windtest grevenbroich gmbh
Company Profile

International Management

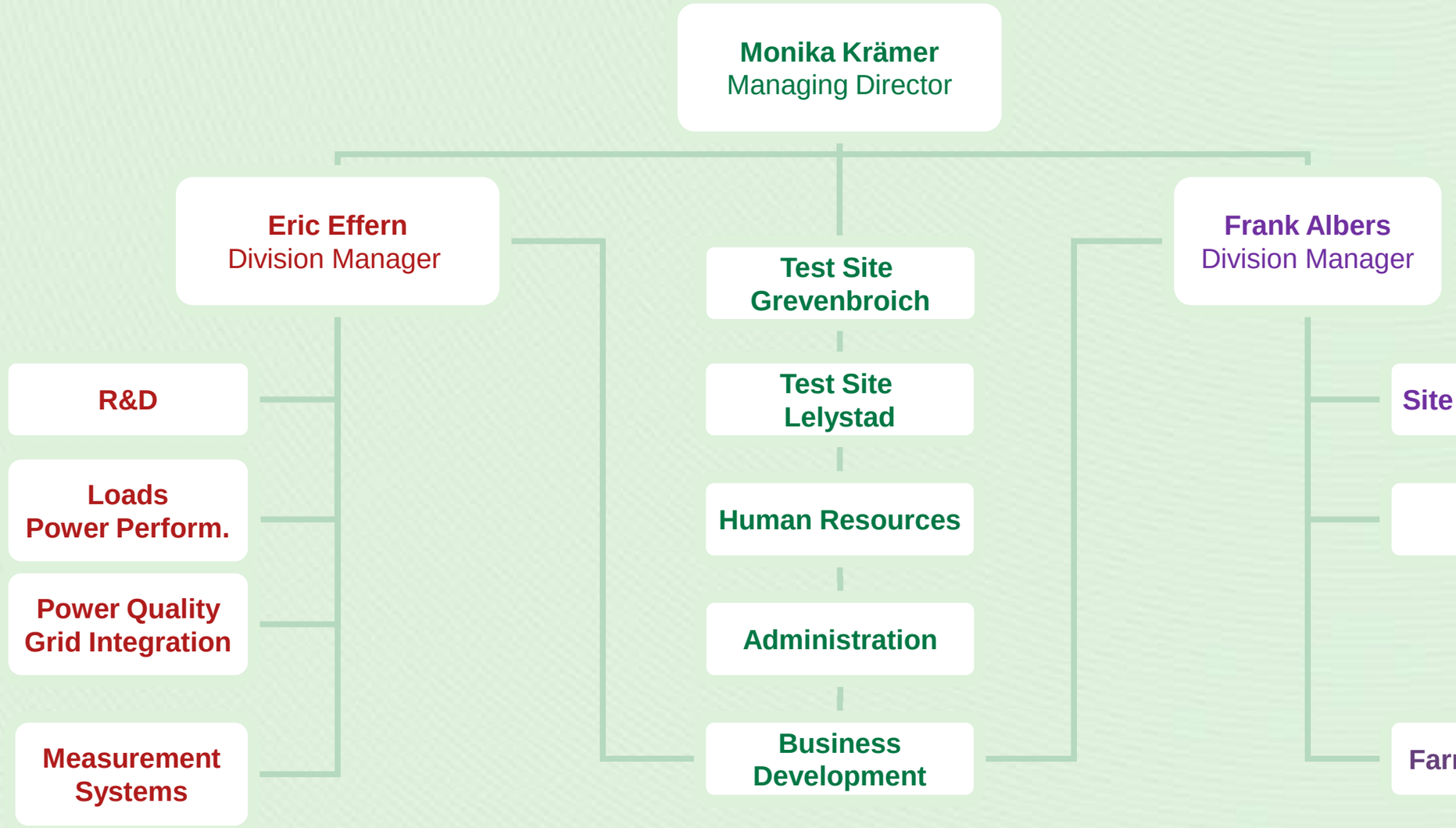
University of Applied Sciences Aachen
Campus Jülich

windtest
grevenbroich gmbh

Contents

Company Profile

Organization



History

1996: Foundation of windtest grevenbroich gmbh

1997: 4 employees, start of operation and
construction of test site infra structure

1998: Erection of the first 3 WEC:
DeWind D4, Südwind S-50, GE Wind Energy TZ-750

1999: Erection of 4th WEC: DeWind D6

2000: 10 employees, erection of 5th and 6th WEC:
GE Wind Energy 1.5sl and
Nordex N-80 (inauguration by chancellor Gerhard Schröder)

2001: Erection of 7th WEC: Vestas NM82/1650

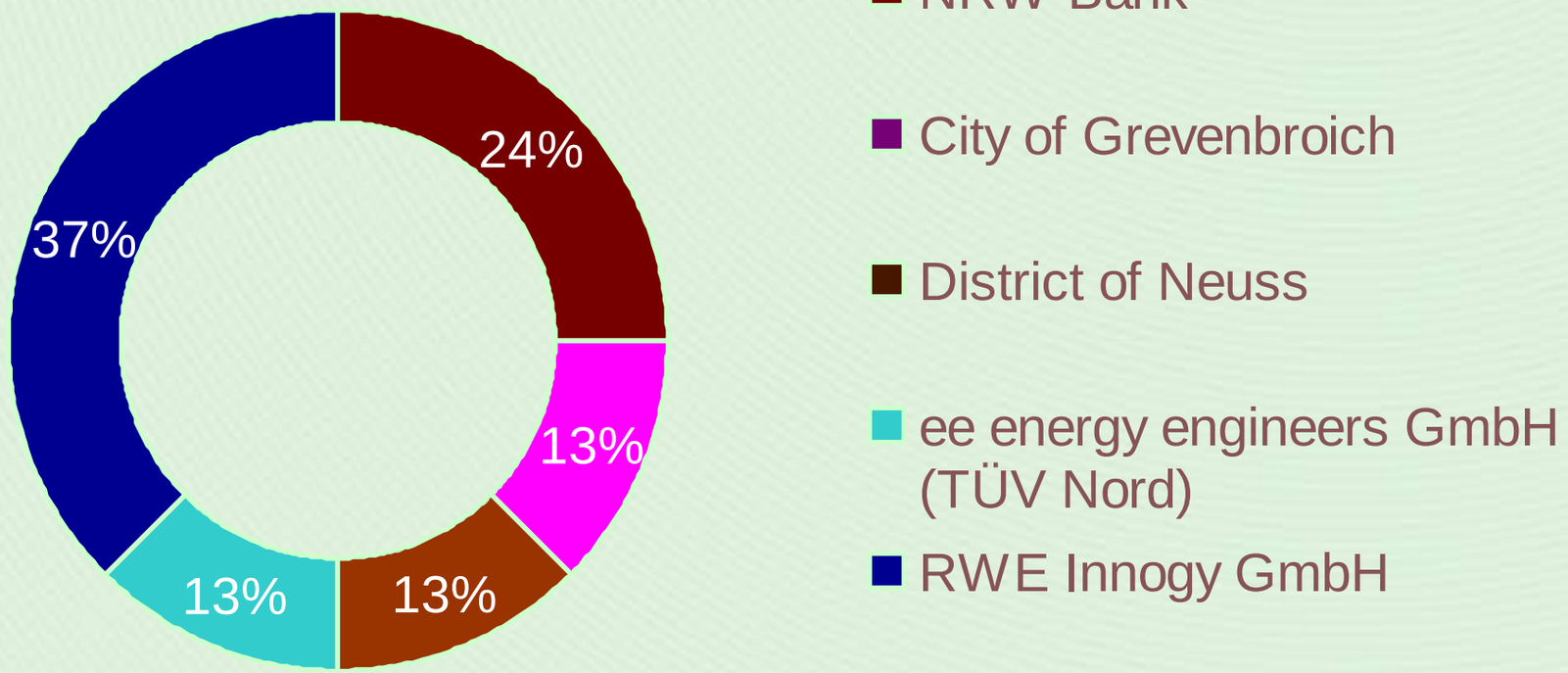
2003: 20 employees, erection of 8th WEC: REpower MM82
DAR Accredited for 15 services by IEC 17025

2004: International approach: India, Brazil, South-Korea, US, France, Poland, Greece, Turkey, Finland

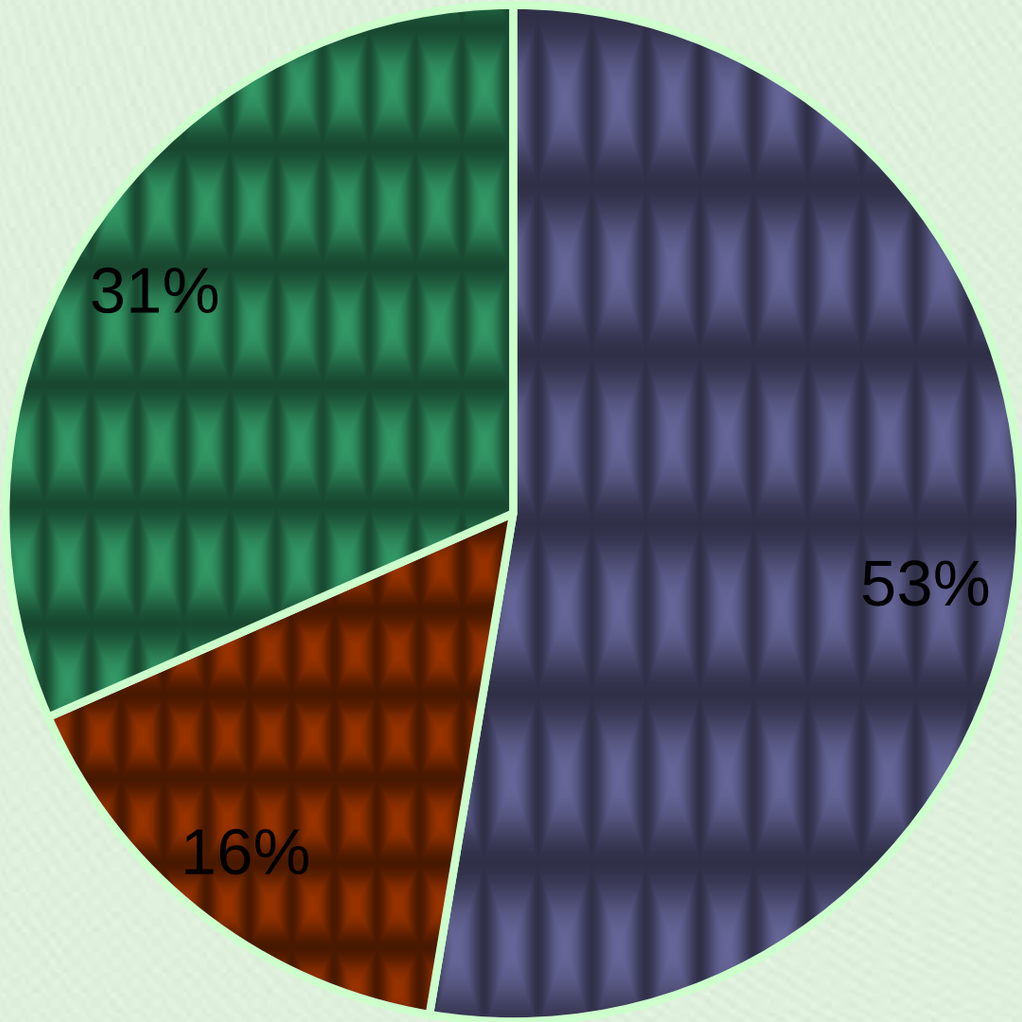
2010: 30 employees, new prototypes on test site in
Grevenbroich/Germany (Lagerwey, eviag)

2013: 40 employees, new prototypes on test site in
Grevenbroich/Germany and
Foundation of a subsidiary in the U.S. (Iowa)

Shareholders



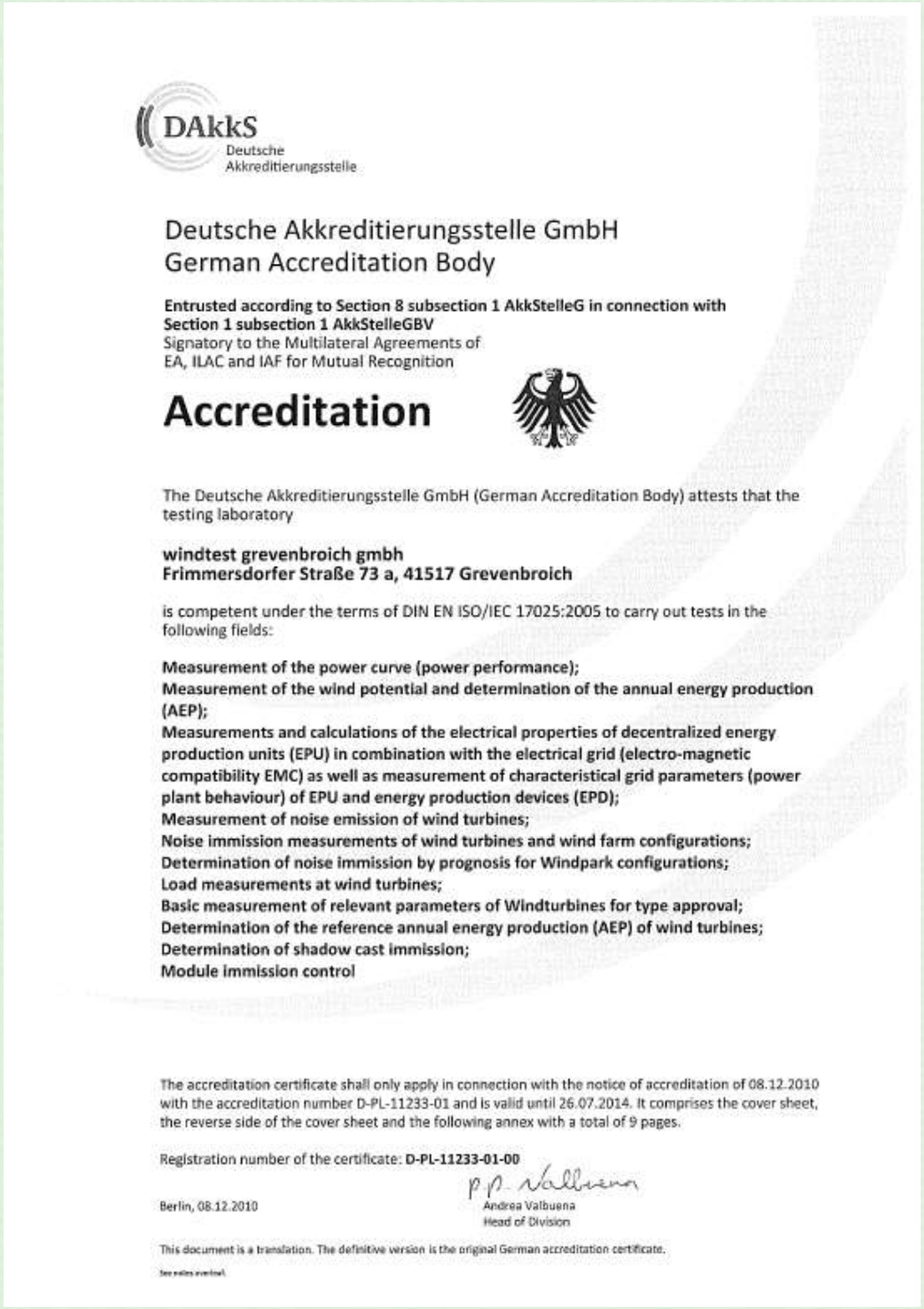
Employee Stucture (40)



- Engineers
- Scientists
- Management & Support

Accreditation

- Accredited service provider according to ISO/IEC 17025
- measurements
  expert assessments
  consulting
- Wind, PV, Combustion Engines
- Test site Grevenbroich
- Test site Lelystad, NL
  in cooperation with Ecofys



DAkkS
Deutsche
Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH
German Accreditation Body

Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV
Signatory to the Multilateral Agreements of
EA, ILAC and IAF for Mutual Recognition

Accreditation

The Deutsche Akkreditierungsstelle GmbH (German Accreditation Body) attests that the testing laboratory

windtest grevenbroich gmbh
Frimmersdorfer Straße 73 a, 41517 Grevenbroich

is competent under the terms of DIN EN ISO/IEC 17025:2005 to carry out tests in the following fields:

Measurement of the power curve (power performance);
Measurement of the wind potential and determination of the annual energy production (AEP);
Measurements and calculations of the electrical properties of decentralized energy production units (EPU) in combination with the electrical grid (electro-magnetic compatibility EMC) as well as measurement of characteristical grid parameters (power plant behaviour) of EPU and energy production devices (EPD);
Measurement of noise emission of wind turbines;
Noise immission measurements of wind turbines and wind farm configurations;
Determination of noise immission by prognosis for Windpark configurations;
Load measurements at wind turbines;
Basic measurement of relevant parameters of Windturbines for type approval;
Determination of the reference annual energy production (AEP) of wind turbines;
Determination of shadow cast immission;
Module immission control

The accreditation certificate shall only apply in connection with the notice of accreditation of 08.12.2010 with the accreditation number D-PL-11233-01 and is valid until 26.07.2014. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 9 pages.

Registration number of the certificate: **D-PL-11233-01-00**

Berlin, 08.12.2010

p.p. Valbuena
Andrea Valbuena
Head of Division

This document is a translation. The definitive version is the original German accreditation certificate.

Testing site Grevenbroich

- WEA 1 – eviag ev2.93
- WEA 2 – Vensys 77
- WEA 3 – Lagerwey L82
- WEA 4/5 – Vestas
- WEA 6 - Siemens SWT-2.3-93
- KWEA 7 – Directtech Global – Windtracker
- WEA 8 – in progress

Testing site Grevenbroich

Activities

Test sites
- large wind turbine
- small wind turbine
- projects

Test benches
- PV, CGU

Expert Networks

- Full Member and chairwoman of **MEASNET**
- Committee for standardization **FGW**
- Committee for standardization **IEC**
- Working Committee Renewable Energies / Wind energy **VGB** Powertech
- **Windgutachterbeirat** des Bundesverband Windenergie (BWE) e.V.
- Named Measuring Body for Sound Measurements according to §26 of the German Immission Control Law (***BImSchG***)
- Working committee Noise Emission
- European Technology Platform (EWEA)
- Official member of IEC committee mechanical loads
- Official member of IEC committee power quality
- Member of several working groups

Services and Products

Site Assessment

Prototyping

Engineering + Technical Consultancy

Technical Inspection

Site Assessment

Site Assessment - Services

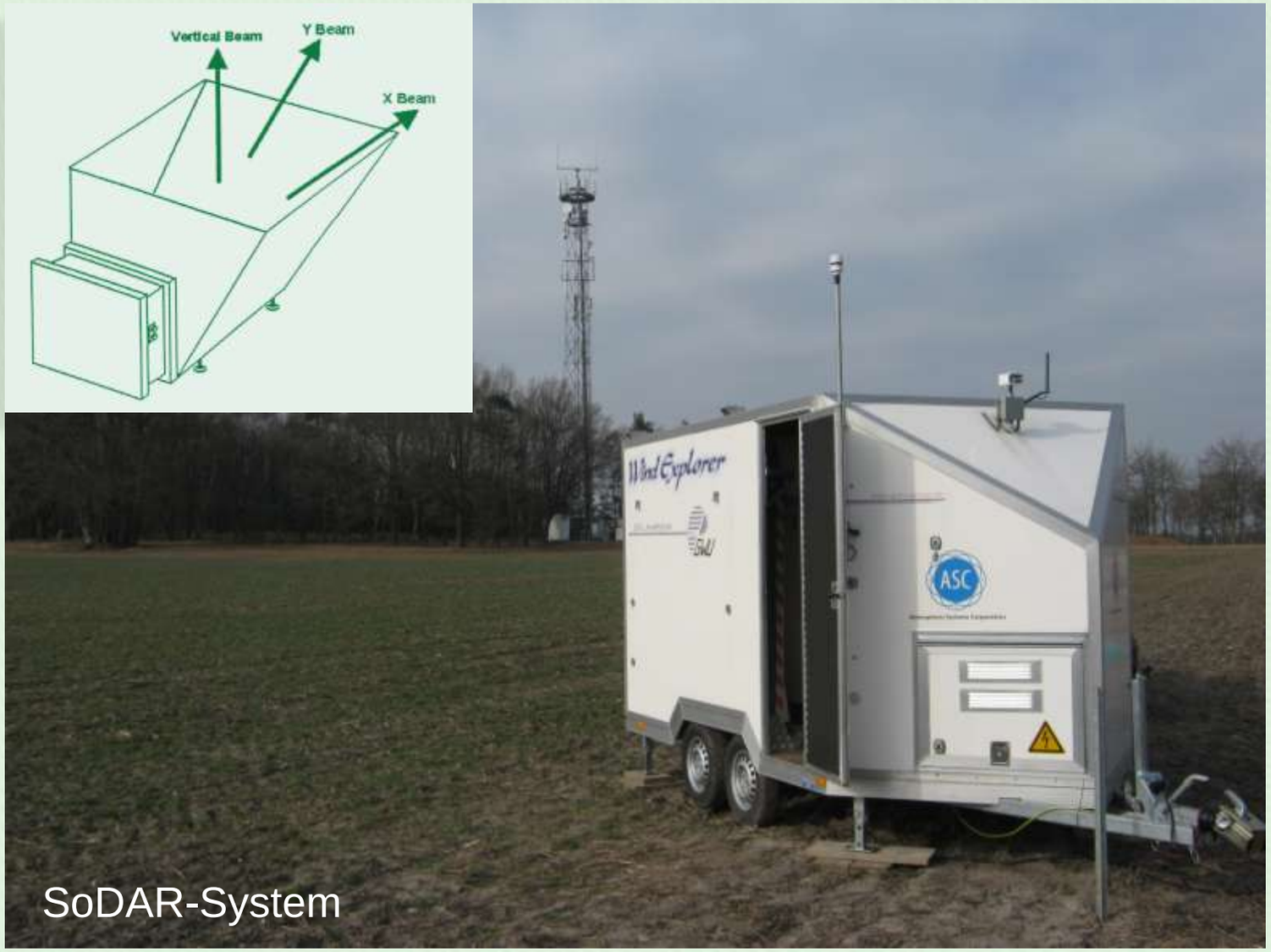
- **Wind profile measurements** with the aid of wind measuring masts and SoDAR
- **Site evaluation** and **yield report**
- Calculations of **turbulence intensity**
- Calculations of **60 % reference yield verification** (Renewable Energy Law Germany)
- **Shadow impact prognoses**
- **Sound immission prognoses**
- **Reports about your wind farm** and customized **increases in production**
- **Authority management**

- With our 100 m high **wind met mast** one can figure out numerous issues: e.g. wind velocity, wind direction, turbulence intensity, air pressure as well the air temperature and last but not least the rain intensity

Site Assessment - Competences

- **Accredited** according to **ISO 17025** for **yield reports.**
- Active member of the technical committee for wind potential of the Federation of German Wind Power (**FGW**).
- Active member of the wind expert advisory board of the German Federation for Wind Energy (**BWE**).
- Active member in the Expert Group "Site assessment **MEASNET**".
- Member in the European Wind Energy Technology Platform**, TP Wind** I.
- Active member Test Group **of O.F.Wind-CFD** prognosis tool.

Site Assessment - Measurements



SoDAR-System

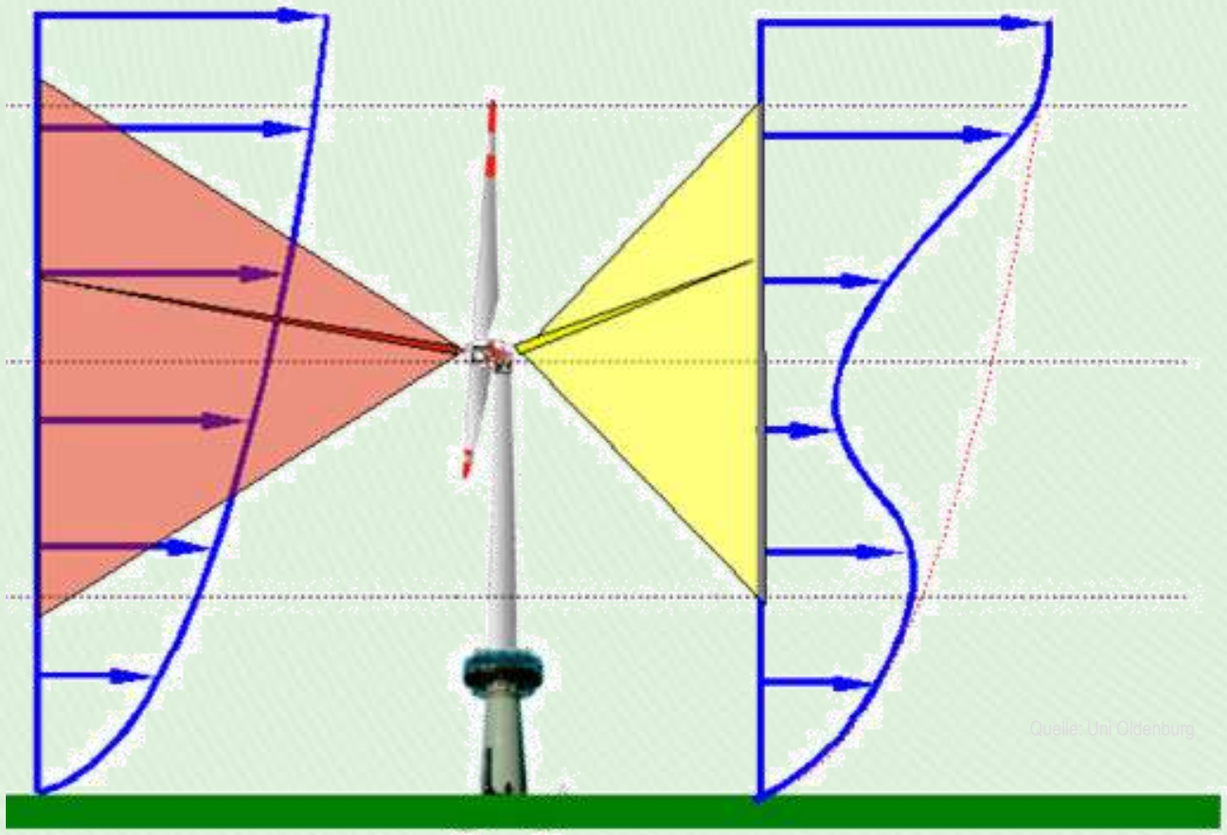
SoDAR-System

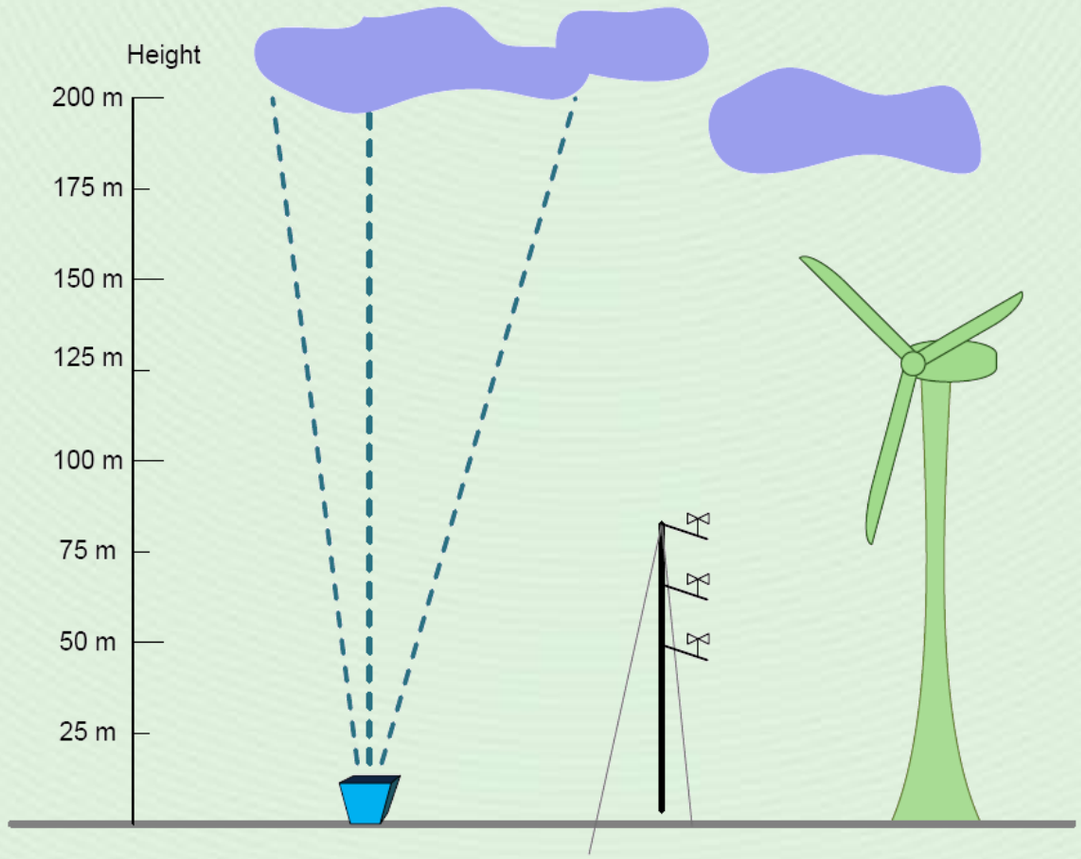
- **Sound waves** are sent out in 3 directions
- **Measuring height** of about **30 - 200 m**
- Doppler shift
- used to measure wind speed profile at various heights

LiDAR-System

- **Laser**-based (multiple BEAM)
- Reflection at aerosols leads to properties of wind velocity

Site Assessment - Measurements





Advantages of SoDAR- and. LiDAR-measurements

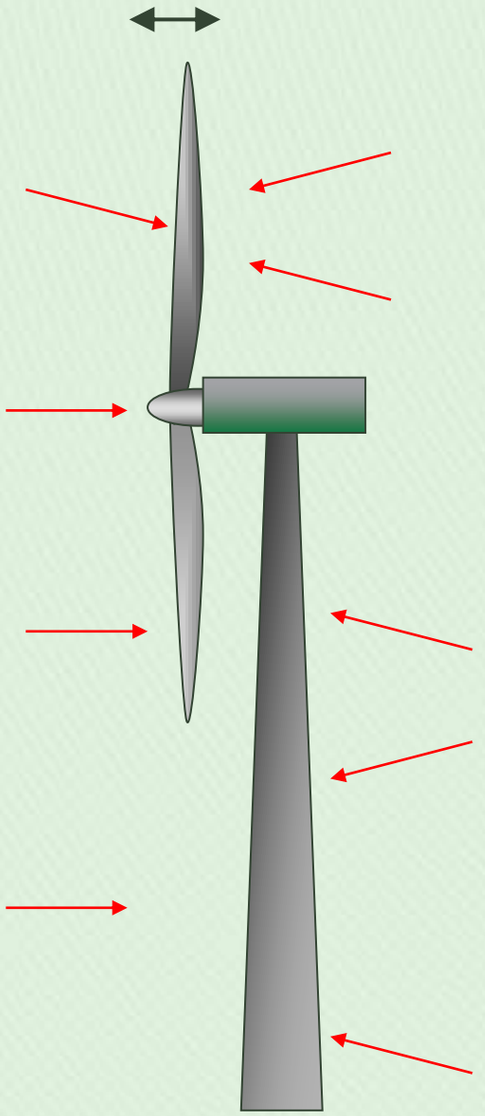
- Drops in vertical wind
  (also in wind farms→ Farm effects)
- Uncomplicated installation and transport
  (no planning permission required)
- Smaller hub heights can deliver greater energy yield (Reduction of investment costs)
- No need for an expensive met mast

Prototyping

Prototyping - services

- **Mechanical loads**
  measurements on blades, power train, tower, bolts, foundation
- **Noise emission**
  sound and vibration,
  sound emission
- **Power performance**
  measurement with wind met mast, SoDAR and/or nacelle anemometer
- **Engineering, Technical consultancy, Technical inspections**
- **Grid integration**
  Grid Code Compliance,
  Power Quality,
  Fault Ride Through (LVRT)

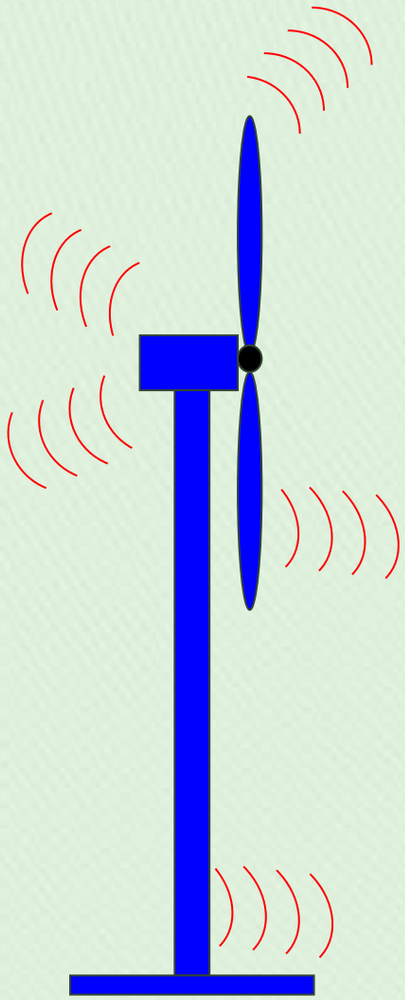
Prototyping – services
mechanical load measurement



The following measurements are performed (abstract)

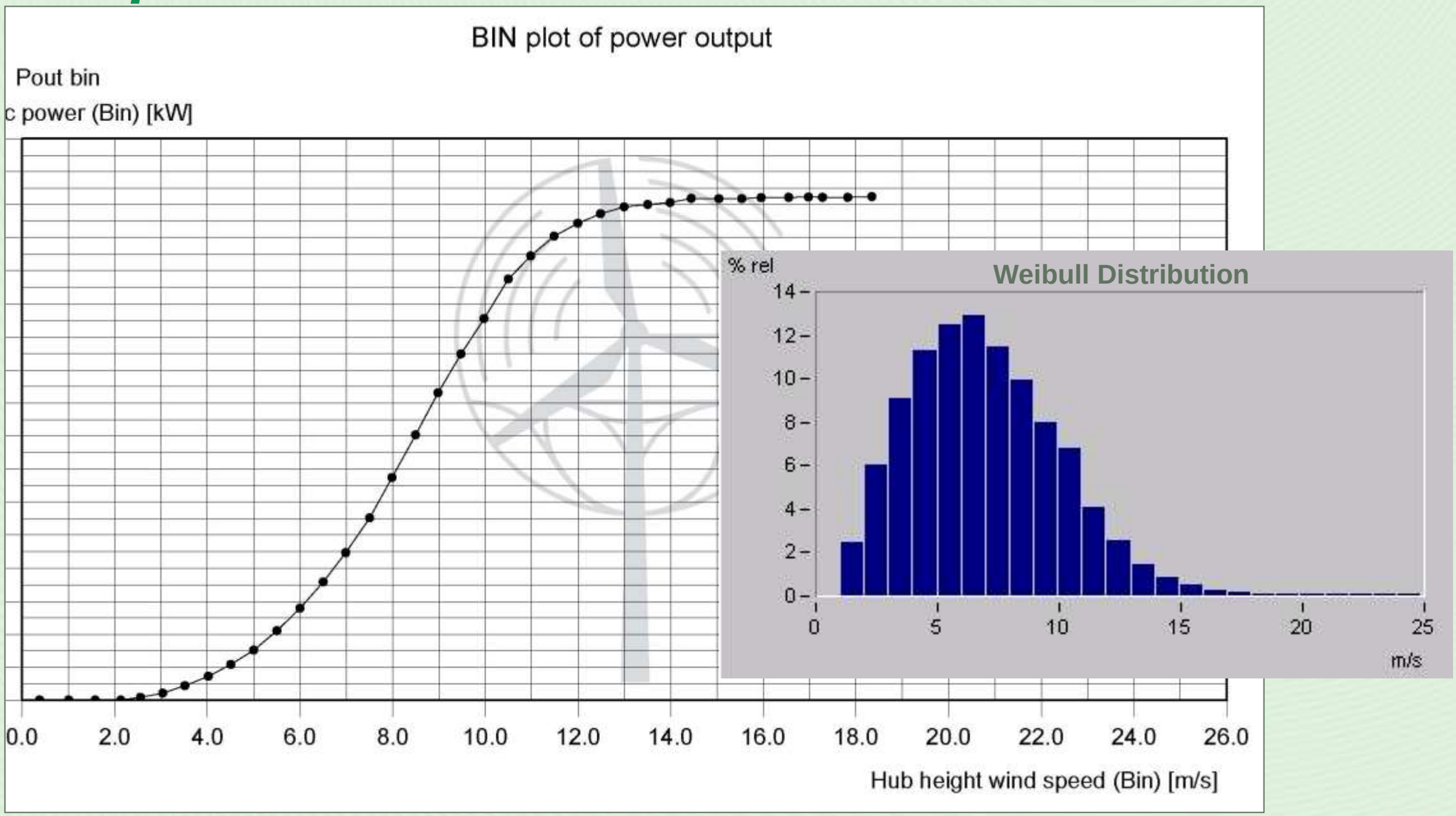
- Blades
- Drive Train
- Tower
- Foundation

Prototyping – services
noise emission



- Sources:
  blades + gearbox
  + generator + tower
- characteristics:
  sound power level
  tonality
  impulse
- goal:
  protection of residents

Prototyping – services
power performance



Prototyping – services
technical inspections

- Examples of damaged components

- **Periodical inspections**
- **Offline condition monitoring**
- **Vibration analyses**
- **Endoscopy**
- **Alignment measurements** at the drive train

- windtest grevenbroich realized **numerous technical inspections**. Our personnel are qualified to work in a **systematic handling** in „Technical Inspections“.

Prototyping – services
grid integration

The electrical characteristics are divided into four main categories:

- **Grid control capability:**

The grid operator must have the option with every PGS to control the **active and reactive power** via remote control.

- **Power quality:**

Determination of the **harmonics**, **flicker** and **switching operations** caused by the power generation unit. The results are required later for planning the PGS.

- **Grid protection:**

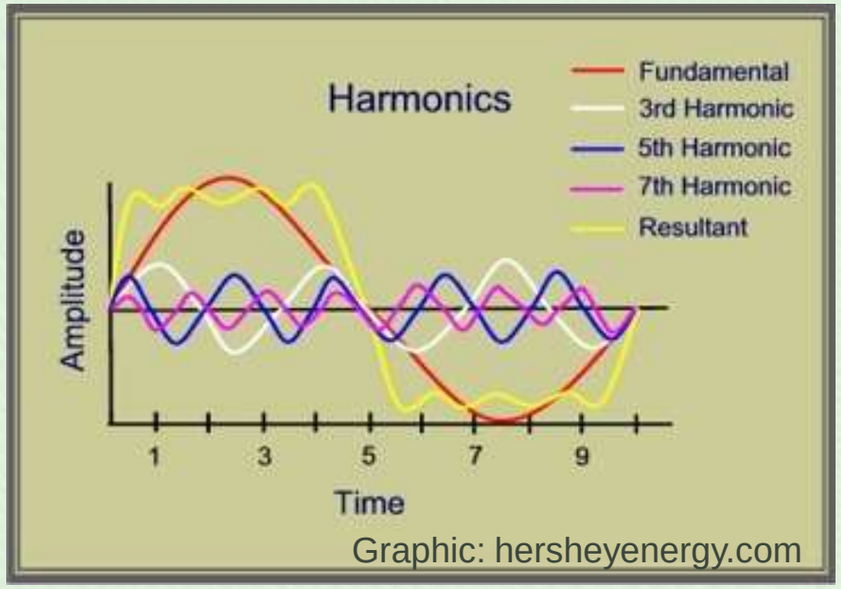
The grid protection of the PGU can be tested on a test bench or directly on site using a grid simulator. The aim here is to determine the actual limit values and times.

- **Voltage drops (LVRT):**

To check the behavior of the prototype in case of temporary **voltage drops**, caused by **short circuits**.

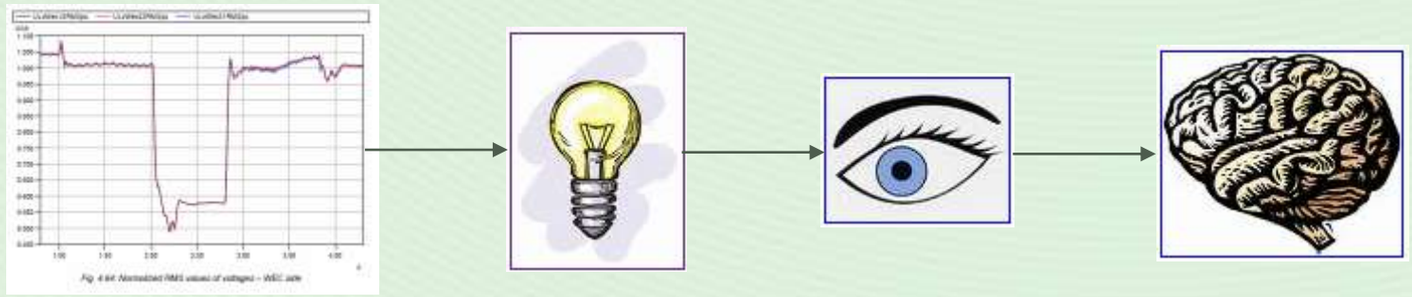
Prototyping – services
grid integration

- **Harmonics**



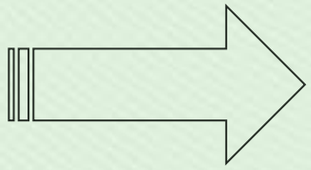
Graphic: hersheyenergy.com

- **Flicker**



Prototyping – services
grid integration

- Power Quality:
  - Stability of voltage
  - Stability of frequency
  - Harmonics, Flicker

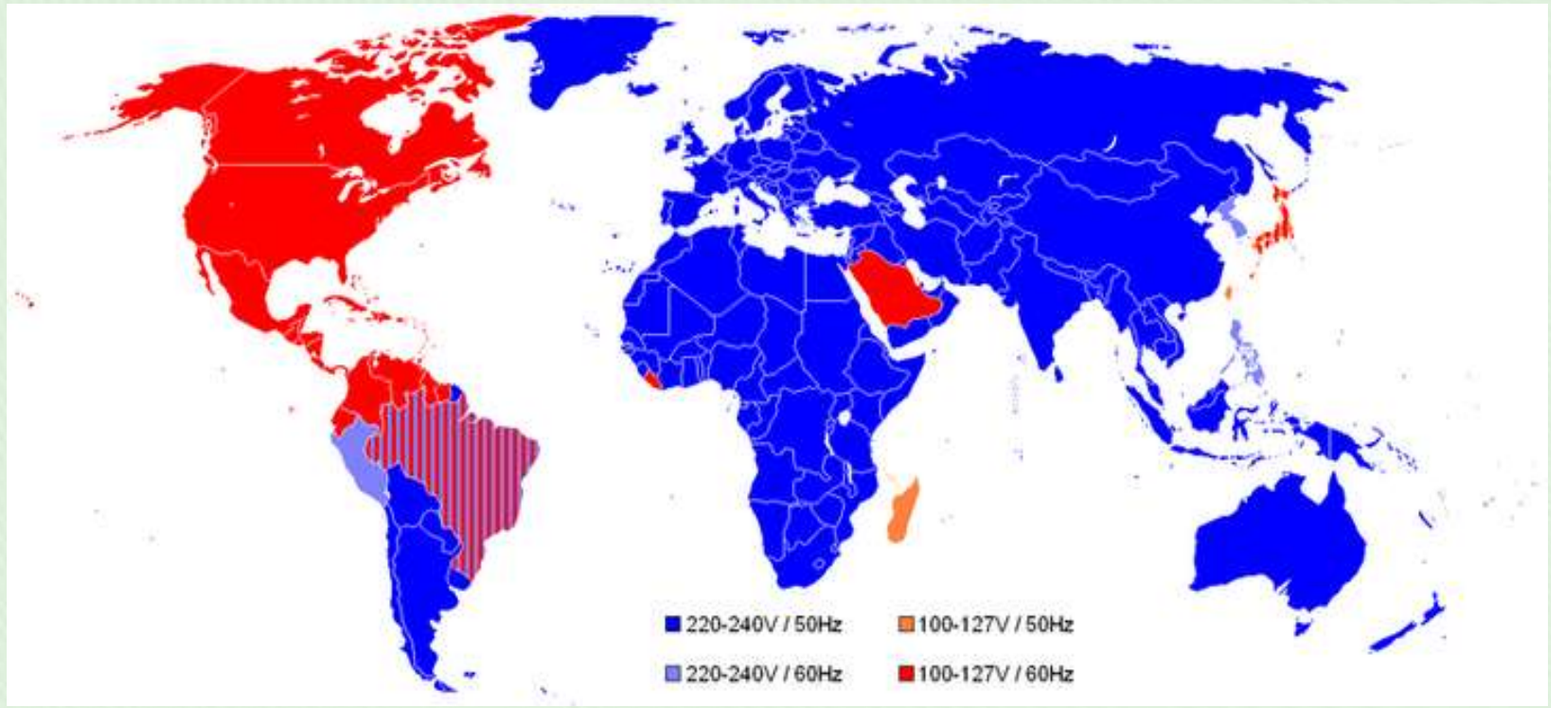


GRID CODE

- Security
  - Constant supply
  - No black outs
  - Safety

Prototyping – services
grid integration

World grid



Grafik: http://www.wikispaces.com

- China
- Japan (50/60Hz)
- USA
- South America
- ...

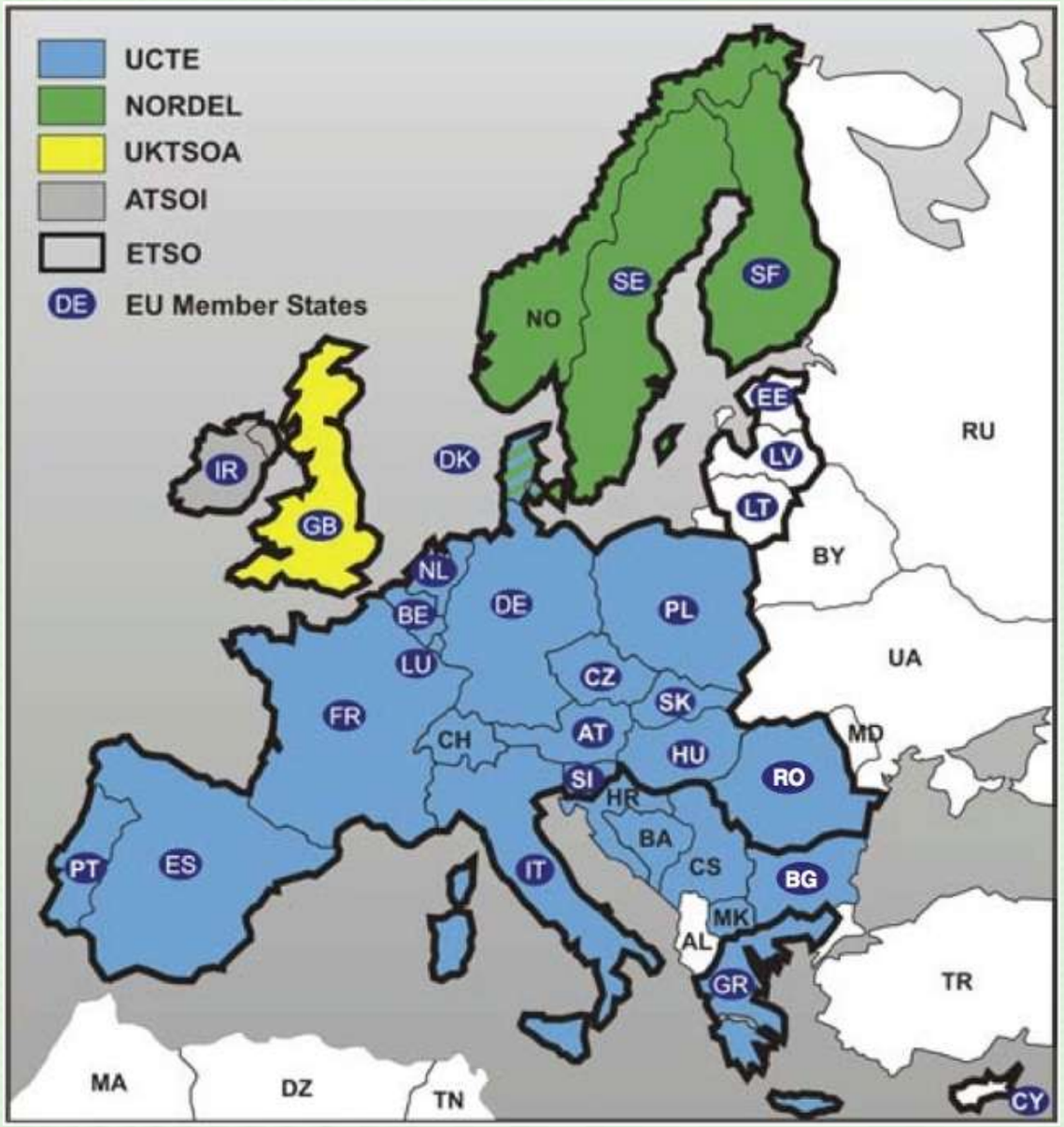
HARMONIZATION !

Prototyping – services
grid integration

European grid

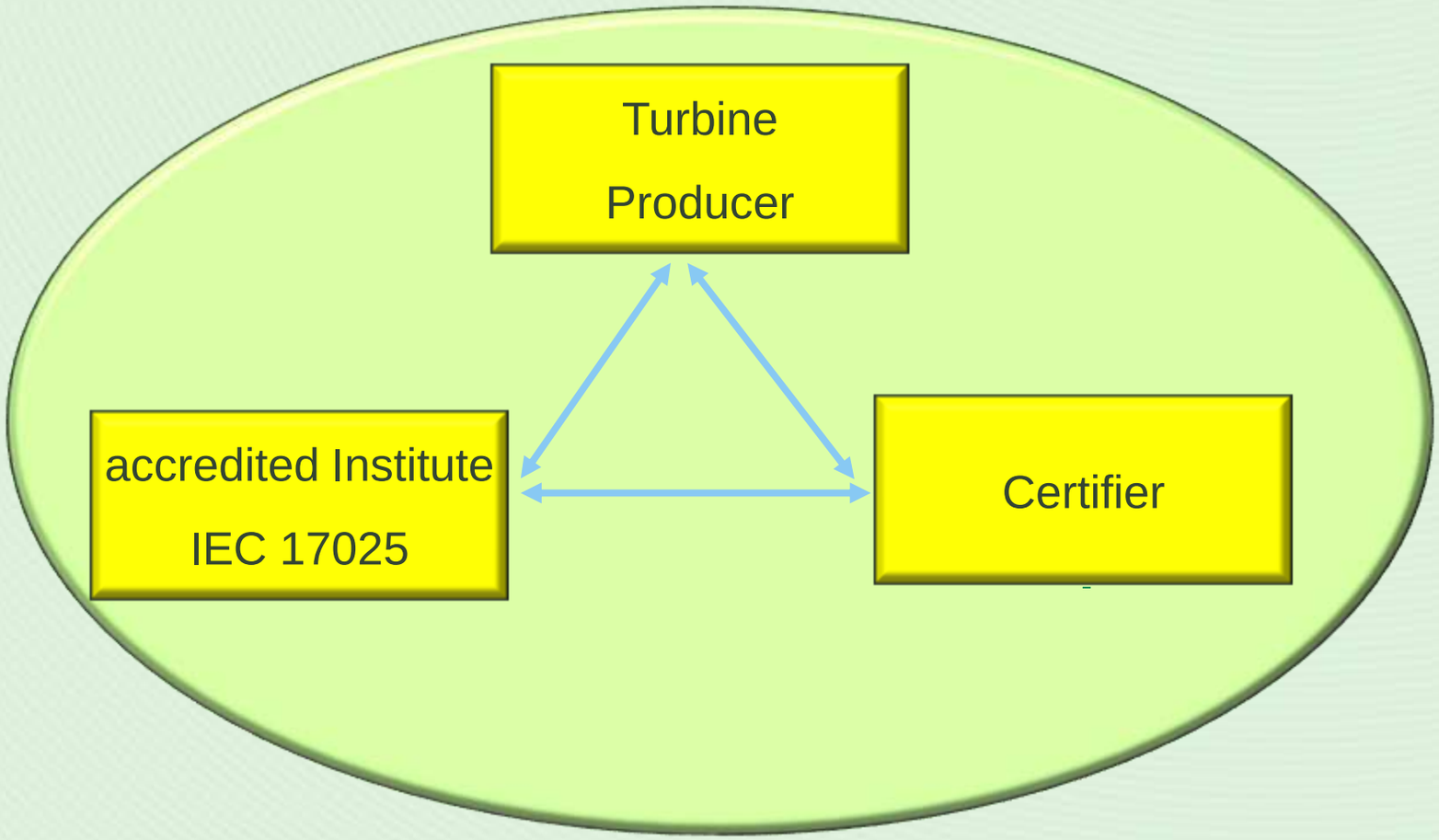
- UCTE: > 300 TWh
- Strong transmission lines required
  Flexibility for renewables

⇨ **HARMONIZED !**



Prototyping – services
grid integration

CERTIFICATION: Proof of grid code compliance



Thank you
for your kind attention!