by the amendment of the European Waste Framework Directive in 2018 and extends the product responsibility of producers to the period after the end of use.

Citation of the Waste Framework Directive § 8, para. 1; sentences 2 and 3:

"These measures may include the take-back of returned products and of waste remaining after the use of these products as well as the subsequent management of the waste and financial responsibility for these activities. These measures may include an obligation to provide publicly available information on the extent to which the product is re-usable and recyclable."

High-quality recycling/ recovery of durable products

The **self-learning aspect** is intended to **enable the actors** in the network to act flexibly, so that the interests of these actors can be taken into account and goals themselves can be flexibly adapted and implemented. The highest premise must always be high-quality recycling in the sense of an efficient circular economy.

Use of new product declarations EPD-plus to be established

EPD = Environmental Product Declaration

- The EPD programme is based on the international standards DIN ISO 14025 including life cycle assessment according to ISO 14040/44 and DIN ISO 15804
- EPD as an important basis for sustainable building
- EPD presents environmental impacts in a transparent and neutral way
- Already established in the construction industry as a basis for sustainability assessments; among other things, a component in tenders for public construction projects.

What is missing so far are statements on recyclability!

Extended EPD-plus with integrated recycling assessments as a basic and decisive document on recycling for the main components of WTGs

- Contains information from the manufacturer about a product and its components, for dismantling, to help waste management and recycling companies to carry out optimised end-of-life operations
- Includes evaluation of the product based on LCA analyses (including carbon footprint) and
- In future, also includes statement / assessment of recyclability

Blueprint/first draft of an "EPD-plus rotor blade" is available (still no assessment of recyclability)



Type I eco-label (according to ISO 14024)

- Third party environmental performance mark or logo
- Well-known examples are the "Blue Angel" or the "FSC" label



Type II eco-label (according to ISO 14021)

- Self declaration by the manufacturer
- The manufacturer is responsible for its own environmental statement.
- Can be independently verified to demonstrate credibility



Type III eco-label (according to ISO 14025)

- Comprehensive description of environmental performance
- No rating
- Based on the life cycle assessment ISO 14040
- all material flows are systematically recorded
- Environmental effects are characterised, e.g. the greenhouse effect in CO2 equivalent.
- Independently verified



An EPD is an official, transparent and non-judgmental document that publishes the results of a life cycle assessment in a standardised format via a programme holder.



GENERAL INFORMATION

- Exact name of the product
- Product image
- Name, logo and contact data of the owner
- Name, logo and contact data of the programme operator
- Underlying product category rules (PCR)
- Scope
- Date of the publication and beginning of the five-year validation period
- Declared unit of the product (e.g. m² or kg)
- Place of manufacture
- A statement that the EPD is based on EN 15804
- Name of the independent verifier



EPDs are an objective description of the environmental effects without any rating.

Disassembly
Reuse phase
Recycling and disposal

DETAILED PRODUCT INFORMATION

- General description of the product and its application
- Technical data and reference to the underlying product norm
- A list of the product's components and/or substances
- Information on substances listed in the SVHC¹ Candidate List if their content exceeds 0.1 %
- Description of the manufacturing process
- Environmental and health impacts during production and use phase
- Installation of the product
- Reference to the underlying product norm
- Information on the product's behavior in the event of fire, explosion, and water and mechanical destruction
- Information for use after the usage phase
- Naming of possible disposal routes
- Information on where explanatory material can be obtained
- System boundaries (which phases of the LCA are declared)

¹ Substances of Very High Concern for Authorisation

LCA BACKGROUND INFORMATION

- Information on background data used (LCA data sets) and rating of the data quality
- Period from which the manufacturer data used originate
- Estimates and assumptions made
- A statement that EPDs are only comparable if they comply with EN 15804
- Information on transports such as means of transportation, distances, and utilisation

SCENARIOS AND ADDITIONAL TECHNICAL INFORMATION

- Installation of the product: auxiliary and operating materials for the installation, use of other resources, etc.
- Maintenance, repair, replacement and modernisation, inspections, cleaning and cleaning cycles etc.
- End-of-life: maintenance service life, waste materials from maintenance, energy use, water consumption
- Energy and water consumption during the use phase
- Disposal: collection, return procedure, specified disposal type
- Reuse, recovery and recycling potentials

ENVIRONMENTAL PARAMETERS FROM THE LCA

- Table with the results of the LCA including the required parameter
- The scenario development
- In the case of an average EPD of multiple products, the range of the environmental impacts must be reported

Construction and material composition

Standard EPD

Category	Unit
Hazardous waste (HWD)	Kg
Non-hazardous waste disposed of (NHWD)	Kg
Radioactive waste disposed of (RWD)	Kg
Components for reuse (CRU)	Kg
Materials for Recycling (MFR)	Kg
Materials for energy recovery (MER)	Kg
Exported energy [electricity]	MJ
Exported energy [thermal energy].	MJ

EPD Plus

Category	Unit
Hazardous waste (HWD)	Kg
Non-hazardous waste disposed of (NHWD)	Kg
Radioactive waste disposed of (RWD)	Kg
Components for reuse (CRU)	Kg
Materials for Recycling (MFR)	Kg
High quality recycling	Kg
Recycling for another purpose	Kg
Materials for energy recovery (MER)	Kg
Total recovery (energetic + material)	Kg
Exported energy [electricity]	MJ
Exported energy [thermal energy].	MJ

These criteria concerning recycling for an EPD plus are to be developed in RecycleWind 2.0

- **Creation of a prototype EDP-plus incl. evaluation of the recyclability** of products/main components using the example of WTG/rotor blade.
- **Concretisation of the steps to set up such a system** (programme holder, certification, etc.) for the creation and administration of EPD-plus
- **Concept development** towards the development and establishment of a future "**Quality Association *RecycleWind***" under the aspects
 - Extended producer responsibility and
 - Ensuring high quality recycling
- **We are still looking for further cooperation partners, supporters of these approaches!**

The responsible departments at the **Bremen and Lower Saxony Environmental Authorities** have taken up this approach and have introduced the product declarations on both the Bremen and Lower Saxony state governments in the Bundesrat during the current deliberations on the amendment to the Recycling Management Act. The **Bundesrat** has approved this proposed amendment to the draft resolution on the amendment to the **KrWG**. It remains to be seen whether this amendment will be adopted by the federal government. This proposed amendment creates the possibility to specifically prescribe EPDs for certain products in the future as an element to increase recycling rates

KOMMISSION DER NIEDERSÄCHSISCHEN LANDESREGIERUNG
Nachhaltige Umweltpolitik und Digitaler Wandel



Arbeitskreis Fortentwicklung der Kreislauf- und Abfallwirtschaft

Arbeitsprogramm

Das Arbeitsprogramm gliedert sich in drei Prioritätsstufen, die kennzeichnen, in welcher Reihenfolge die Themen angegangen werden sollen:

Priorität 1:

1. Möglichkeiten und Grenzen von „Null-Abfallkonzepten“
2. Fragen zur Gewerbeabfallverordnung nach einem Jahr Vollzugserfahrung, dabei auch: Praxisansatz zur Beurteilung der wirtschaftlichen Zumutbarkeit
3. Begleitung des BMU-Vorhabens zur Novellierung der Altholzverordnung
4. Umstellung der Klärschlammverwertung im Lichte der novellierten Klärschlammverordnung
5. Hindernisse beim Gipsplattenrecycling und Bewertung sonstiger Verwertungswege
6. Konzepte zum Stoffstrommanagement (z. B. in Anknüpfung an das Vorhaben „Verwertungsnetzwerk RecycleWind“, dabei auch: Möglichkeiten und Grenzen der Stoffstromlenkung über Quoten)
7. Abfallwirtschaftlich Belange einer „Strategie für den künftigen Umgang mit Kunststoffabfällen“

Background information on EPDs

Our Study:
EPDs: Benefits, Expectations and
Fulfilments – A Stakeholder View

Part 1



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- **The work of such a quality association is based on sufficient product declarations (EPDs) from the manufacturers**, whereby in the case of WTGs the main components are to be considered separately. The developed EPD-plus is considered the standard for members of the quality association, as long as it is not generally required by law in the future, especially for durable products
- **By continuously updating the evaluations, the Quality Association thus also creates a constant re-evaluation of the "old" EPDs, including their integrated LCA evaluation.** Only this recurring (re-)assessment will do justice to the recycling of durable products and thus also to producer responsibility.
- In addition, **a general overview of the total stock of all wind turbines** and their characteristics is of great importance for the work in the Quality Association. **This is the only way to depict or forecast material flows of the current and future stock and thus to estimate or show the necessary processing and recycling capacities.** If capacities are lacking, appropriate solutions must be discussed within the framework of extended producer responsibility.

- **Preparation or establishment of standards for the dismantling of WTGs or the main components, for dismantling, treatment and recycling of the individual components**, including possible specifications for material substitution, taking into account current developments on the market (state of the art, alternative materials).
- For the **assessment of the recyclability and recoverability of the main components and of the overall system**, definitions of recyclability, recycling and recovery rates and control variables derived therefrom shall be established and thus an assessment of the overall WTG system shall be performed in a process-related manner by applying resilience criteria (e.g. adaptability, redundancies).
- Furthermore, in addition to the assessment of the recycling quota, the use of LCA assessments or the CO₂ footprint is also to be considered as control parameter.