

WINDGUARD

Certification

Verification of electrical Behavior of Energy Storage to the Grid German Transformation of NC RfG

Rainer Klosse

Düsseldorf, 16.03.2017



Deutsche WindGuard (DWG) GmbH

DWG Consulting, Varel

DWG Wind Tunnel Services, Varel

DWG Engineering, Bremerhaven

DWG Offshore, Bremerhaven

DWG Systems Berlin

WG North America, USA

WG Eastern Europe, Ukraine

**WindGuard Certification GmbH
Varel**

- business start: 2010
- number of staff members: 20
- high qualified staff (physicists, engineers, technicians) with long year experience in wind engineering and R&D
- Type certification of wind turbines
- Grid Code compliance and reliability of renewable energy systems and now a days Storage Systems

Test & Certification of Electrical Grid Connection



Test Laboratory
DIN EN ISO/IEC 17025:2005

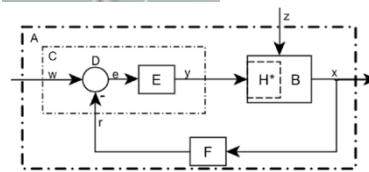
Power Plant
(Wind Farm)

Single Unit
(Wind Turbine)

Component
(Controller,
Grid Protection, etc.)



Certification Body
DIN EN ISO/IEC 17065:2013



Low-, Medium-, High- Voltage



Solar

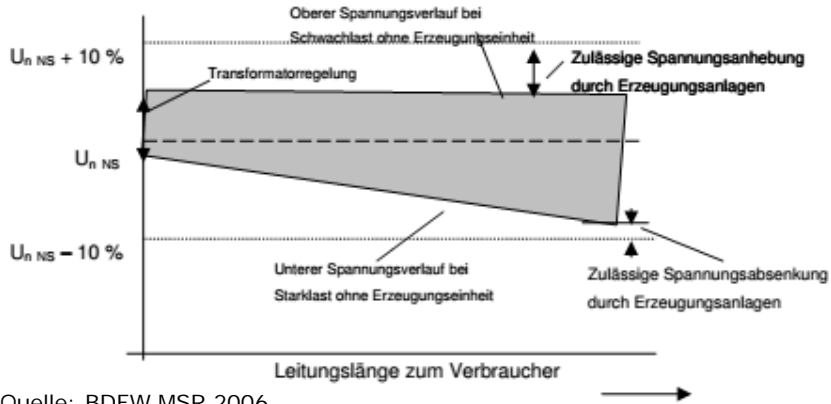
Wind

GenSet

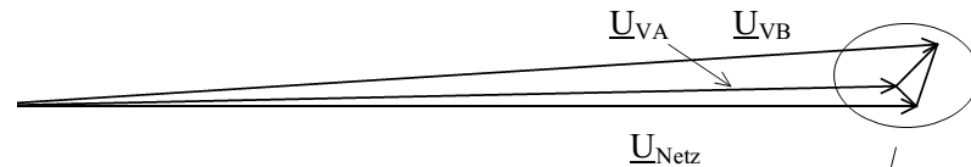


Storage

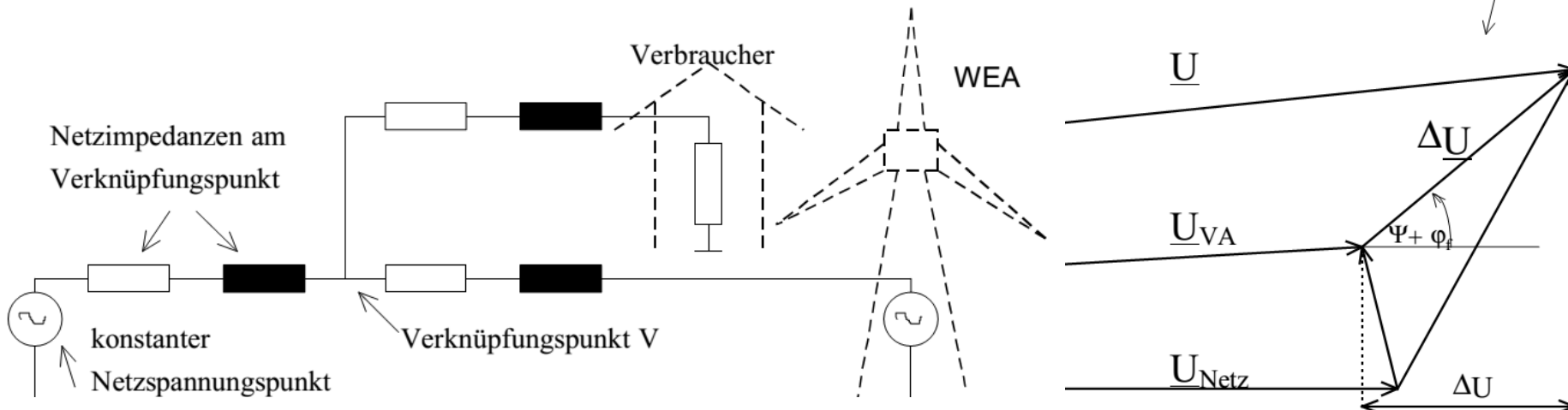
- Power Quality (Flicker, Harmonics, Switching)
- Active Power Control
- Reactive Power Capability and Control
- Fault Ride Trough (FRT)
- Grid protection



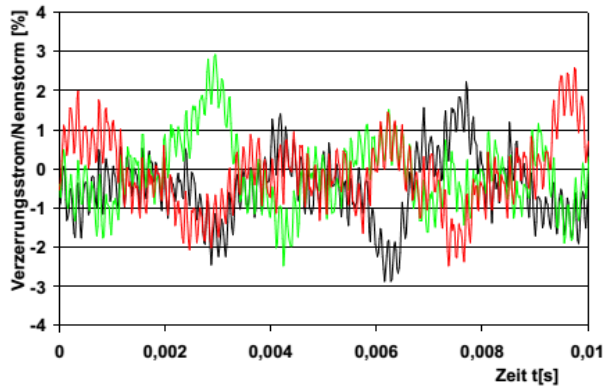
$$\Delta U = \frac{\Delta P \cdot R + \Delta Q \cdot X}{\sqrt{3} U_{\text{Netz}}}$$



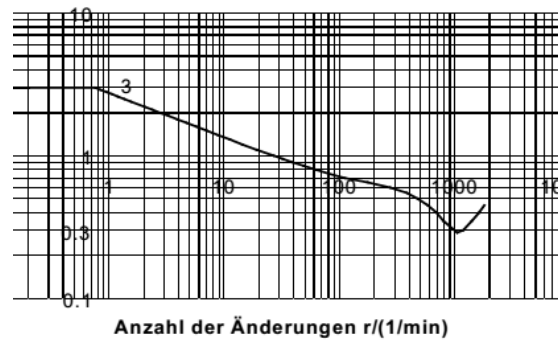
Quelle: BDEW MSR 2006



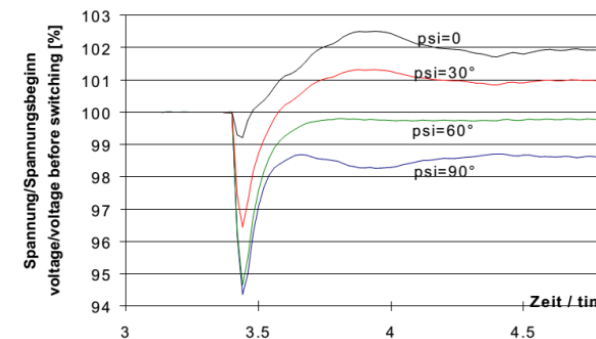
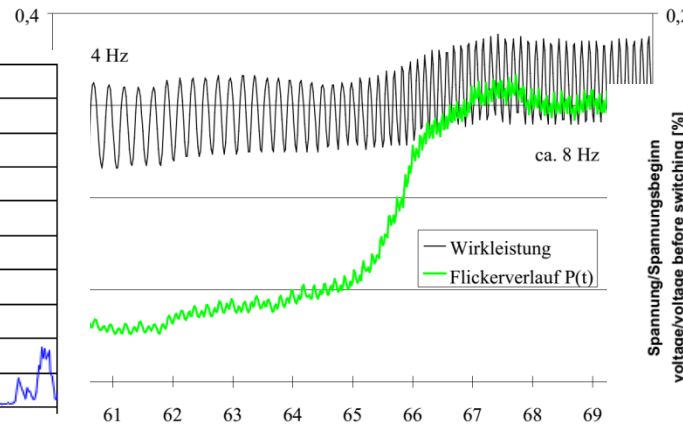
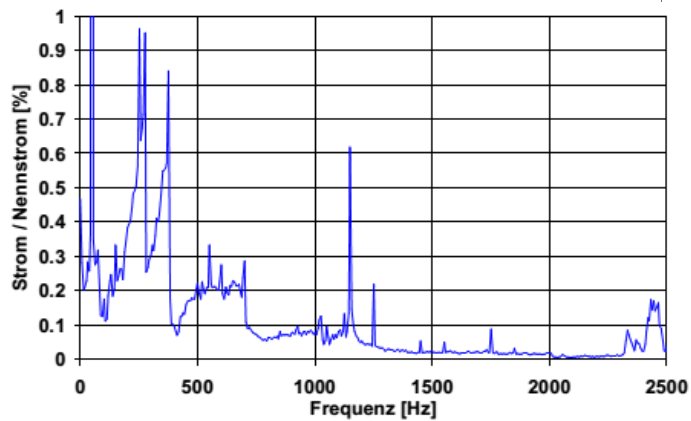
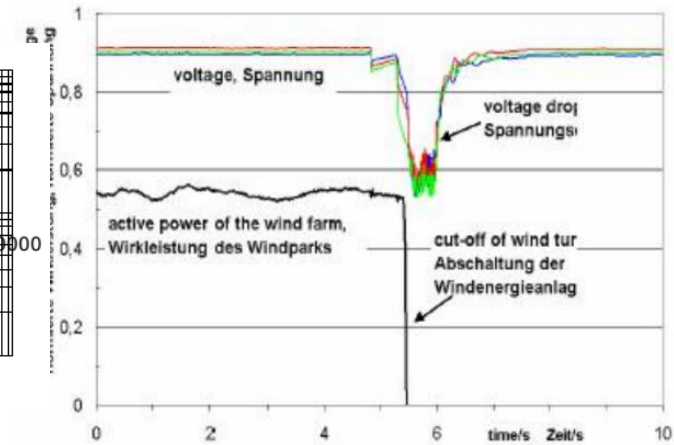
– Harmonics



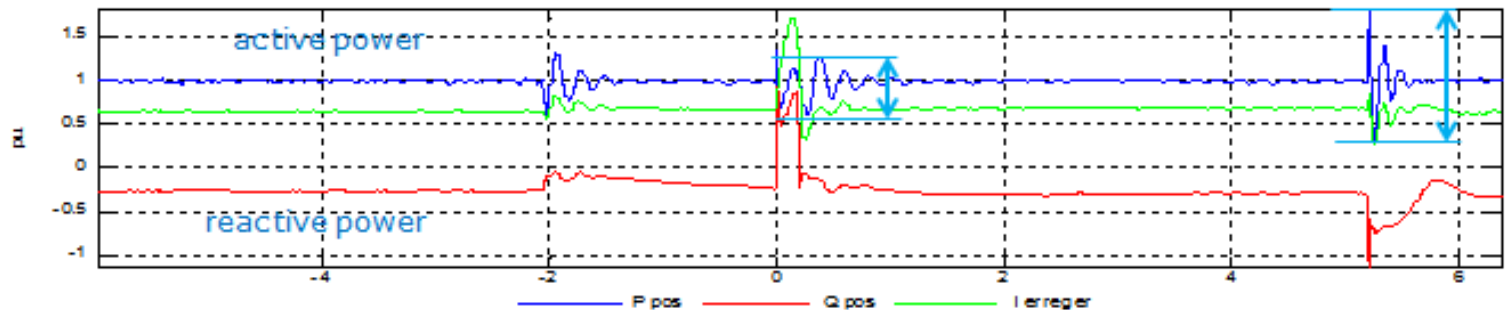
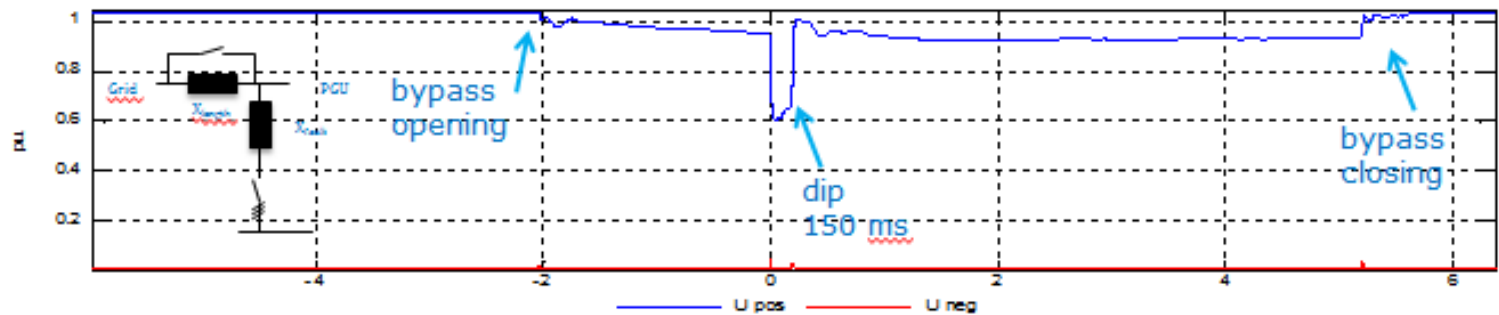
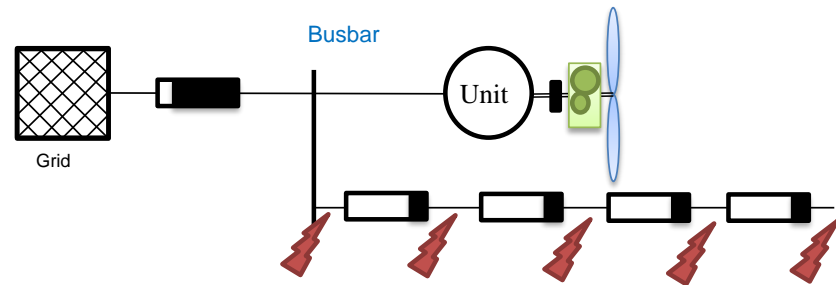
Flicker

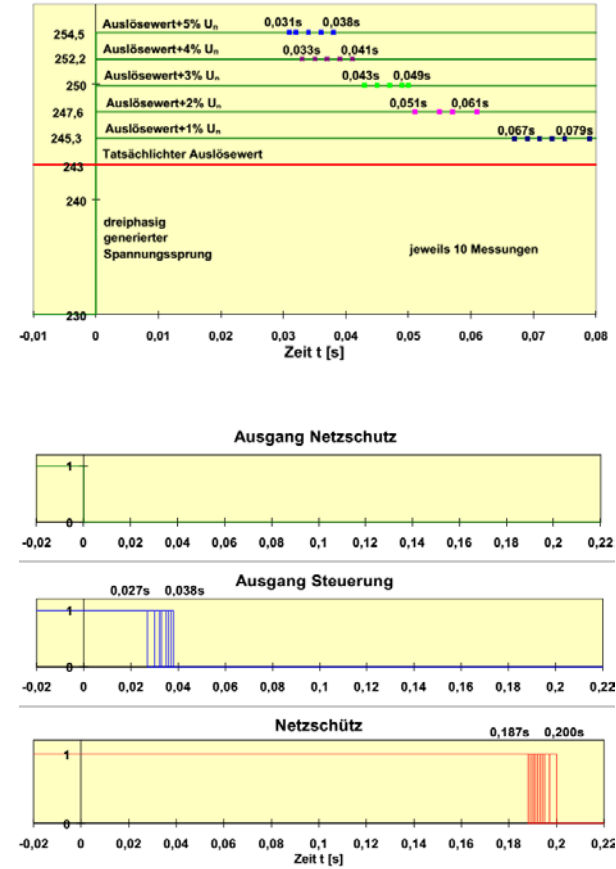
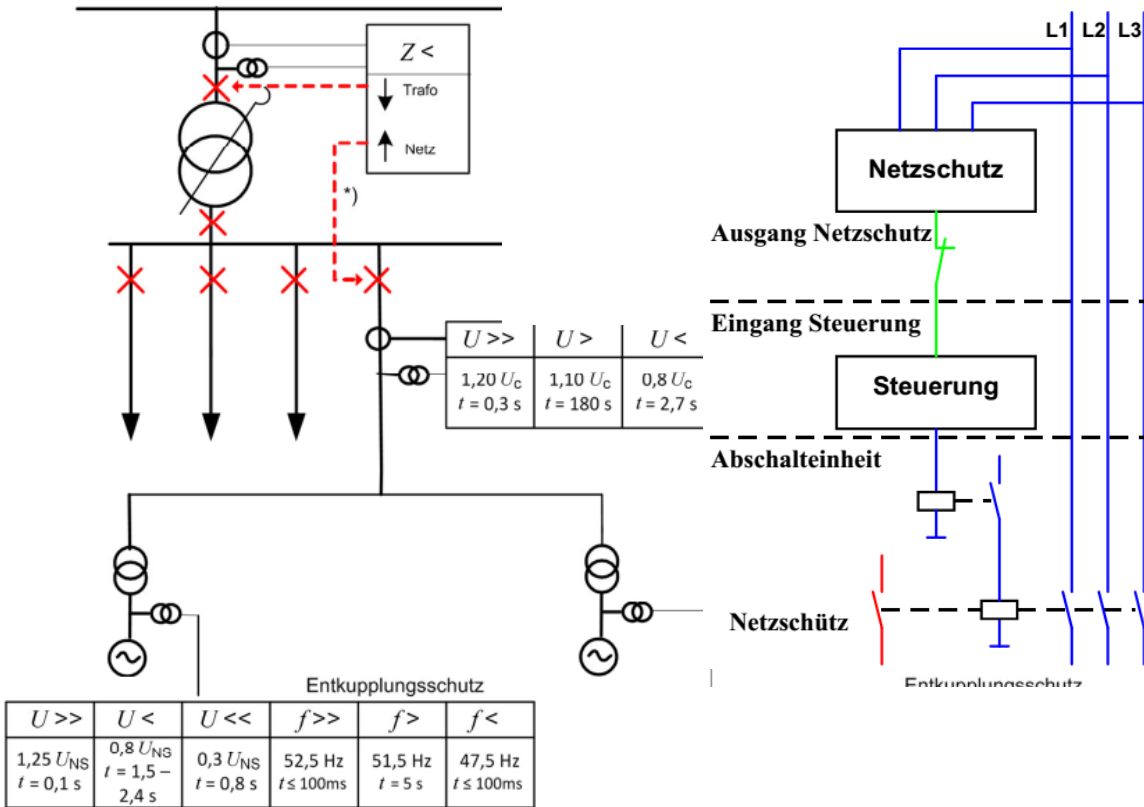


Switching



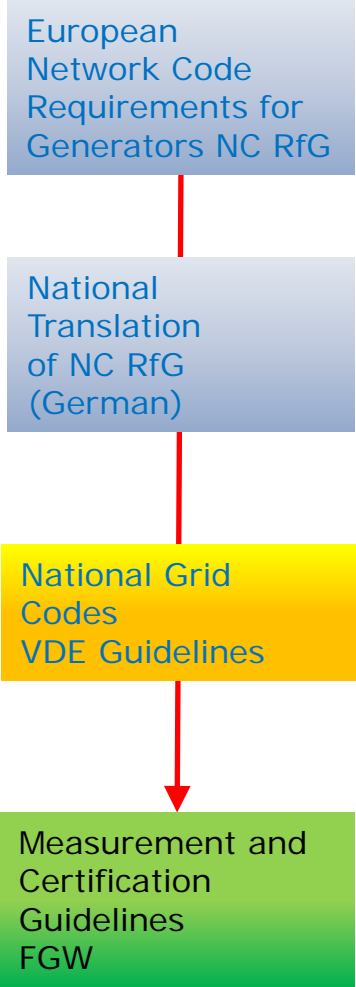
- Under Voltage
- Over Voltage
- Phase Angle Shift





- Power Quality (Flicker, Harmonics, Switching)
(not causing *but solving distortions*)
- Active Power Control (grid operator,
direct due to over frequency *and under frequency*)
- Reactive Power Capability and Control
(Voltage stability *and reactive power balance*)
- Fault Ride Trough (FRT)
(Over- & under-voltage ride trough and supporting grid)
- Grid protection
- *Fast Island Grid Detection*
cursive not part of German
grid code ride now

Transformation of European Network Code Requirements for Generators NC RfG in to German Grid Codes



27.4.2016 EN Official Journal of the European Union L 112/1

II
(Non-legislative acts)

REGULATIONS

COMMISSION REGULATION (EU) 2016/631
of 14 April 2016
establishing a network code on requirements for grid connection
(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Entwurf März 2017

| | | |
|--|----------------------|------------|
| | VDE-AR-N 4110 | VDE |
| Dies ist eine VDE-Anwendungsregel im Sinne von VDE 0222 unter gleichzeitiger Einhaltung (es in der VDE-AR-N 150 beschriebenen Verfahren. Sie ist nach der Durchführung des vom VDE-Institut beschriebenen Genehmigungsverfahrens unter der oben angeführten Nummer in das VDE-Vorschriftenwerk aufgenommen und in der seit 1.10.2016 in der "Automation" bekannt gegeben worden. | FNN | |

Vervielfältigung – auch für innerbetriebliche Zwecke – nicht gestattet.
ICS 29.240.01 Einsprüche bis 2017-04-1

Entwurf

Technische Regeln für den Anschluss von Kundenanlagen an das Mittelspannungsnetz und deren Betrieb (TAR Mittelspannung)
Technical requirements for the connection and operation of customer installations to the medium voltage network (TAR medium voltage)
Exigences techniques pour la connexion et l'opération des installations des clients au réseau moyenne tension (TAR moyenne tension)

Revisions 24
Stand 01.03.2016

27.4.2016 DE Amtsblatt der Europäischen Union L 112/1

II
(Rechtsakte ohne Gesetzescharakter)

VERORDNUNGEN

VERORDNUNG (EU) 2016/631 DER KOMMISSION
vom 14. April 2016
zur Festlegung eines Netzkodex mit Netzanschlussbestimmungen für Stromerzeuger
(Text von Bedeutung für den EWR)

DIE EUROPÄISCHE KOMMISSION –

Entwurf März 2017

Technische Richtlinien für Erzeugungseinheiten und -anlagen

TEIL 3 (TR3)

Bestimmung der elektrischen Eigenschaften von Erzeugungseinheiten und -anlagen am Mittel-, Hoch- und Höchstspannungsnetz

Revisions 08
Stand 01.03.2016

Technische Richtlinien für Erzeugungseinheiten und -anlagen

TEIL 4 (TR 4)

Anforderungen an Modellierung und Validierung von Simulationsmodellen der elektrischen Eigenschaften von Erzeugungseinheiten und -anlagen

Revisions 08
Stand 01.03.2016

Technische Richtlinien für Erzeugungseinheiten und -anlagen

TEIL 8 (TR 8)

Zertifizierung der elektrischen Eigenschaften von Erzeugungseinheiten und -anlagen am Nieder-, Mittel-, Hoch- und Höchstspannungsnetz

Revisions 08
Stand 01.12.2016

Transformation of European Network Code Requirements for Generators NC RfG in to German Grid Codes

Extra High Voltage EHV >110 kV



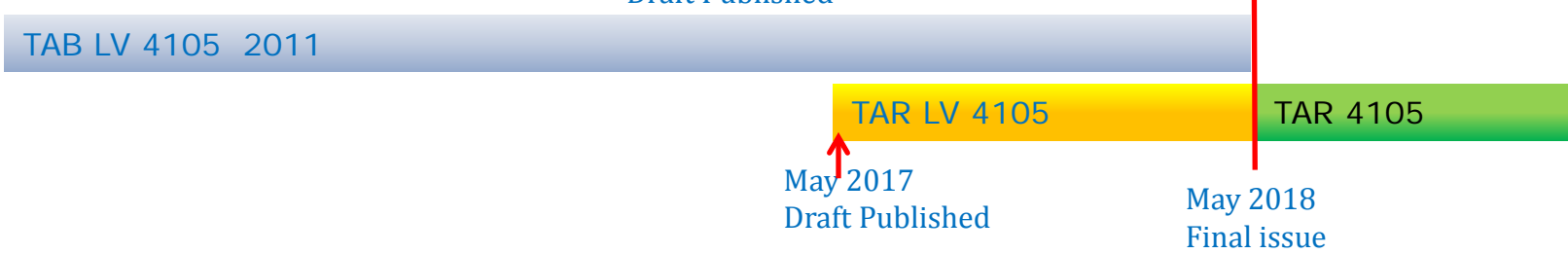
High Voltage HV =110 kV



Medium Voltage > 1kV and ≤ 60 kV



Low Voltage <1kV



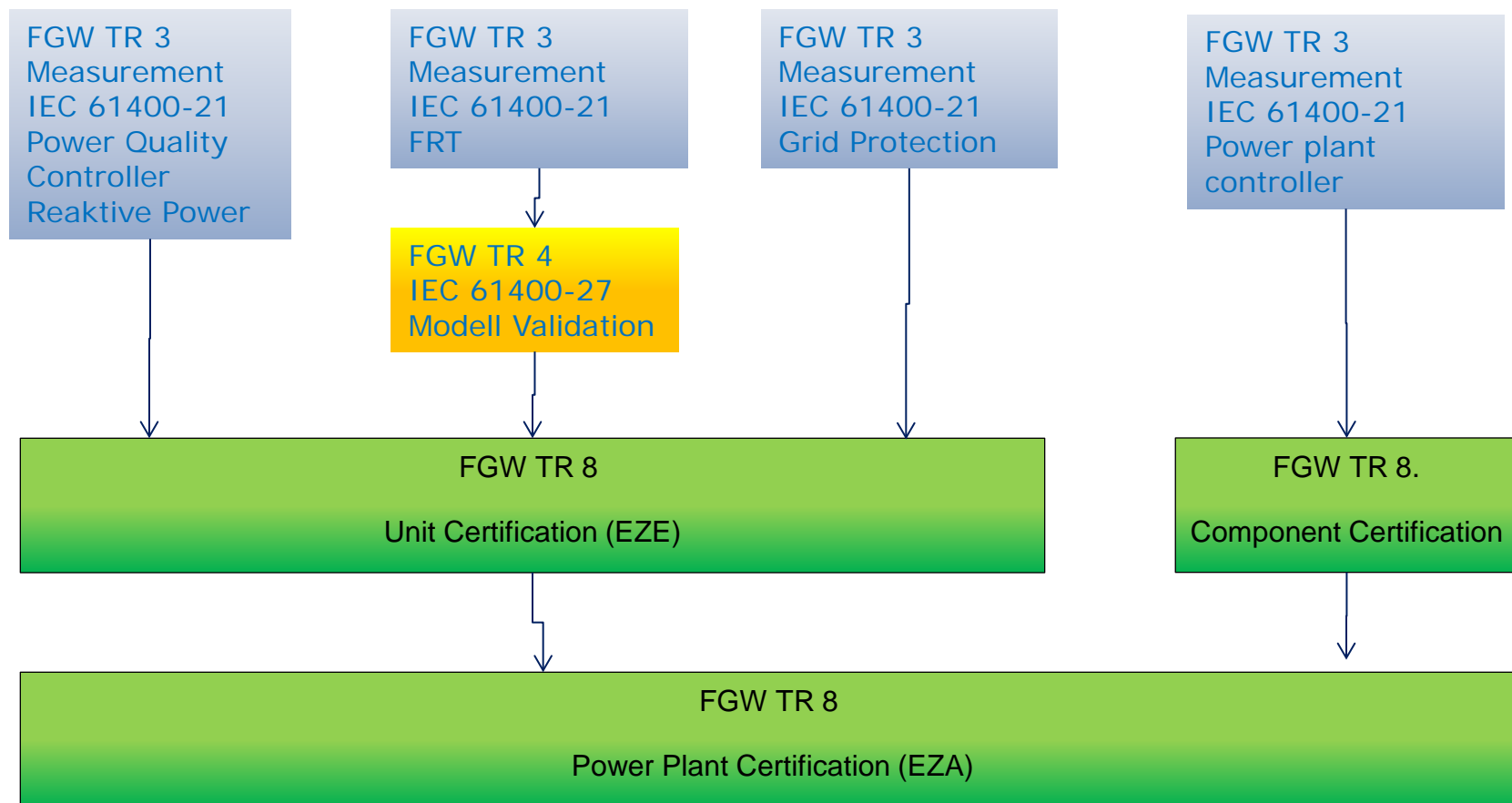
April 2017
Draft Published

Feb 2017
Draft Published

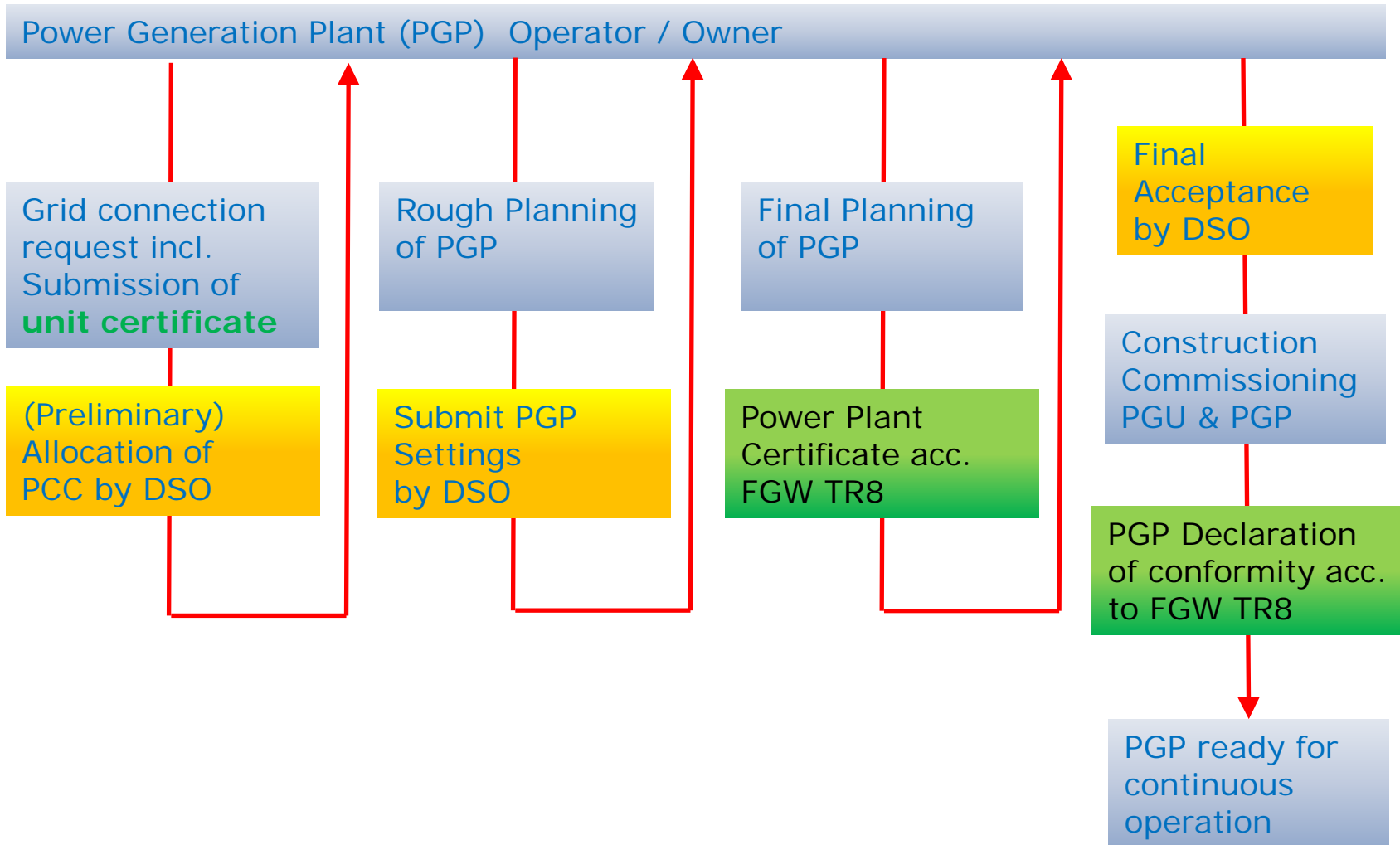
May 2017
Draft Published

May 2018
Final issue

Validation-Process of Grid Compliance According FGW Technical Rules (TR) >1kV



FGW → Society for the Promotion of Wind Energy



Why is plant certification necessary?

New Wind and Solar Power Plant in 2013
for which no further requests for documents were required

| | Power | | LVRT | | reactive Power limiting | | grid protection | | power quality | | together | |
|-------------------------|--------------|------------|----------------|------------|----------------------------|------------|-----------------|------------|----------------|------------|---------------|--|
| | | Anteil | in MW | Anteil | in MW | Anteil | in MW | Anteil | in MW | mt | in MW | |
| Zertifizierungsstelle 1 | 300 | 90% | 270,00 | 60% | 180,00 | 10% | 30,00 | 90% | 270,00 | 10% | 30,00 | |
| Zertifizierungsstelle 2 | 582 | 70% | 407,40 | 15% | 87,30 | 80% | 465,60 | 80% | 465,60 | 15% | 87,30 | |
| Zertifizierungsstelle 3 | 120 | 25% | 30,00 | 4% | 4,80 | 10% | 12,00 | 65% | 78,00 | 4% | 4,80 | |
| Zertifizierungsstelle 4 | 1.420 | 75% | 1065,00 | 70% | 994,00 | 54% | 766,80 | 76% | 1079,20 | 22% | 312,40 | |
| Zertifizierungsstelle 5 | 280 | 45% | 126,00 | 35% | 98,00 | 38% | 106,40 | 90% | 252,00 | 25% | 70,00 | |
| Ergebnis | 2.702 | 70% | 1898,40 | 50% | 1364,10 | 51% | 1380,80 | 79% | 2144,80 | 19% | 504,50 | |

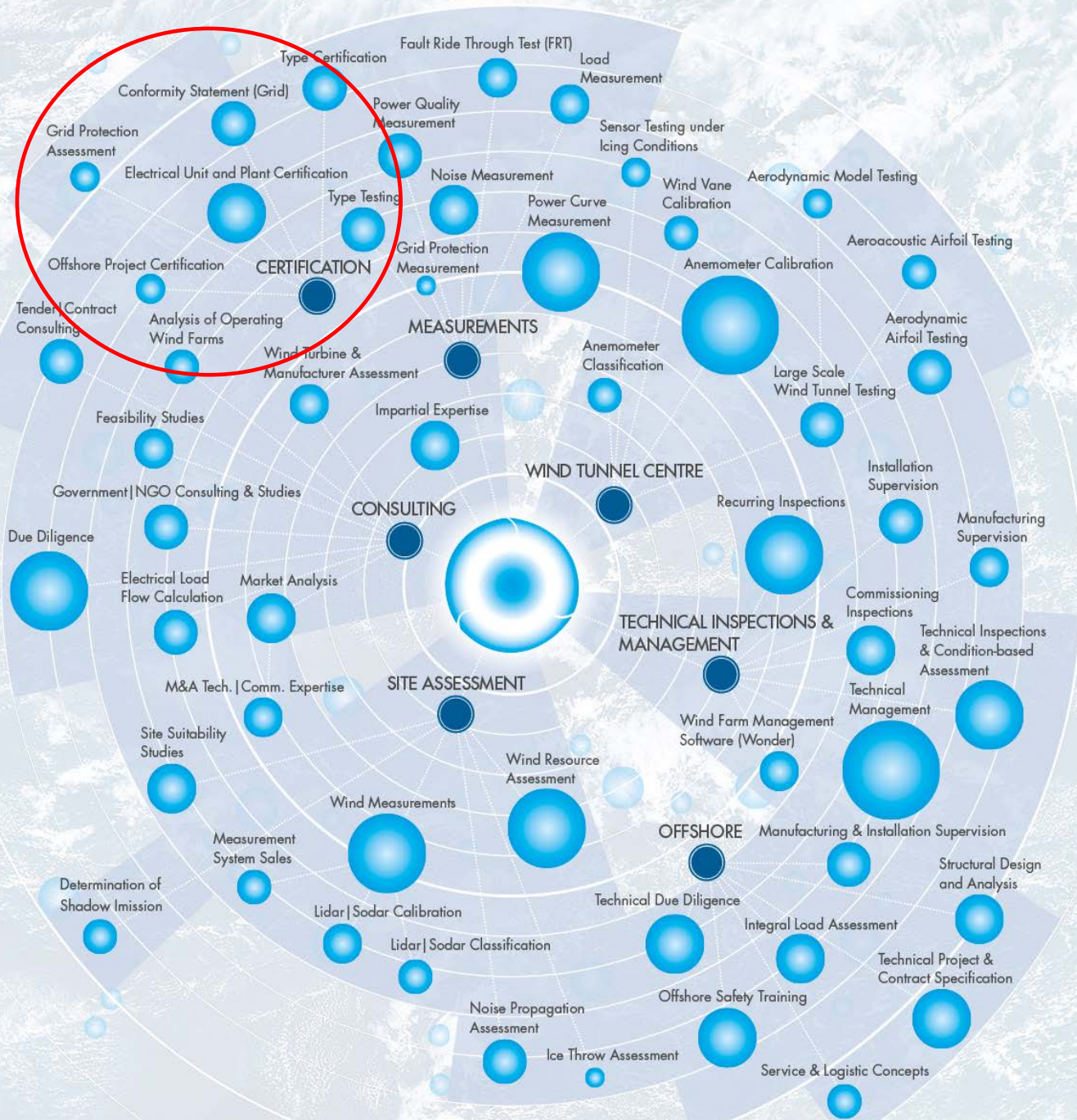
- Certification bodies have a high level of experience.
- According NELEV all PGP needs to verify there probability to support and stabilize the grid.
- NELEV:
Directive to proof the electrical behavior of power generation plant

Verordnung zum Nachweis von elektrotechnischen Eigenschaften von Energieanlagen

government requirement



DEUTSCHE WINDGUARD



Where science teams with experience:
WindGuard Universe.
Ever-expanding.

ONSHORE.
OFFSHORE.
WORLDWIDE.

Thank you very much



Unit Certificate

- 10 Family Unit- Certificate (98 Single types) TR8
 - 1 Family Unit- Certificate (8 Single types) CEI 0-16
 - 1 Component- Certificate (Grid protection)
 - 3 Unit-Certifications in process
-
- 1 Unit unique EZE \geq 10 MW

Power Plant Certificate

| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016-10 | Summe |
|--------------------------------------|------|------|------|------|------|------|---------|-------|
| Plant Certificate | 9 | 29 | 47 | 51 | 47 | 36 | 19 | 238 |
| Active Power in MW | 125 | 194 | 310 | 276 | 203 | 306 | 219 | 1632 |
| Solar | -- | 2 | 33 | 34 | 23 | 12 | 6 | 110 |
| Wind | 9 | 27 | 14 | 17 | 24 | 24 | 12 | 124 |
| Combined Power and Heat | -- | -- | -- | -- | -- | -- | 1 | 1 |
| Conformity check after commissioning | -- | 25 | 29 | 21 | 16 | 32 | 23 | 143 |



Association and Committee Work

Society for the Promotion of Wind Energy (FGW)

- FGW Technical Rules TR3, TR4, TR8

Subworkshops

- Certification Bodies
- LVRT
- Mixed Network (Wind, Solar, Fuel ..)
- Fuel Machines, Photovoltaic, Harmonics

German Wind Energy Association

- Workshop Grid