



SESSION ID: ES1163C

VESTAS: IMPROVING MANUFACTURING SUSTAINABILITY WITH DIGITAL PRODUCT DATA

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```
00 02341
2305-1103-4051
///
StageCheckPointA at C2D4
byte 50A 50A 50A 50A 50A 50A
byte S22224 S2FSID S2P SID
StageCheckPointB
byte 514514 514 514 514 50F
byte S27220 S2FSID S1C
FirstScreenScreenTable at C2E8
; Initial screen start?
byte 500 500 500 500 500
```

```
044 15BB > W8116 > 01 > 00000015XK 103 11
8304-6499-65055
125053 01 16 77 99%
F935069569193045 < RFPD > 16 77 90%
URAUWEB D-DOCUMENT.
++
0001C2A7 A5 00 kta #500
0001C2A9 B5 19 sta JoyD1
0001C2AB A2 FF kck #5FF
002A0 9A ds
0001C2AE A 05 kta #505
0001C2B0 85 42 sta
CurrentBank
0001C2B2 80 05 C0 sta
```



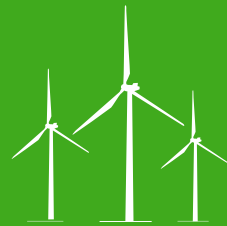
```
00000000000225A
7942-5922-2305-1033-0051
GUK OFF
///
StageCheckPointA at C2D4
byte 50A 50A 50A 50A 50A 50A
byte S22224 S2FSID S2P SID
StageCheckPointB
byte 514514 514 514 514 50F
byte S27220 S2FSID S1C
FirstScreenScreenTable at C2E8
; Initial screen start?
byte 500 500 500 500 500
```

VESTAS IS THE ENERGY INDUSTRY'S GLOBAL PARTNER ON SUSTAINABLE ENERGY SOLUTIONS



+29,000 people

We employ more than 29,000 people worldwide and have 40 years of experience with wind energy



+54,000 combined turbines

We have a total of 54,942 combined turbines under service, or more than 137 GW



+83,000 turbines

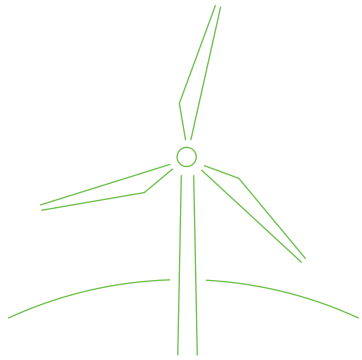
That is more than 157 GW of installed wind power capacity in 88 countries worldwide spanning five continents



€15.6 billion

Vestas' revenue for the full year 2021 was EUR 15.6bn

CO₂E AVOIDED THROUGH OUR FLEET OF WIND TURBINES



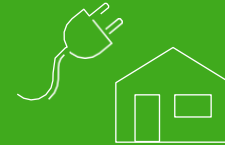
1,699

million tonnes CO₂e
avoided from 1981 - 2021

The turbines produced & shipped in 2021 are expected to avoid **532 million tonnes of CO₂e** over their life time, equivalent to:



125 million
passenger vehicles
driven for one year



97 million
homes' electricity
use for one year



2.64 million
km² forest's carbon
sequestering in one year

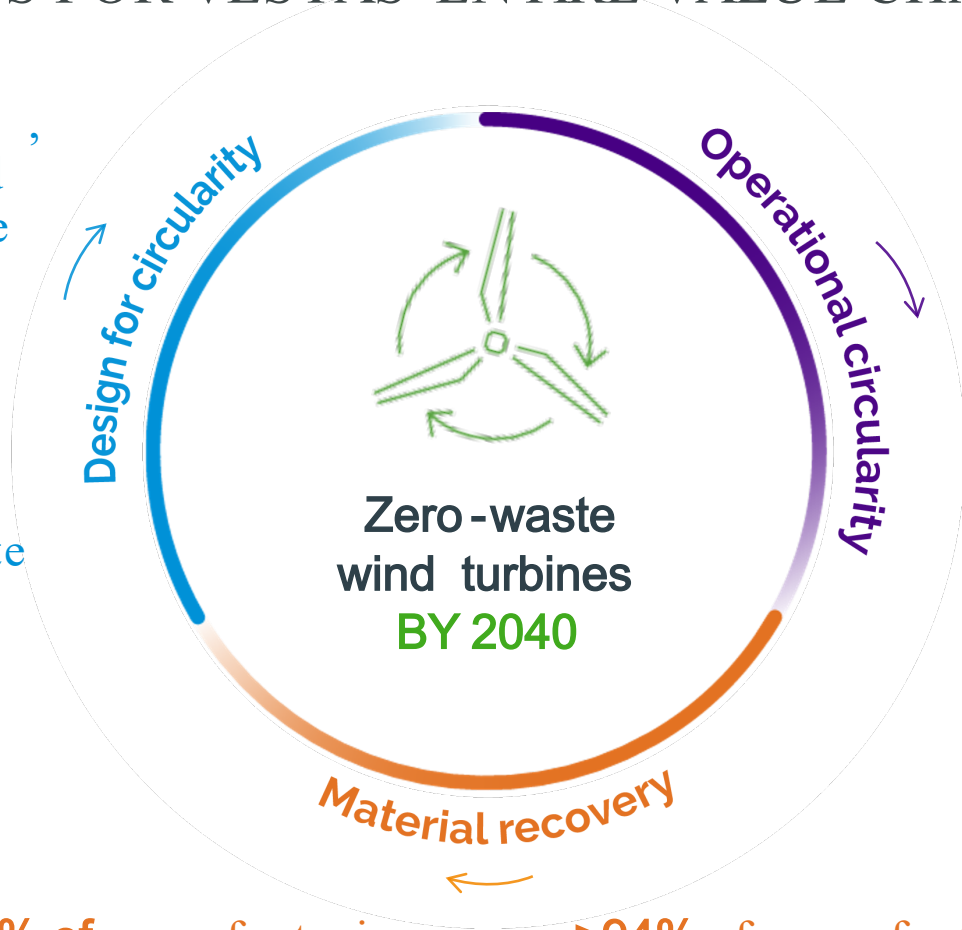
VESTAS' CIRCULARITY ROADMAP

CIRCULARITY PATHWAYS FOR VESTAS' ENTIRE VALUE CHAIN **BY 2030**

Fully recyclable blades, both from technical and commercial perspective

90% increase in material efficiency

50% reduction in supply chain waste intensity



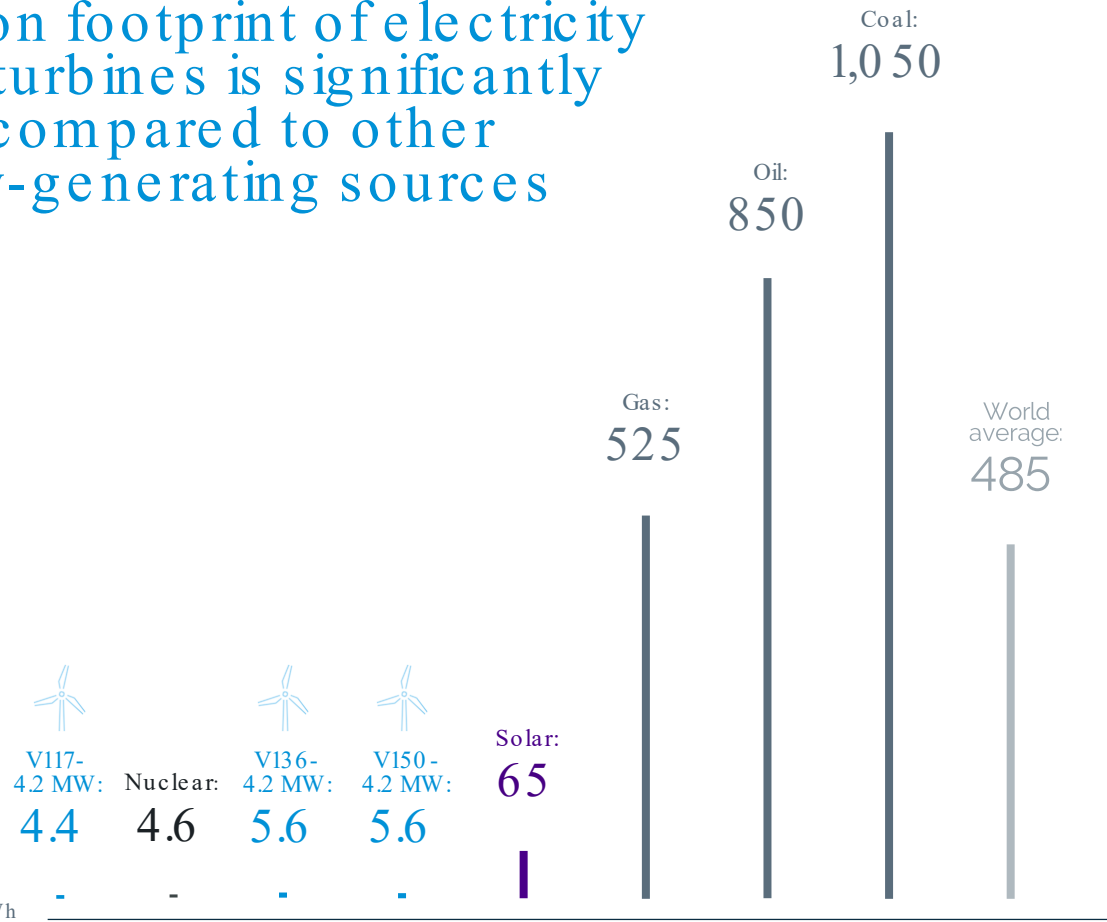
55% total refurbished component utilization

<1% of manufacturing waste landfilled

>94% of manufacturing waste recycled

CARBON FOOTPRINTS COMPARED

The carbon footprint of electricity from our turbines is significantly reduced compared to other electricity-generating sources



CO₂e emissions for Vestas turbines range from 4-9 kilograms per MWh. Values for specific turbine models and variants are based on our Lifecycle Assessments, which are publicly available on our website. Source: Sphera (2021). Sphera – GaBi 9 dataset documentation for the software-system and databases, LBP, University of Stuttgart and Sphera Solutions GmbH, Germany.



DIGITALIZATION STRATEGY



- Track/measure the carbon footprint of our product
- Allow customers the choice to configure based on carbon footprint
- Do rollup of carbon foot-print – like cost
- Enable the above through configuration of our supply chain



Sustainability through transparency.

HOW TO ACHIEVE THE STRATEGY– STEP 1



- Digitalize Base Materials (in ANSYS / GRANTA)
- Transition from 2D to Model Based Definitions (MBD)
- Replace "dead text" base material data on drawings
- Represent both parts, semi-finished parts and raw materials in Windchill
 - Link base material objects parts in Windchill
 - Use PartsLink for classification and assignment of attributes and hence reuse of the above

CENTRALIZED BASE MATERIAL DATABASE

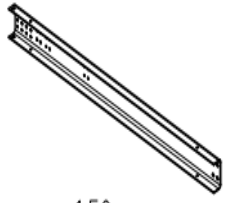
ABLE TO FETCH ALL THE BASE MATERIAL AND RAW MATERIAL ATTRIBUTES FOR ANY SEMI FINISHED COMPONENT

Current

Unspecified shape is specified by DXF and STEP
 DXF and STEP is considered TED (Theoretically Exact Dimensions)
 Surface Treatment acc. to TPS A005-7357
 To be produced acc. to TPS 0069-7962
 No CTQ tolerances specified
 Unspecified shape tolerances acc. to basic material standard
 Unspecified cutting tolerances acc. to ISO 9013:2017 -332
 Unspecified machining and cold forming tolerances acc. to ISO 2768:1989 -cL

Unspecified edges acc. to ISO 13715:2017 $\sqrt{-2}$

Unspecified hole edges acc. to ISO 13715:2017 $\sqrt{-0.5}$



1:50

1 Basic material: Plate EN 10029:2010 2

Item no.	Mass (kg)	Certificate	Format	Status	Revised by	Created date	Created by
29184602	65,3	EN 10204:2004-3.1	A2	Released	ANPVA	2019-11-27	BGSIB

Material specification	Scale	Change no.	PDM ver.	Approved date	Approved by
EN 10025-2:2004 - S355J2+N + Option 5	1:10	CN026003	1.5	2020-11-20	AJKVS

5 4

3

REAR STRUCTURE TOP BEAM 1

Vestas
vestas.com

Pro/E	Metric	Replaces / Copy of	Drawing no.	Ver.	Sheet
	Dimensions shown in mm unless otherwise specified	29142513	29184602	1	1 of 2

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 This document and the information set forth herein are confidential and proprietary to Vestas Wind Systems A/S. It contains trade secrets, and independent economic value, actual

To-Be

Actions Component - PLM-001456308, Steel plate for Granta demo, 0.2 (Design)

Details Structure Related Objects Changes History Where Used Traceability AML/AVL

Visualization and Attributes | More Attributes

Base Material Attributes

Base Material Name: S355J2H (EN 10210-1)
 Base Material Source: Metals_plastics_Elastomers
 Base Material Grade: 4 S355J2H
 Base Material Standard: 5 EN 10210-1
 DENSITY: 7850.000000 kg/m³
 Export DateTime PLM:
 Base Material Identity GUID PLM: 59419725-1F43-4DE1-A981-7456C57AE8DD
 Base Material Version GUID PLM: 6911634E-AA72-4396-8F20-7B3091869130
 Base Material Identity GUID CAD:
 Base Material Version GUID CAD:

RAW MATERIAL ATTRIBUTES

RAW MATERIAL CATEGORY: STEEL
 RAW MATERIAL TYPE: HOT ROLLED
 RAW MATERIAL CERTIFICATE: 3 EN 10204 TYPE 3.1
 RAW MATERIAL FAMILY: METALS
 RAW MATERIAL SUB CATEGORY: 1 PLATES
 RAW MATERIAL NOMINAL THICKNESS: 12 mm
 RAW MATERIAL TOLERANCE STANDARD: 2 EN 10029

HOW TO ACHIEVE THE STRATEGY– STEP 2



- Link supplier parts to both parts and raw materials
- Track carbon footprint per supplier (based on production methods)
- Configure the value chain as per the customer selected target
- (if needed) allow price differentiation based on configuration of supply chain

CONCLUSION



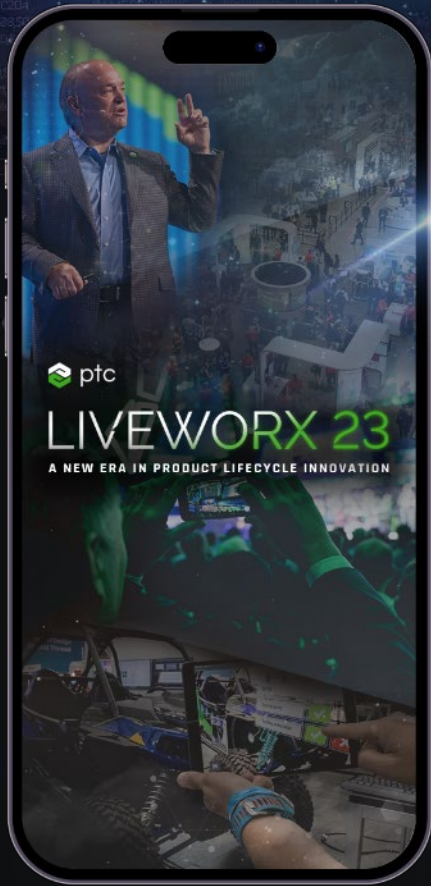
Through the transparency provided by our PLM systems, we can empower individuals from engineers to customers to make informed decisions that contribute towards a sustainable future.”



QUESTIONS?

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