



# Sustainable supply chain –

## Refurbishment and Replacement of Power Electronics

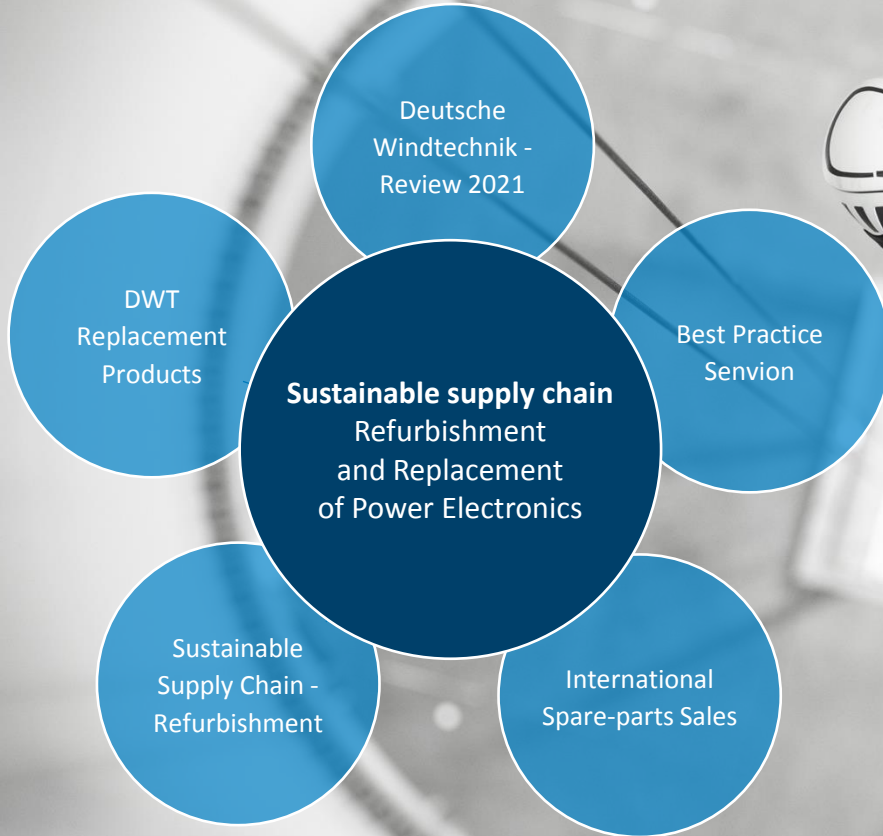
Jonas Gottwald | Team Lead Spare Parts Sales

Wind Farm Operators Forum 2022

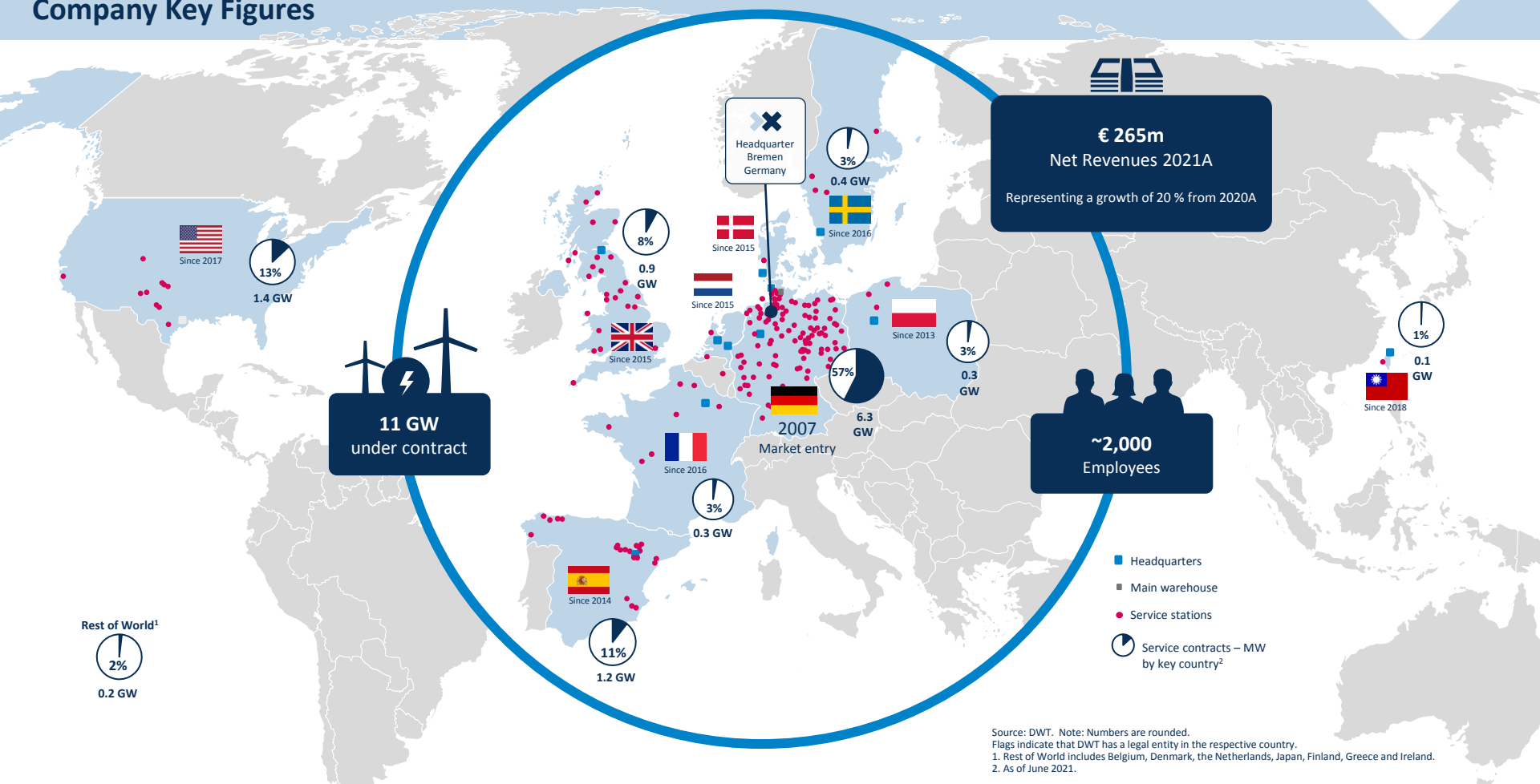
10-03-2022



## Agenda



# Company Key Figures



Source: DWT. Note: Numbers are rounded.

Flags indicate that DWT has a legal entity in the respective country.

1. Rest of World includes Belgium, Denmark, the Netherlands, Japan, Finland, Greece and Ireland.

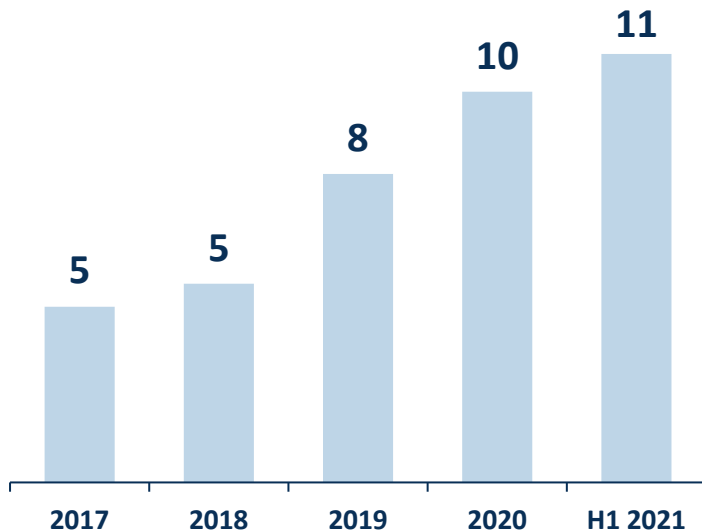
2. As of June 2021.

## Largest Independent Service Provider in the World

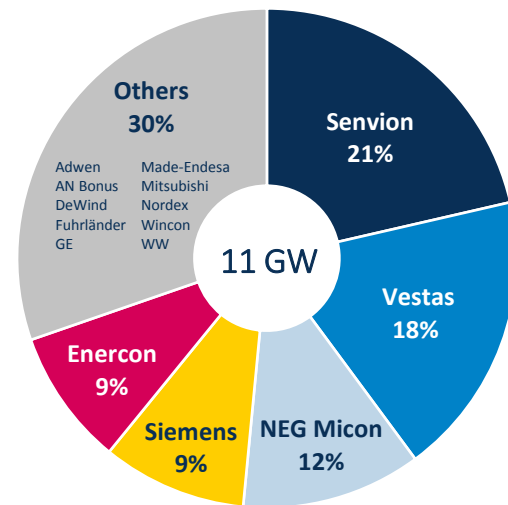
There is no other service provider that is comparable to Deutsche Windtechnik in terms of size and number wind turbine brands serviced.

With its portfolio, Deutsche Windtechnik covers over 80 % of the wind turbine technologies installed worldwide<sup>1</sup>.

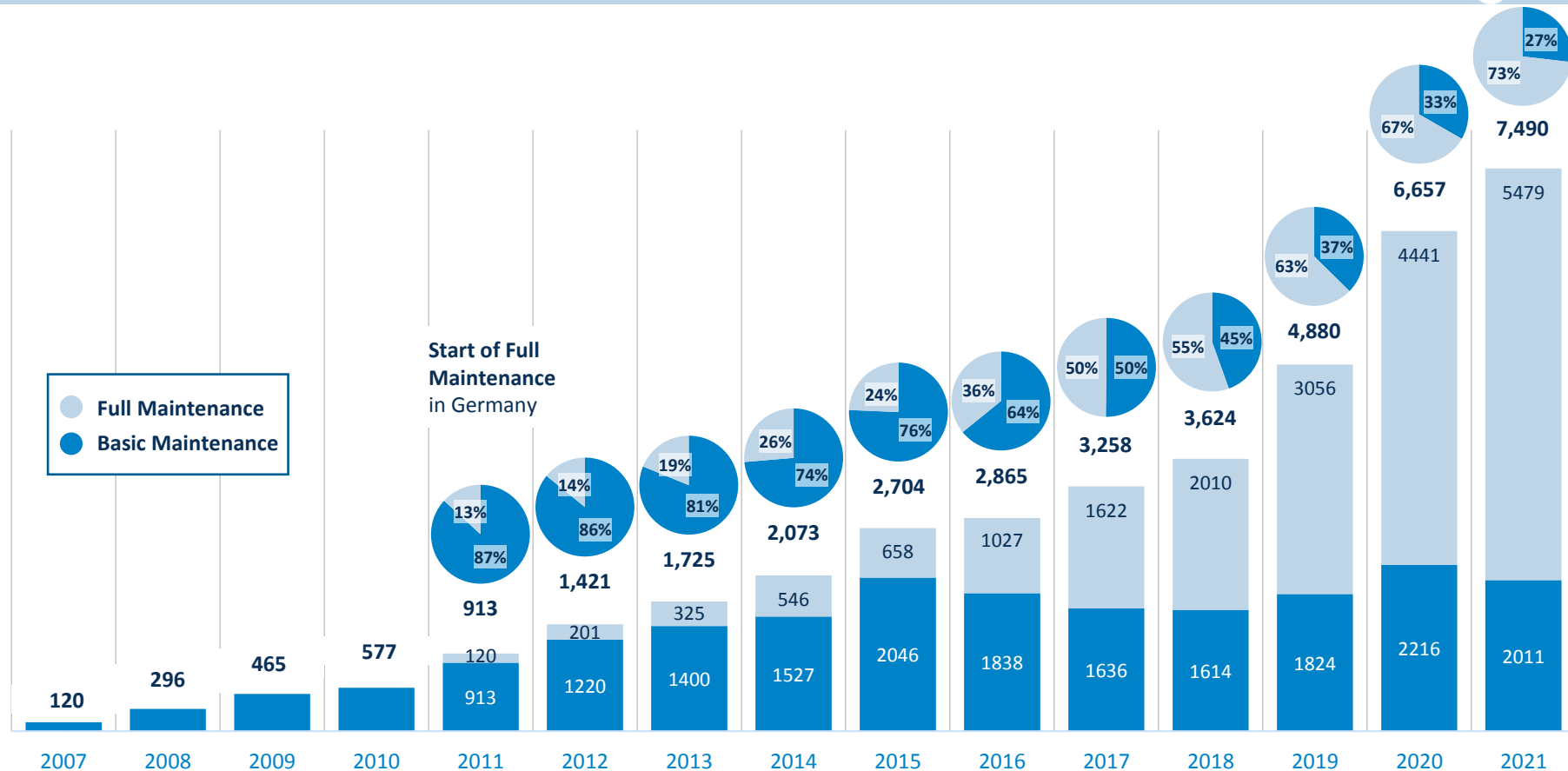
Development of GW under contract



Split of GW in H1 2021 by technology



## Wind Turbines under Maintenance Contract Development 2007 – 2021 (as of December 2021)



## Key Figures Poland



Established

2013



Staff

40



WTG under contract  
MW

144

250



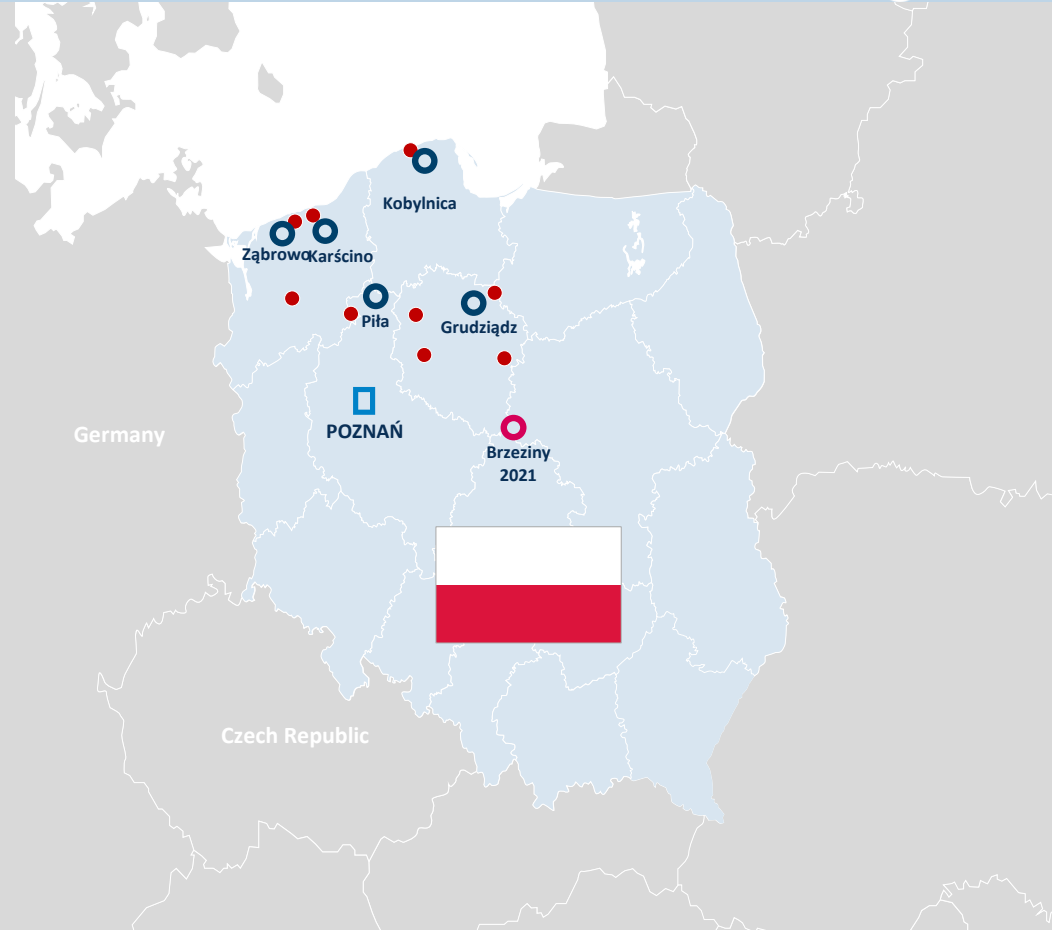
Centres and service stations

7



Service vehicles

12





## Maintenance Contracts and Additional Services in Poland

System expertise in Poland 	
Vestas	35 WTG
Enercon	21 WTG
Fuhrländer	60 WTG
Senvion	54 WTG
NEG Micon	6 WTG
Siemens / AN Bonus	

Performed main component exchanges
Gearbox <b>FL77</b> (11x)
Gearbox <b>Senvion MM92</b> (3x)
Main shaft <b>Senvion MM100</b> (2x)
Main shaft <b>Senvion MM92</b> (1x)
Main shaft <b>FL77</b>
Gearbox <b>Vestas V80</b> (2x)
Transformer <b>Vestas V80</b> (2x)
Blade bearings <b>Senvion</b>
Blade bearing <b>Siemens 2.3</b>
Generator <b>NEG Micon NM52</b>

Additional system expertise  
Deutsche Windtechnik Group

Gamesa  
Nordex

STACJA  
ELEKTROENERGETYCZNA  
ZAJĄCZKOWO 110/30kV

A high-angle photograph of two technicians in safety gear working on the white nacelle of a wind turbine. They are positioned on a flat surface, possibly a bearing or a mounting plate, with various yellow and grey fasteners scattered around. In the background, a vast landscape of green fields is dotted with numerous other wind turbines under a cloudy sky. The nacelle they are working on has the text 'RB-0761-4A' printed on it.

**Service for Senvion / Repower WTG**





## Servion / Repower Fleet under Service Contract

6.2M



5M



3.XM



MM92



MM82

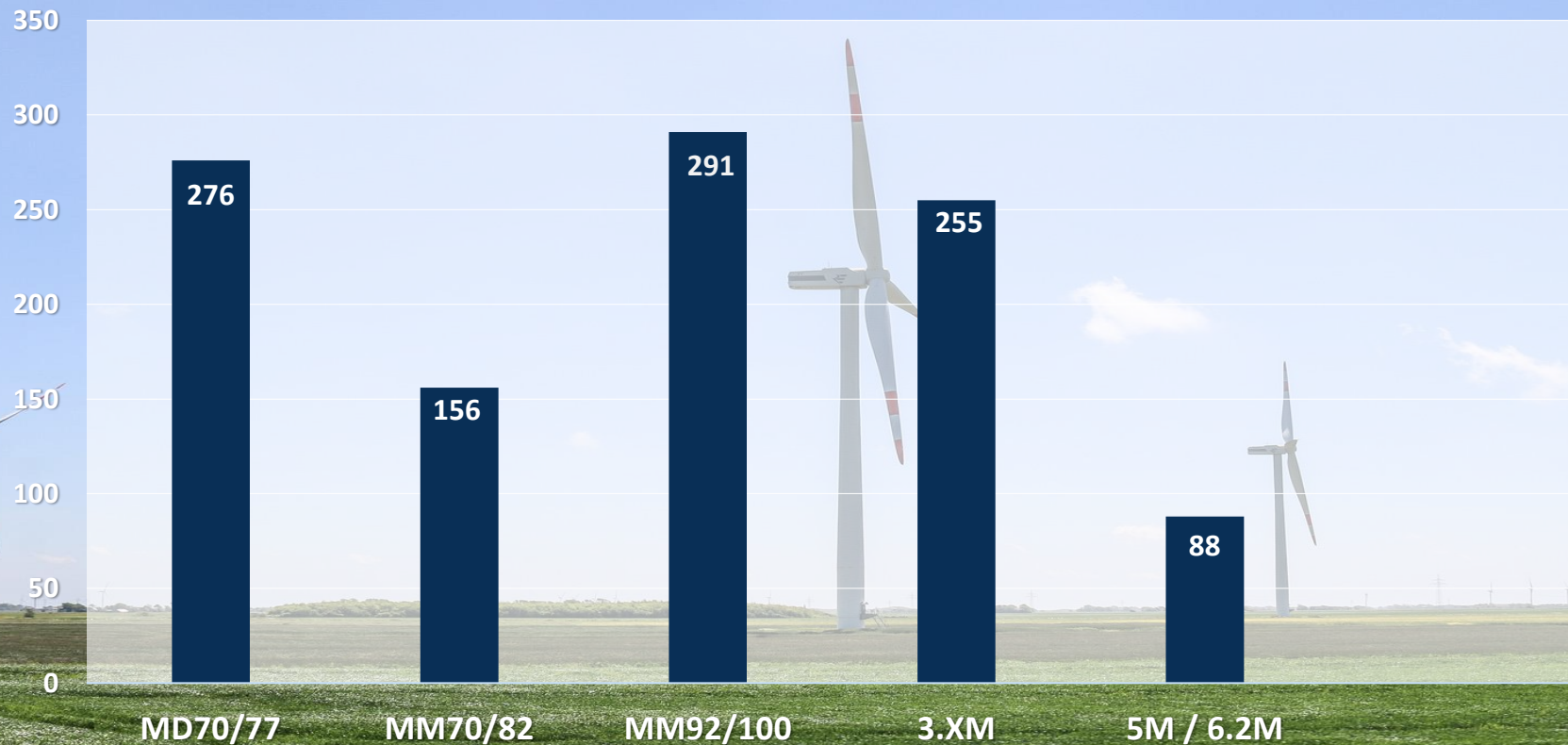


MD 70/77

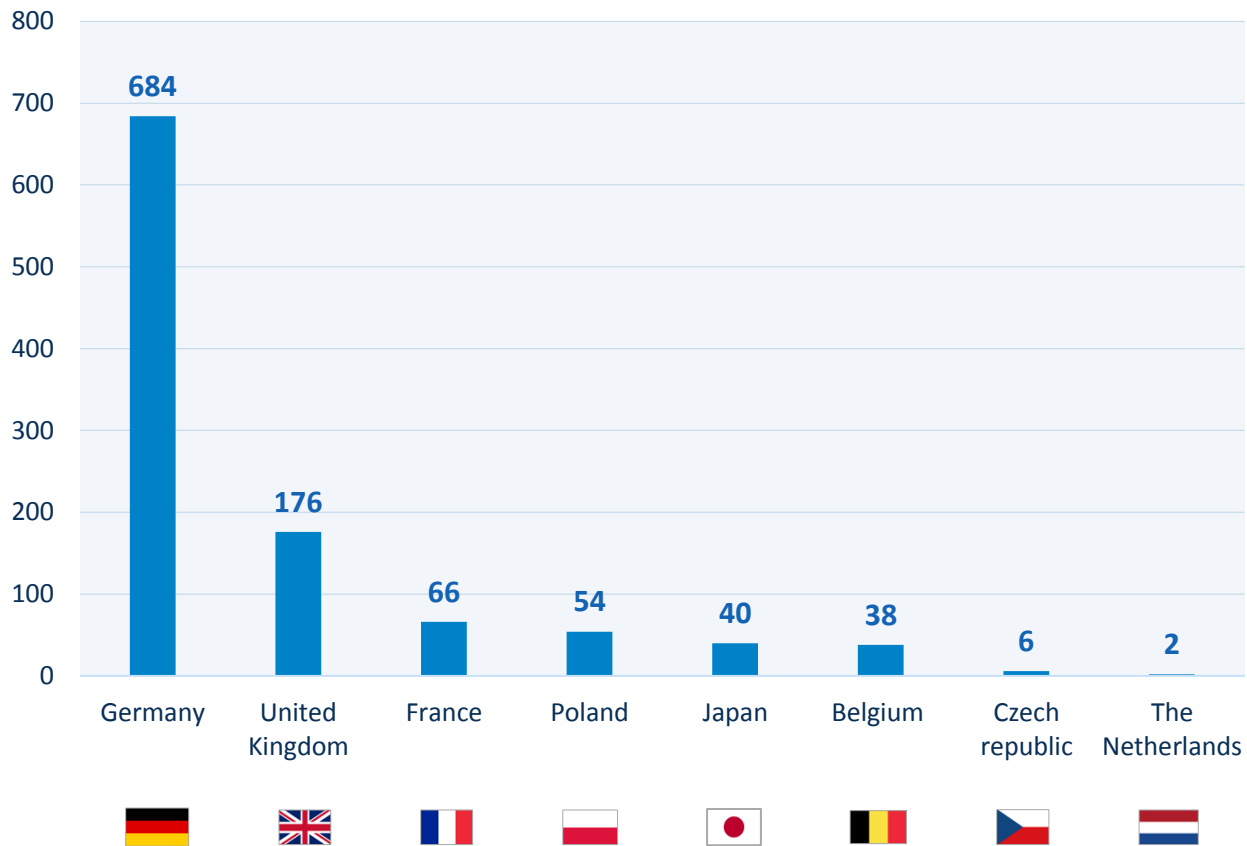
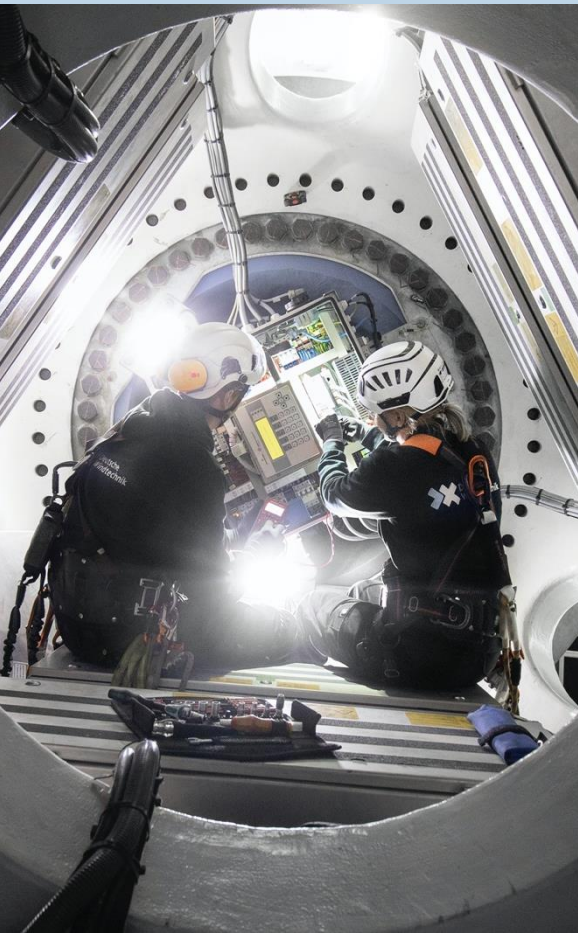


## Service Contracts for Servion / Repower WTG

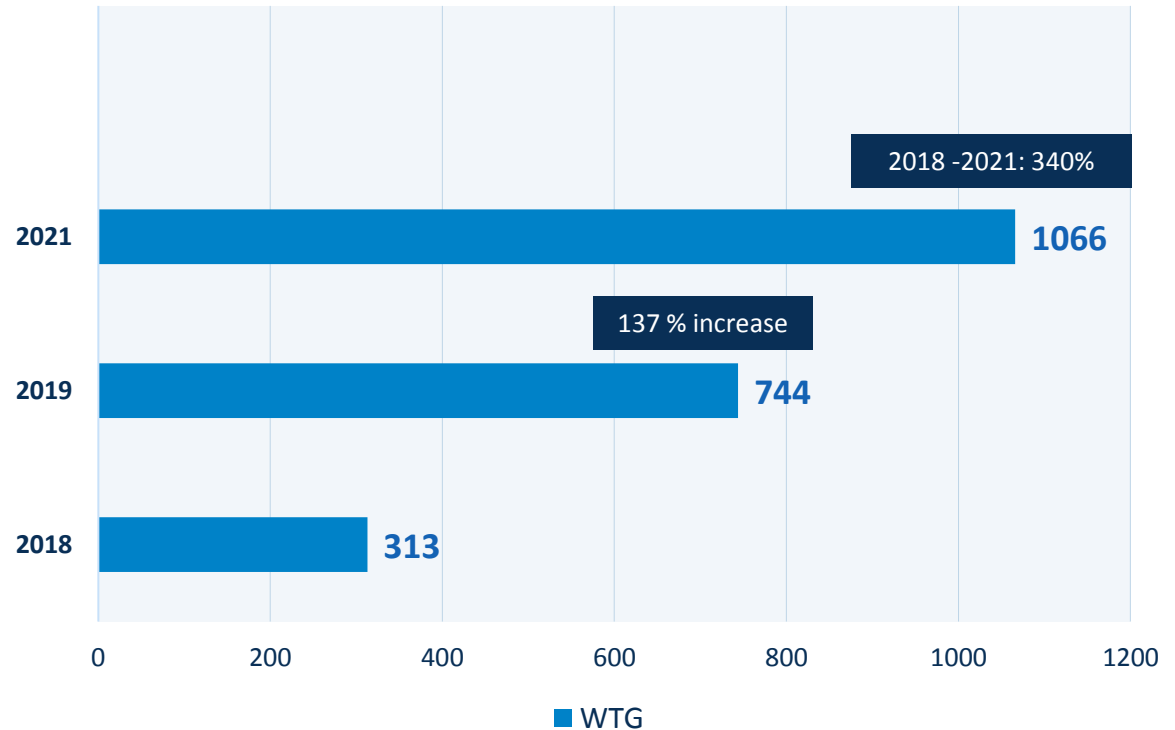
12/2021



## Servion / Repower – Service Contracts per Country



## Growth of Service Contracts after Servion Insolvency





## Development of our Servion Competence Center

### Manpower

Additional technicians

Acquisition of highly qualified supporters and technical engineers with Servion background

### Stock level & parts identification

Increase of safety stock for components

Large investment in major component stock

### Tools

High investments in Servion tools and special equipment

### Knowledge

Full competence for all Servion WTG MD70/77 up to 6.2MW





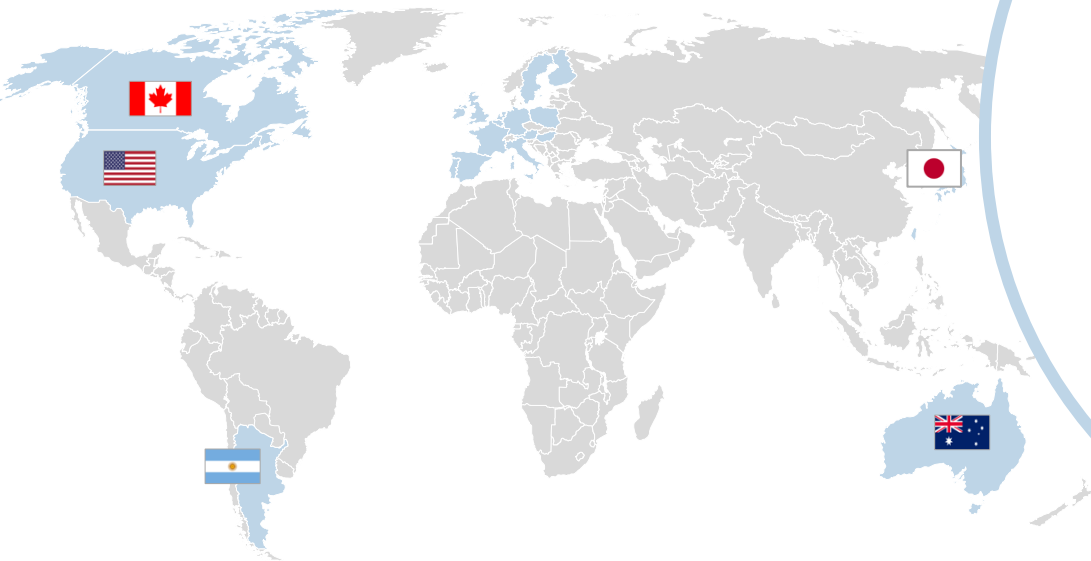
A man with a beard and short hair is focused on working on a large, circular metal component with red, gear-like teeth. He is wearing a dark t-shirt. The background is a blurred industrial setting with various equipment and lights.

## International Spare Part Sales



## Key Facts

Employees with focus on Spare Parts Sales	Turnover in 2020	Turnover in 2021	Number of new customers in 2021
7	2,5 Mio €	5,2 Mio €	40



## Profile and Core Competencies

**One stop shop for wind farm operators**

**Partnerships with major „self performers“**

**Customized price lists**

**Obsolescence management**

**Customized support along the entire supply chain**

### Benefit from our diverse competencies

Identification of required spare parts

Wind farm specific spare parts lists

One source for different technologies

Spare parts as well as major components

Competitive prices

Reliable supply chain

Availability and fast delivery

Consumables and maintenance kits

Stock consultancy

Own development and sales of electronical components

Strong logistics (overnight / air- and sea-freight)





## Supply Chain and Warehouse Facility



**Approx 65.000 different items on Stock / over 53M € on Stock**

**Different warehouses in EU / over 12.000m<sup>2</sup> / 24h deliveries**

**Knowledge and ownership of all O&M parts for our WEC types**

**Manufacturer independent supply chain**

**Cooperation with strategic suppliers / Framework agreements**



## Sustainable Supply Chain - Refurbishment



## Definition of Sustainability

*“Sustainability is a principle of action for the use of resources, in which a lasting satisfaction of needs is to be ensured by preserving the natural regenerative capacity of the systems involved.” Wikipedia*

**The principle was first applied in forestry.**

### Three Pillar model is existing since 1997

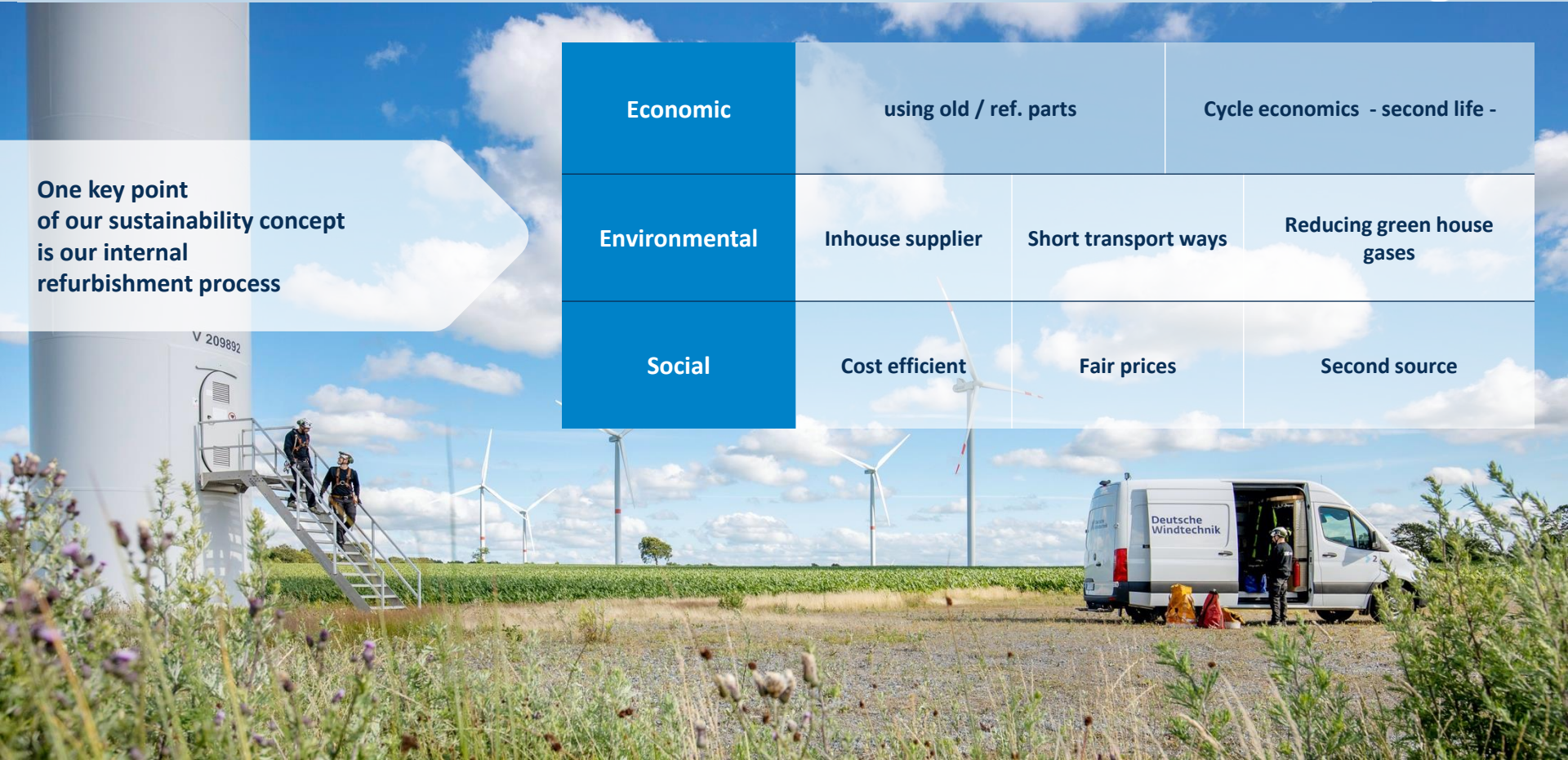
- |   |   |
|---|---|
| 1 | <b>Economic sustainability</b> – resource efficient                                   |
| 2 | <b>Enviromental sustainability</b> – reducing greenhouse gases                        |
| 3 | <b>Social sustainability</b> – ergonomical and social standards for production & work |



## Sustainability for Deutsche Windtechnik

One key point  
of our sustainability concept  
is our internal  
refurbishment process

Economic	using old / ref. parts		Cycle economics - second life -	
	Inhouse supplier	Short transport ways	Reducing green house gases	
Social	Cost efficient	Fair prices	Second source	



## Different Reasons for Refurbishment

**Increase of WTG under contract**  
**Many contracts changed from Basic to Full Service variants**  
(73 % Full Service in 2021)

**High demand on different spare parts**

**WTG age process - more defective parts**

**Cost reduction**

**Higher availability / shorter lead times**

**Independent OEM supply chain**





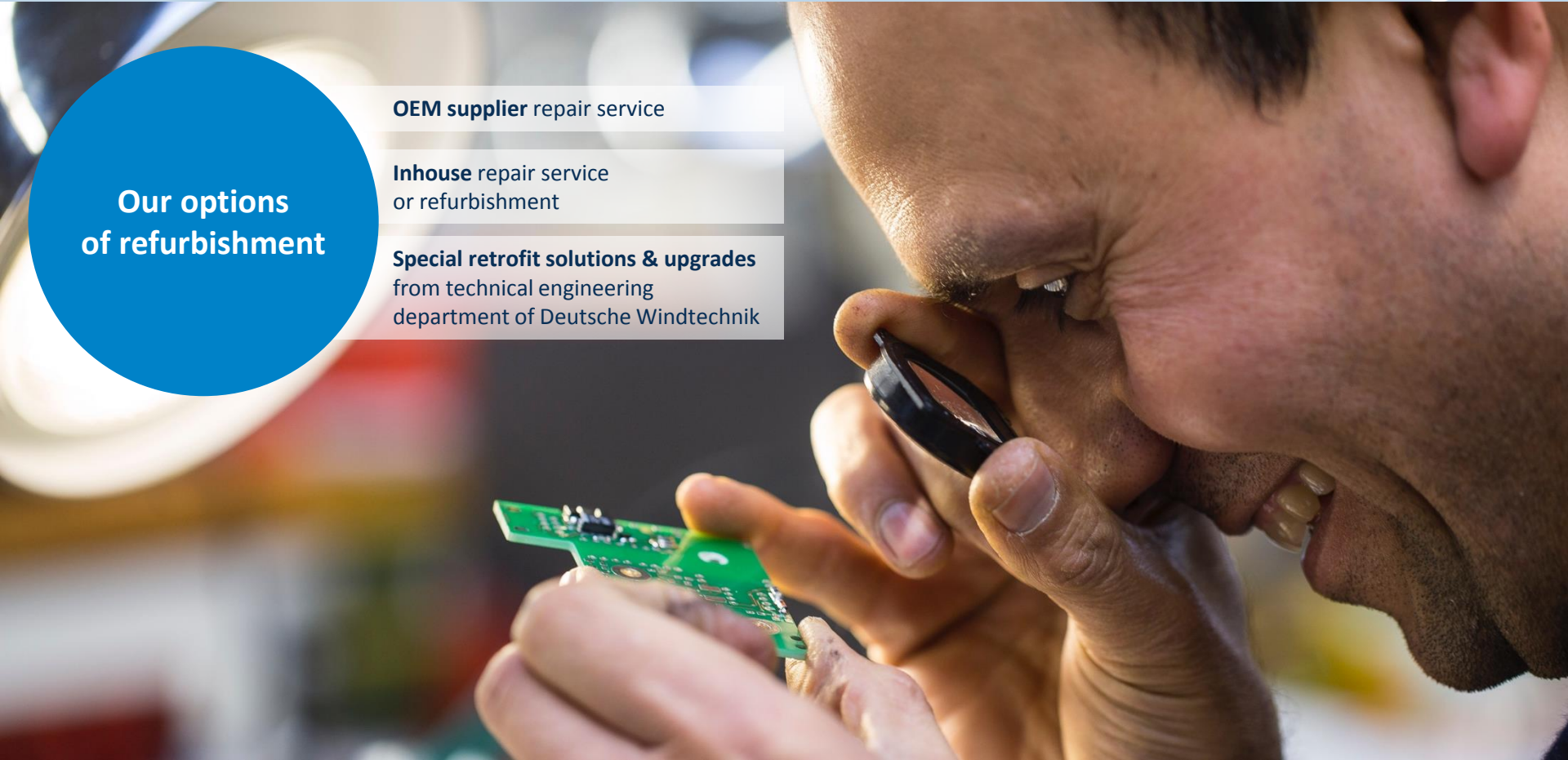
## Different Options for Refurbishment

### Our options of refurbishment

**OEM supplier** repair service

**Inhouse** repair service  
or refurbishment

**Special retrofit solutions & upgrades**  
from technical engineering  
department of Deutsche Windtechnik



## Inhouse Repair & Refurbishment



**Inhouse repair service** for major components and electronical components

Our repair department was **founded in 2011**

**More than 20 employees** are working in this department

Repair service **for internal use** and **external clients**

Development of **own replacement products** since 2015



## In-house Repair Workshop Deutsche Windtechnik



## Another In-house Repair Workshop and our Test Room for Converter Technologies



## General Repair Process

Customer

DWT Refurbishment Department

Customer

### Step 1



Defective  
component

Initial  
diagnosis

#### Initial diagnosis:

- Knowledge of the error
- Cleaning of the component
- Inclusion of the specific defect in database

### Step 2

Error  
known

Yes

Refurbishment

No

Manufacturing  
& Development

#### Refurbishment:

- Replacement of the defect components
- Proactive replacement of all components that show signs of aging based on our database

### Step 3

Final test



Refurbished  
component

#### Final test:

- Fully comprehensive function test
- Optional live test in WTG



## Key Facts of our Repair Department

### Key Facts

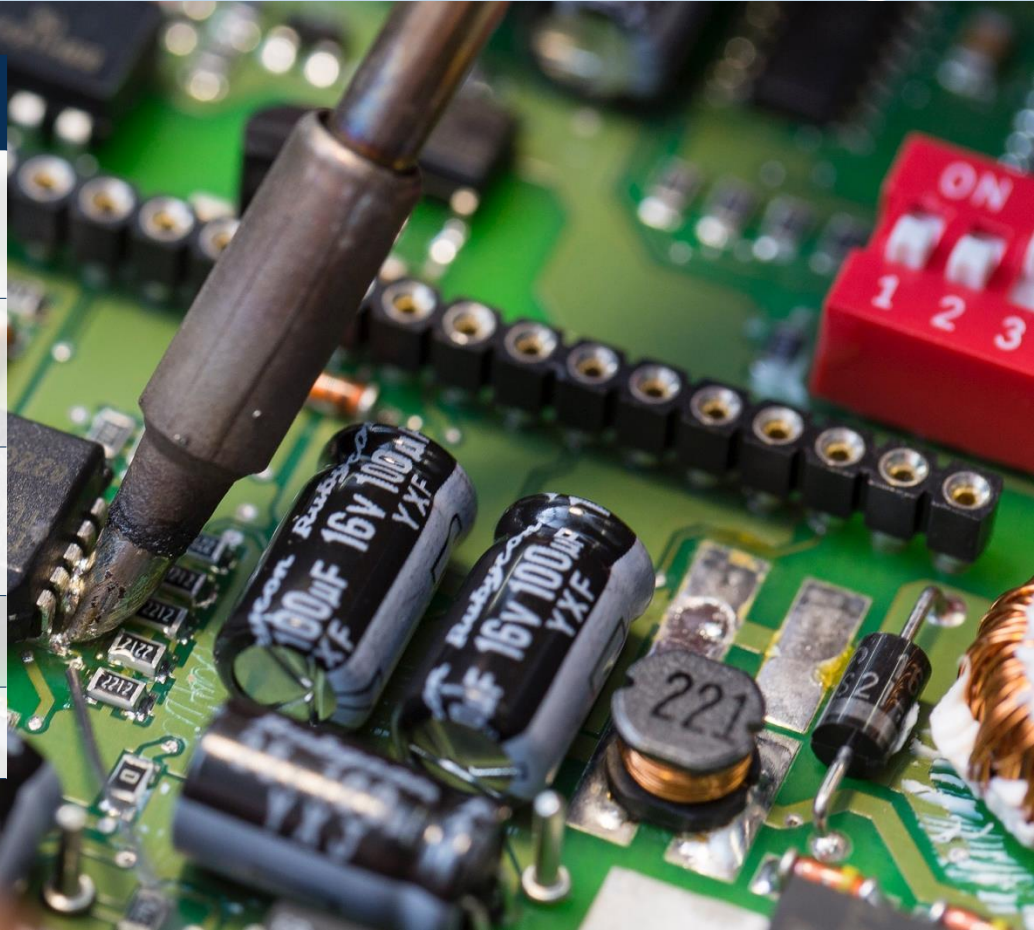
DWT offers **refurbished and improved electronic components** as reliable alternative to new spare-parts

**Development and implementation of procedures** for general overhaul and testing of select electronic assemblies

**Reverse Engineering** to increase their service life, keep delivery times short and be independent from third parties

**Obsolescence Management** for components which are no longer available

Still open for **new tasks** and **new turbine models**



## Technical Development / Upgrades

Around **60** technical engineers  
are mainly focused on improvements  
and upgrades

**20** Software engineers

A lot of upgrades  
for different WTG's available

Deutsche Windtechnik has developed  
**plenty of upgrades, retrofits and product  
developments** for **mechanical** and **electronic  
components**



**Engineering** is part of **Deutsche Windtechnik's  
entrepreneurial DNA** and is an **integral part** of all  
technical departments and a wide range of services,  
products and software.

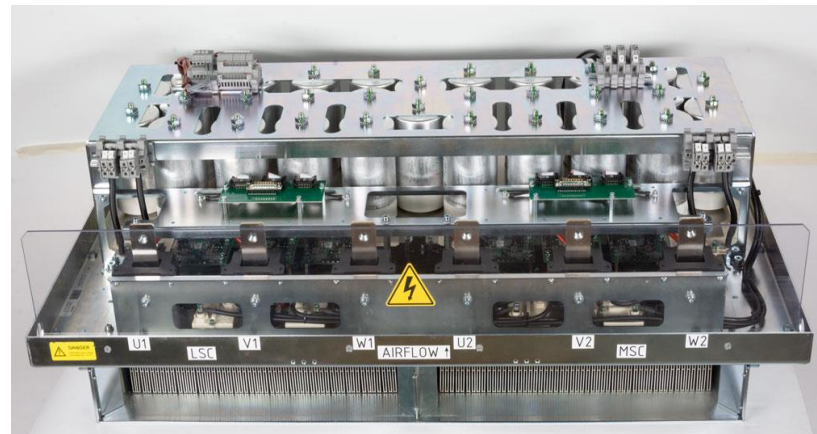
### Example: Cooling for Inverter Control Unit of a Vestas' Nacelle

Problem	Solution	Advantages
reduced lifetime due to constant overheating	– improve the temperature balance by installing an additional fan on the inverter control unit (VCP-Board)	– Improved component cooling – Active ventilation of the housing – Reduced component aging – Increased durability of the VCP-Board



# Key Facts / Milestones

2012	2015	2018	2019
First SkiiP® Check Development	Developing first DWT SkiiP® Pack 1813 & 2413 moduls	First OEM independent converter teststand (Equipment like Semikron/Infineon)	Developing first DWT Power Stacks for Nordex® and Senvion ® WTG
	„Virtual wind turbine system“ (check and repair for VCP Boards)		



## Replacement products for Vestas® WTG

DWT Skiip® 3 (AGO 2)  
grid & rotor side (V66- V90)

Different CT's for V52 – V90  
power supplies etc.

Refurbishment of VCP Boards  
including cooling upgrade



## Replacement products for Enercon® WTG

Refurbishment of „heatsink unit 300kW“ for CS48a – CS82a since 2020

Refurbishment of Wind sensors & Ultrasonics

Ref. different PCB (Power supply, Pitch box, Condensator box etc. )



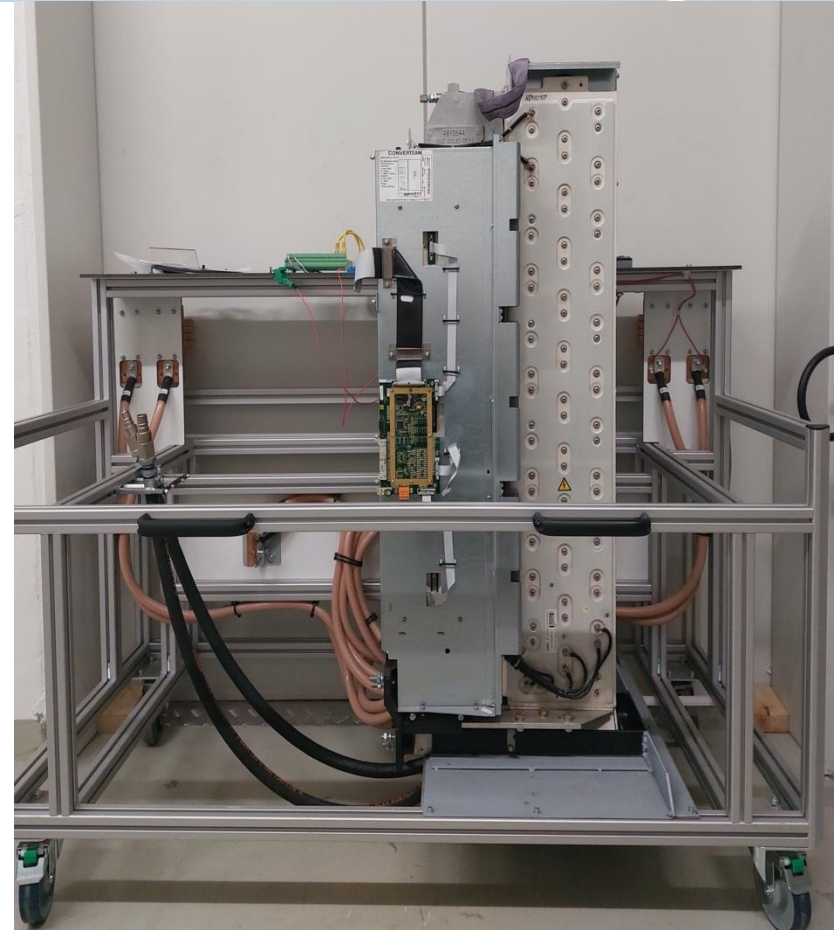


## GE converter products – Siemens® WTG

### Refurbishment of DELTA-Modul 2.3MW since 2021

#### Other refurbishment options:

- WTC 2 & WTC 3
- Power supply module SMPS
- DIB Boards



## GE Converter products – Senvion®, Nordex® & Fuhrländer®

### Replacement parts for GE ProWind I - IV and ProWind NX

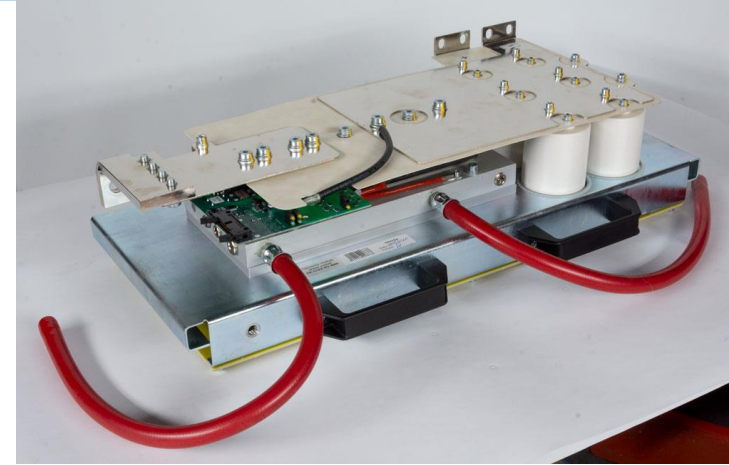
**DWT PRO Moduls - air and water cooled (1.5MW – 2.5MW)**  
for ProWindX690 & ProWind NX 2.5

**DWT DC-Chopper (1.5MW – 2.5MW)**

**Full test including driver repair possible for all units**  
**2 years warranty**

#### Advantages

- Latest IGBT Technology
- Mixed used possible
- Simple plug and play functionality
- No converter adjustments are necessary



## Woodward / SEG / ConverterTec converter products – Senvion® & Nordex®

### Replacement parts for Woodward 1.5MW – 2.5MW

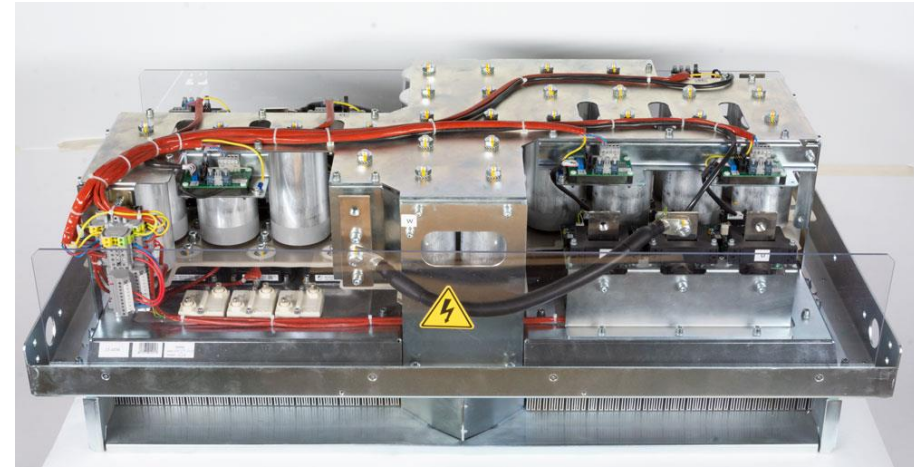
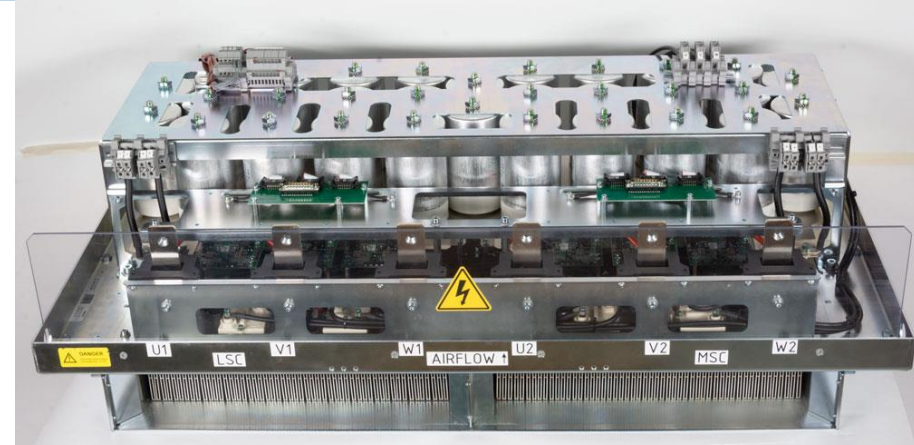
**DWT Stack Master and Slave**  
for Infineon ModSTACK 300, 301, 302

**DWT RAC 3.XX**  
for Semikron Power Stack RAC 310, 311, 313

**Full test including driver repair possible for all units**  
**2 years warranty**

#### Advantages

- Latest IGBT Technology
- Mixed used possible
- Simple plug and play functionality
- New capacitors with extended lifetime
- No converter adjustments necessary





## Woodward / ConverterTec converter products – Senvion® & Nordex®

### Replacement parts for NGX Converter 2.0 MW – 6.2 MW

#### DWT Moduls for Senvion®

WTG Skiip 2414 & Skiip 2013

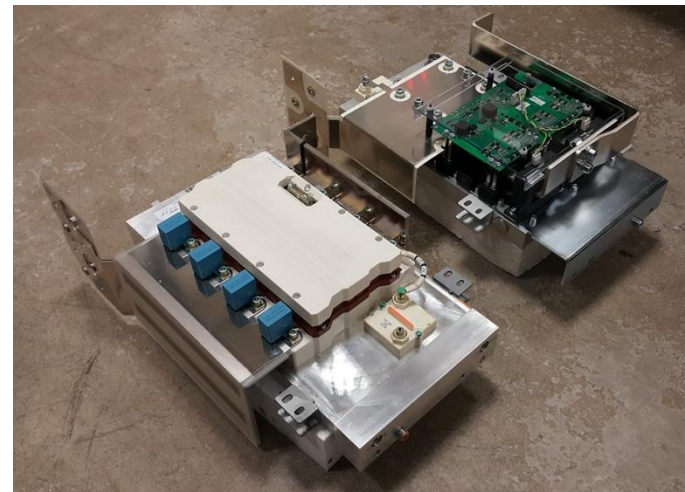
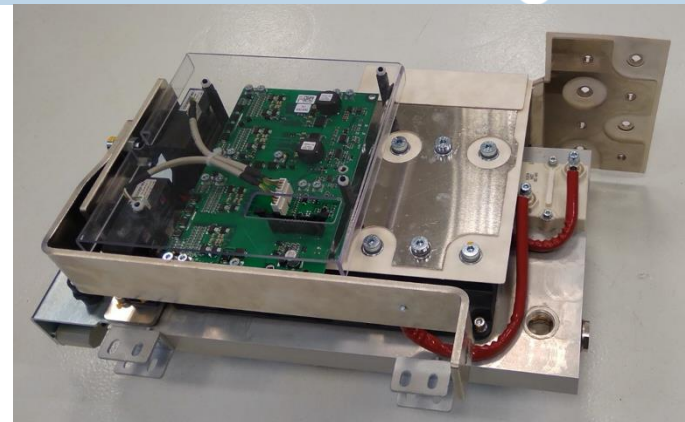
#### DWT Moduls for Nordex®

WTG Skiip 2403 & Skiip 2013

Full test including driver repair possible for all units  
2 years warranty

#### Advantages

- Latest IGBT Technology
- Mixed used possible
- Simple plug and play functionality
- No converter adjustments necessary



We look forward to  
get in touch with you!

[deutsche-windtechnik.com](https://www.deutsche-windtechnik.com)

