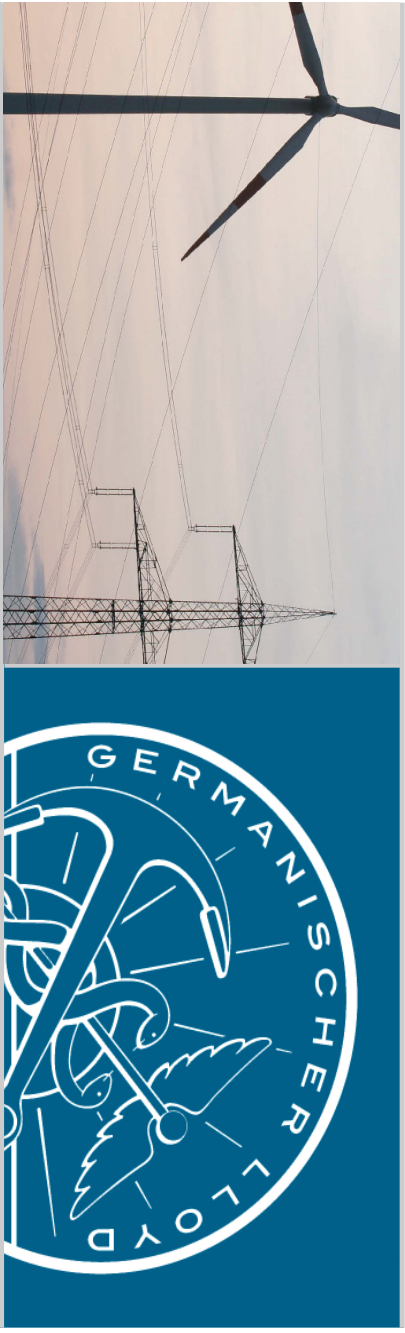


Certification of Grid Code Compliance

Tobias Gehhaar, Christian Nath Germanischer Lloyd Industrial Services

11.10.2007



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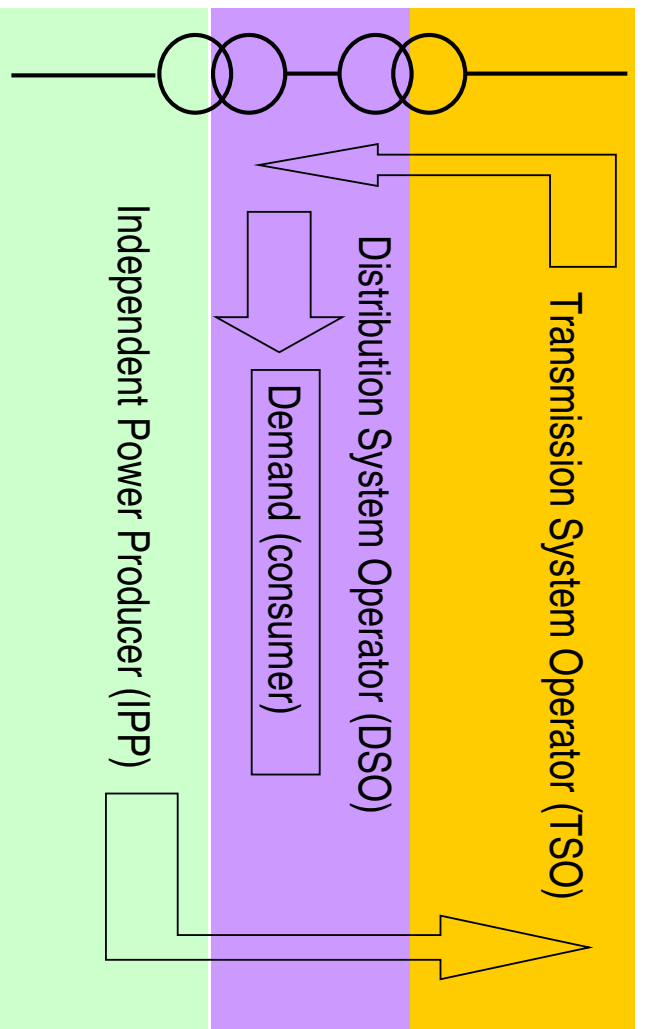
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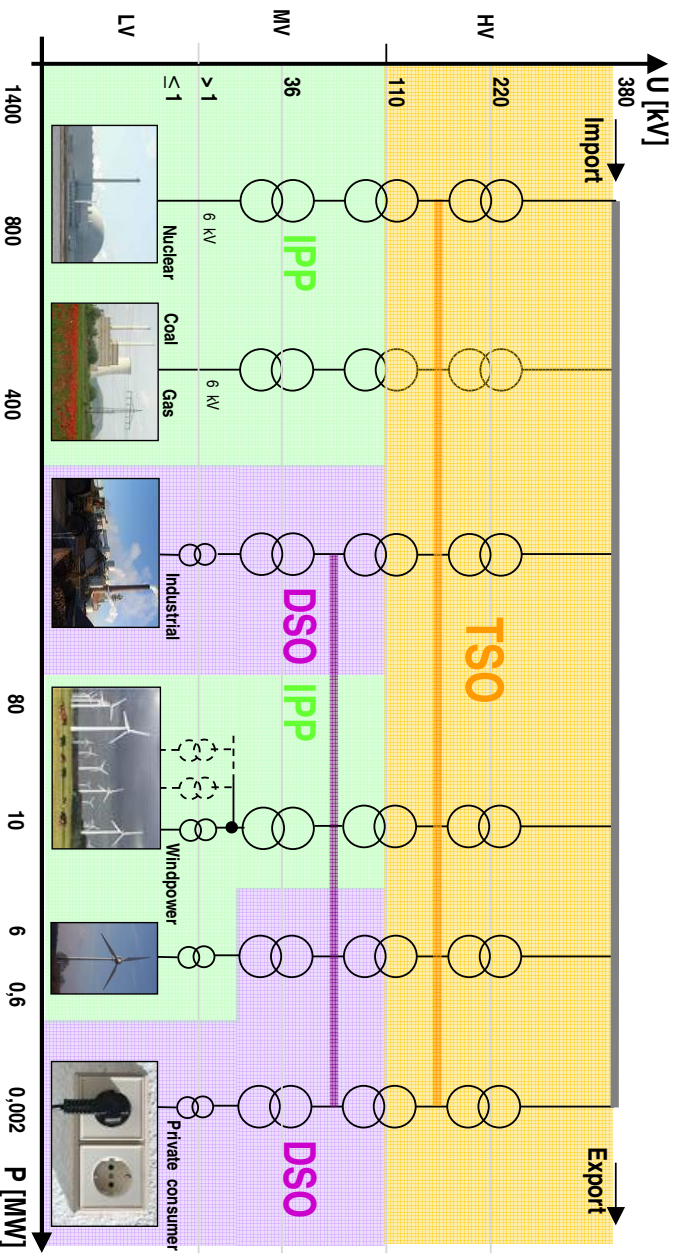


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Introduction



Power Ranges



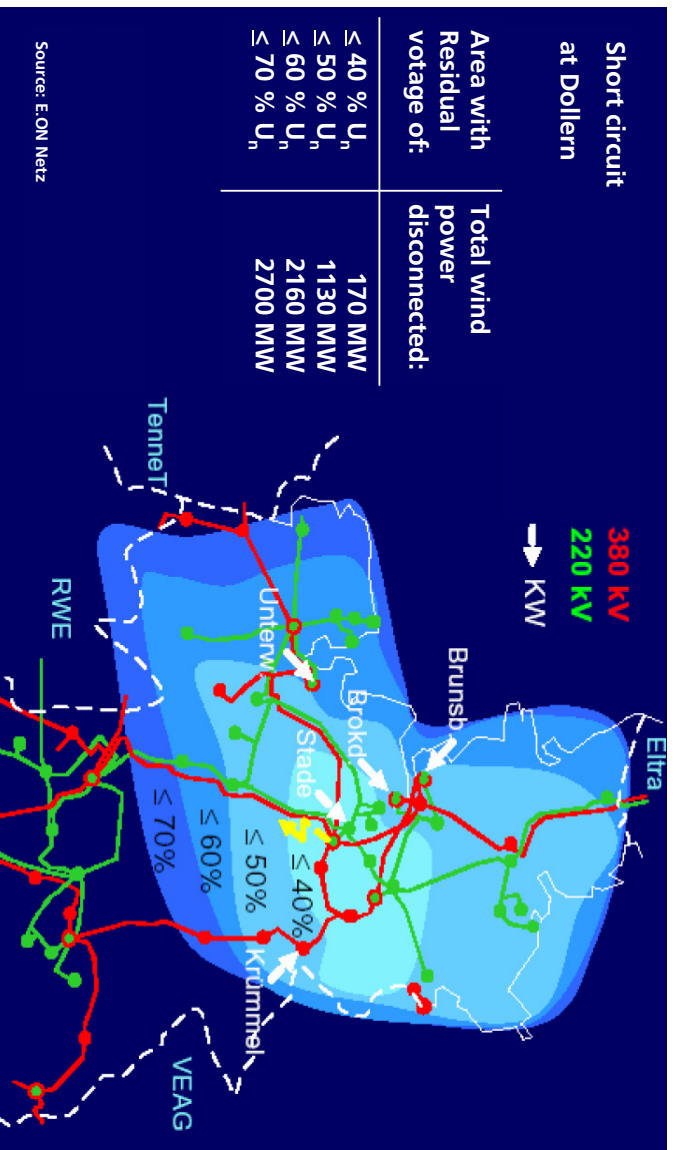
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A voltage Drop and its Distribution



Source: E.ON Netz

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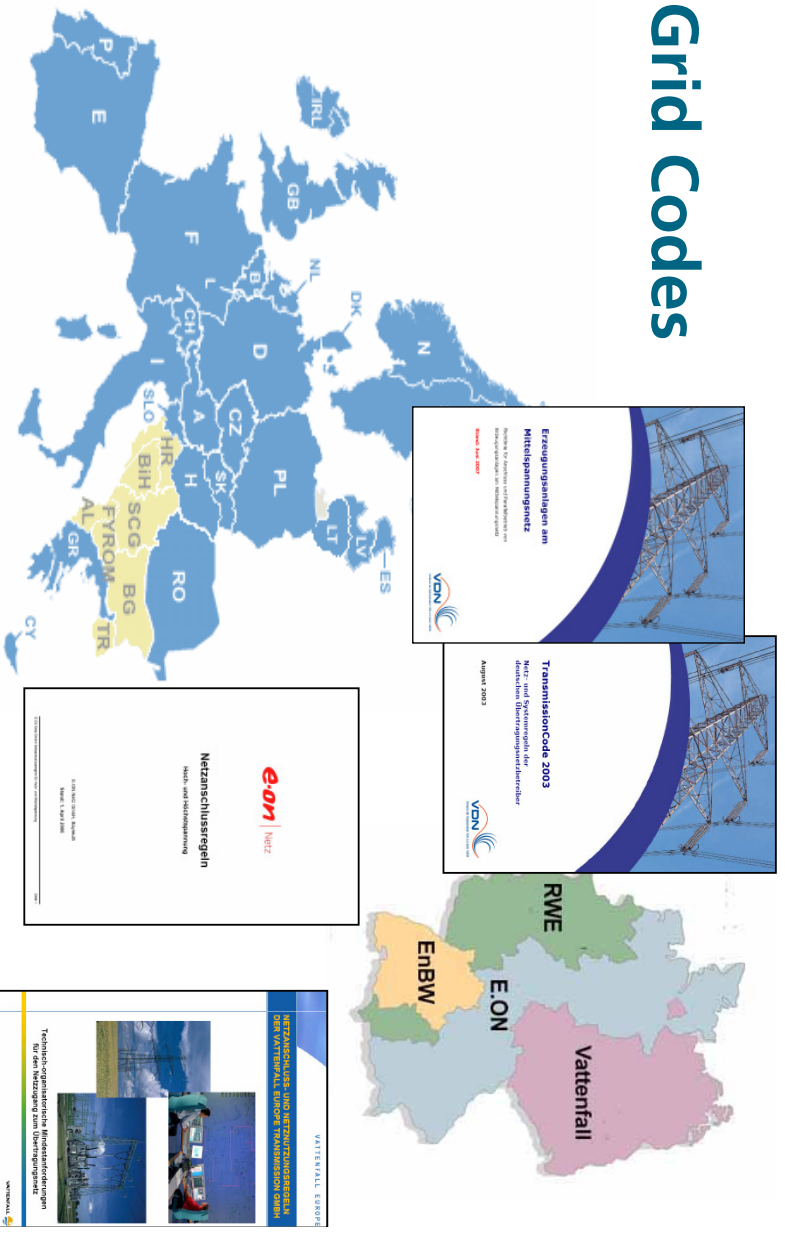
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Grid Codes



Source: ETSO, E.ON, Vattenfall, VDN

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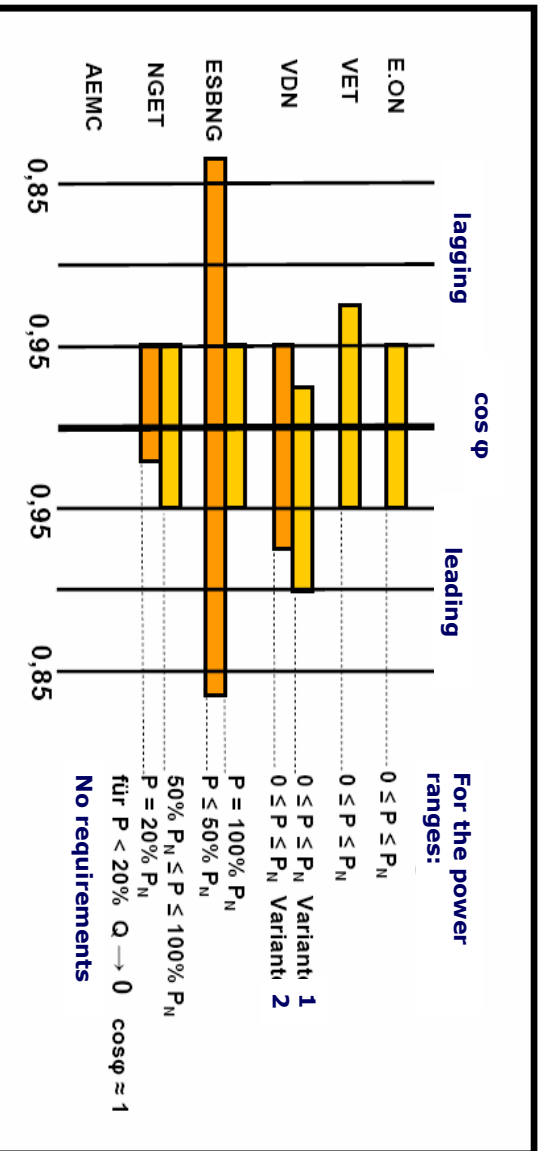
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Comparison of Existing Codes

Example of comparison of grid code requirements



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Test Plan Design and Test Specification

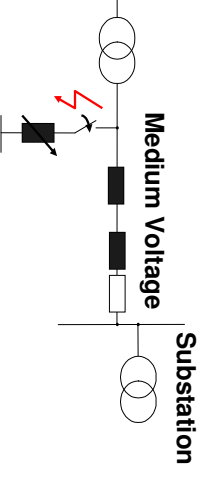
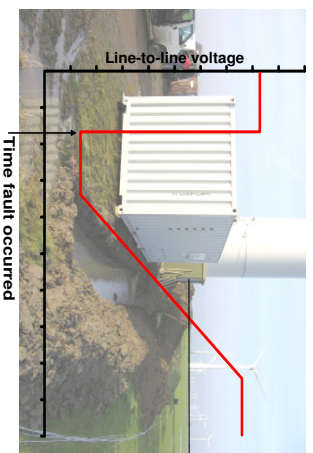
- A test plan improves testing procedure
- Definition of markets (TSOs, DSOs -> grid codes)
- Requirements are taken from the grid codes
- Definition of scope of testing (LVRT or complete set of requirements)
- Reasonable combination of tests increases significance
- Test plan to be approved by accredited certification body

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Testing



- Accredited testing laboratory (ISO 17025)
- Time series until end of t_{recover}
- 5 KHz measurements of U and I
- Recommended measurement of
 - rotational speed, pitch angle of each rotor blade, mechanical torque
- Definition of 4 different tests
 - endurance test (50 % test), minimum test (0 % test)

Test Performance

- Tests are performed for a type of wind turbines (Type-Tests). Performed by an accredited testing laboratory (according to e.g. IEC 61400-21, TN066 GL), concluded with a report
- Tests with (heavy) test equipment (container)
- Measurement without heavy test equipment
- Start of tests after agreement about test plan

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What is Certification?

- **Certification (Definition from ISO/IEC 17000)**
 - third-party **attestation** related to products, processes, ...
 - **Attestation**
 - issue of a statement, based on a decision following the **review**, that fulfilment of **specified requirements** has been demonstrated
 - **Review**
 - Verification of the suitability, adequacy and effectiveness...
- **Grid codes alone can not be used (no tests defined)**
- **Certification procedure e.g. by GL Wind (TN 065)**

Type Certificate for Grid Code Compliance

- **Assessment of results by an accredited certification body (accreditation to EN 45011)**
- **Comparison with limit values as given in the grid codes**
- **Type Certificate of Grid Code Compliance.**
- **Comparable by having basic conditions defined (GL Wind Technical Note TN065)**
- **The Type Certificate enables the installation of the wind turbines in the relevant grids**

Project Certificate for Grid Code Compliance

- Analysis of the future site regarding grid connection
- Using the existing Type Certificate for the turbine chosen for the site
- Simulations using site specific data
- **Basic criteria:**
 - The grid code in force and applicable for the site
 - Site specific grid data (short circuit power, neutral point connection...)
 - Details from Type Certificate for Grid Connection Compatibility
- **Result: Project Certificate for Grid Code Compliance**

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Conclusions (1)

- **There is an unknown number of grid codes**
 - GL currently offers grid code comparisons for 34 codes
 - Harmonisation is strongly recommended
- **Numerous acceptance tests with the inclusion of local TSOs or DSOs are to be carried out**
- **Certification comprises the following steps**
 - Grid code selection
 - Test plan and testing
 - Type certification
 - Project certification

Conclusions (2)

- **Project certification will be mandatory in Spain as of January 1, 2008**
- **Type certification will become mandatory in Germany, probably in 2009**
- **Others might follow...**

**Thank you for
your attention!**



Certification of Grid Code Compliance

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