

# World-wide Project Experience in Certification of Grid Connection

## Introduction to Grid Code Compliance Certification

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# Content

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- Introduction and History
- Players in the game of grid connection and grid codes
- What is certification and how to certify compliance with grid codes?
- GCC-Matrix – invitation to co-operate
- Summary

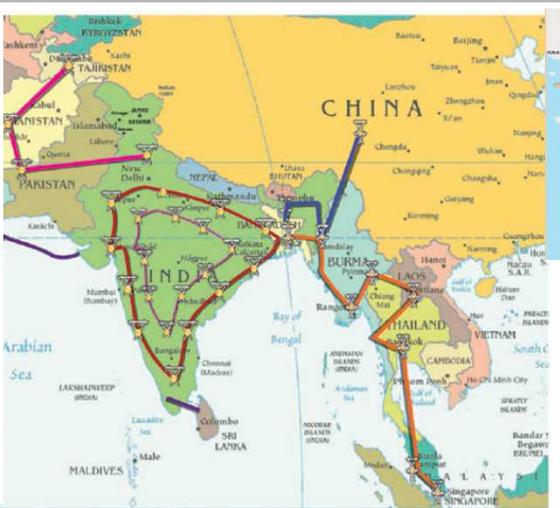
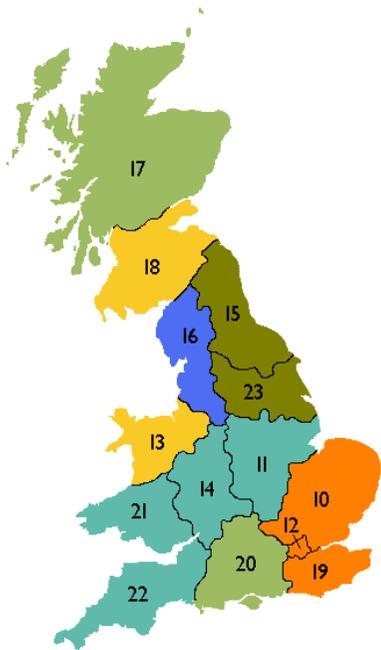
**How to prevent black-outs?**

**Comply with grid codes**



**Relevant Grid Codes are listed here:**

**[www.dnvgl.com/GridCodeListing.pdf](http://www.dnvgl.com/GridCodeListing.pdf)**



International Grid Code Listing			
No.	Country (english)	Title	Date

Tests by DNV GL  
Test &  
Measurement

Validation of  
simulation model  
against test result

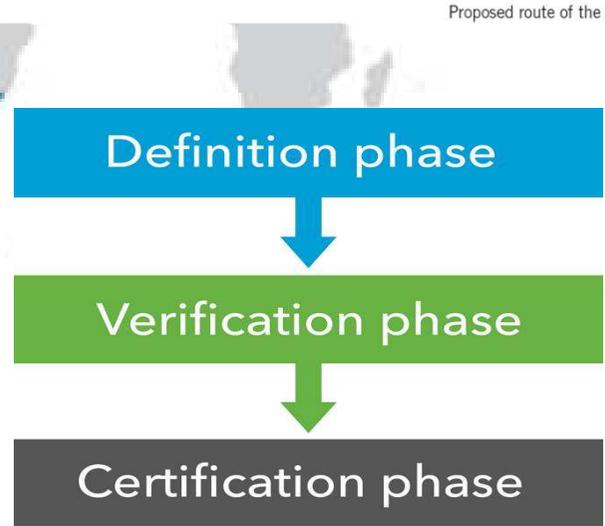
Verification  
according to  
Definition Phase

Certificates:  
Comply with Grid  
Codes as defined

Technical Market  
Analysis

Listing of Grid  
Codes with No.

Testing needs are  
determined in  
Definition Phase



Proposed route of the Asian Power Grid

## Historic reasons for grid code compliance certification

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German start of non-governmental certification being mandatory by law:

1. Steep rise in power production by wind turbines over a few years 1990-2005
2. Utilities ignored this development: they required the opposite of LVRT over years, i.e. to disconnect as soon as a fault appears
3. EU-Law requires reserve power from utilities. For that they had to require LVRT within the grid code.
4. Wind turbines ignored the grid code -> government required 2-Step certification scheme in 2009:
  - Type Certificate for types of generating units
  - Project Certificate for wind power stations (site specific plants), required for each wind power station above 1 MW to be finalized prior to first connection (commissioning) of the wind farm.

Spain

- Spanish Royal Decree requires LVRT only, but on project level (for each site).

## History in India regarding grid code compliance certification

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1. CEA requirement on LVRT was in draft and in force many years before 2013
2. Wind turbines did not implement this requirement for years
3. Law suits and discussions resulted in a stuck situation before certification was implemented to be required in India
4. Solution for LVRT certification controlled by MNRE: implementation of non-governmental certification within RLMM-Process.
5. Full compliance with CEA is still not required by MNRE, only LVRT is required for the type of a wind turbine
6. CEA draft is requiring LVRT for Photovoltaic inverters, too. Not yet in force.
7. No independent supervision if CEA requirements are implemented in the field: no project certification required in India so far.

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  - Players in the game of grid connection and grid codes
  - judgement principles
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## Players and their objectives regarding grid code compliance

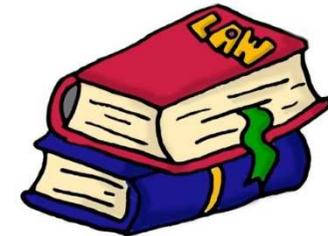
- Rule makers

writing grid codes

putting requirements to laws



- Rules setting requirements (GCC-features)
- Rules to define judging principles (verification, certification)
- Any other rules for connection application, connection agreement, electric power purchase agreement, current in-feed or rules for commissioning tests etc.
- Rules for judgement



- Judges

evaluating tests by comparing result with requirements (assessment)

stating that requirements are met (certification)

giving the “go” or stopping the plant

- Judgement principles can be different



# Judgement Principles

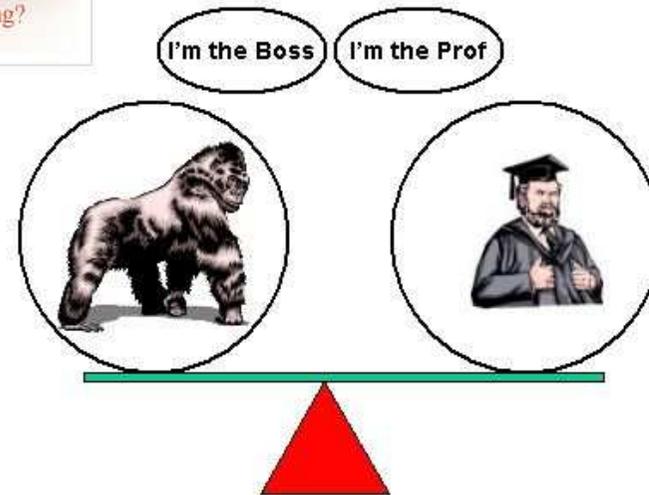
- **Engineering Judgement**

- Transparency is very low
- Quality can be low or high
- Experienced judges only



- **Discussing** each connection singularly

- Time consuming
- Possibly unfair for some
- Mostly non-transparent



- **Verification and certification procedure**

- Clear definitions and specifications
- Mostly repeatable tests
- Equal quality
- High transparency
- Very fair
- Transparent if properly written down

## More players with more objectives

### ■ Power Producers

Operators, developers, owners and investors

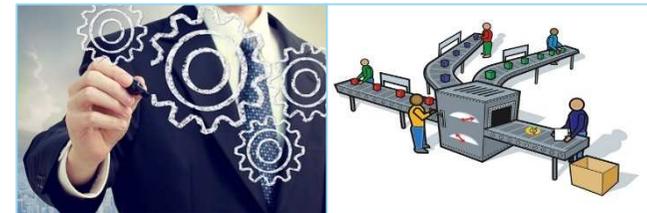
- Selling electricity, reducing installation cost and operational cost



### ■ Manufacturers

...of generating units and their sub-suppliers, of infrastructure and power plant level equipment

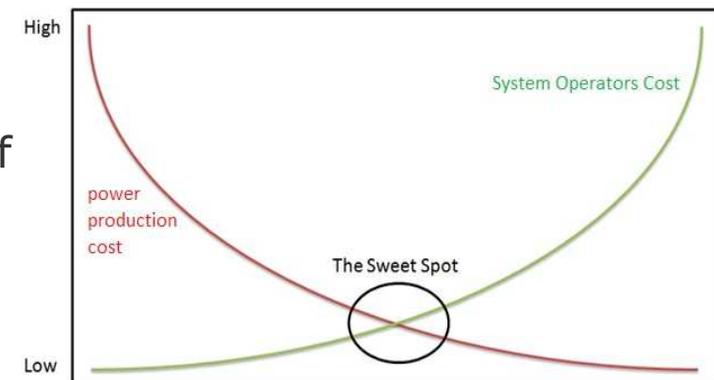
- Providing the solutions for the requirements
- Not directly responsible for grid code compliance



### ■ End user of Electricity – all of us

Price of electricity is low, if both is low by means of good and well balanced verification procedures:

- System operators cost
- Power producers cost



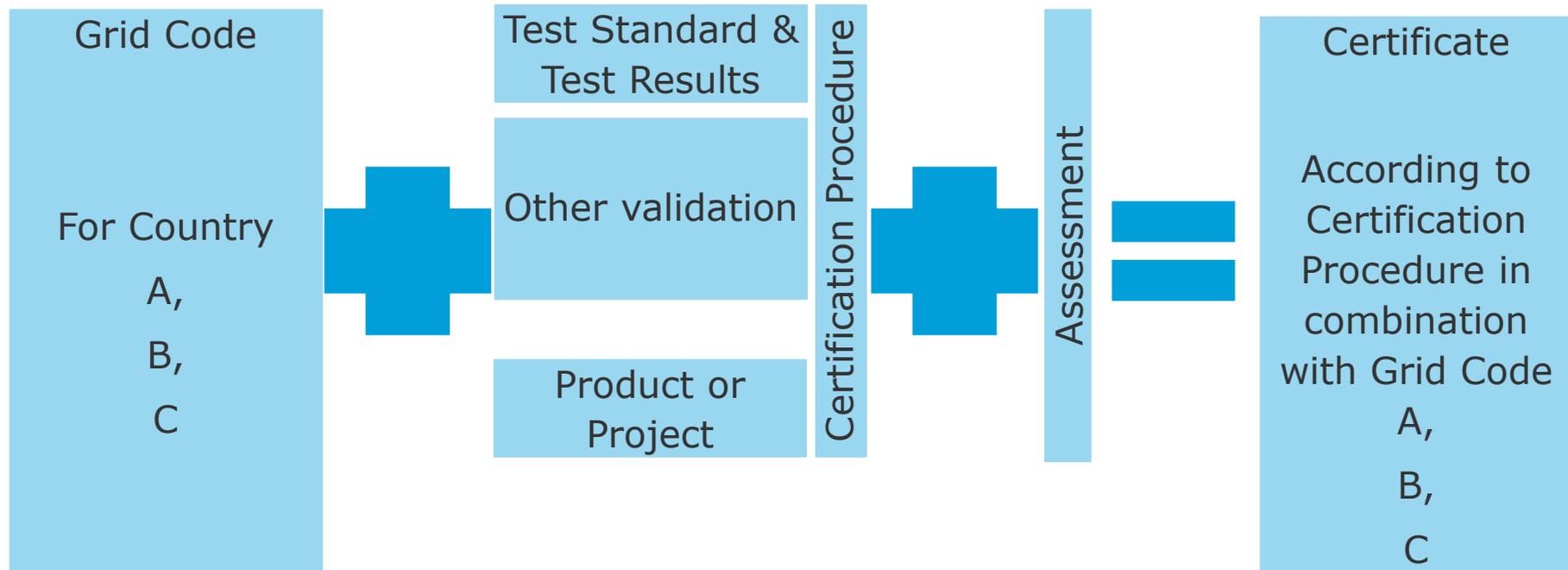
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## Certification

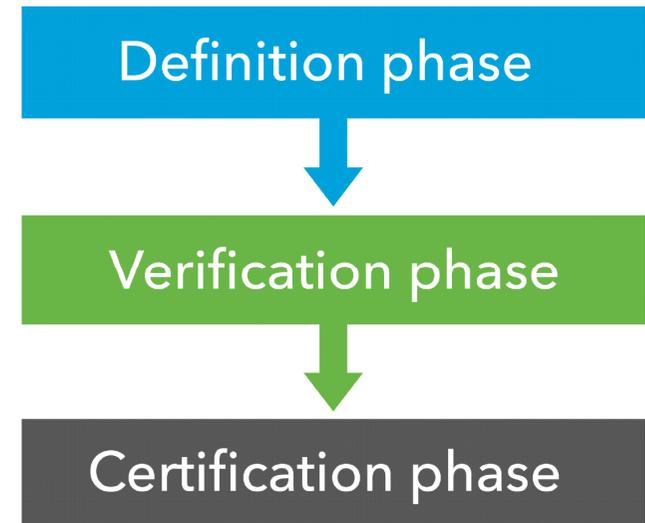
- Certification means comparing (i.e. evaluating or assessing) a subject with specific evaluation criteria and stating conformity or compliance (if the subject complies with the evaluation criteria)
- In our case the subject is the electrical behaviour of power generating units and power plants.
- evaluation criteria are grid codes and the certification procedure defining tests.



## Certification of Grid Code Compliance

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- Requirements: taken from Grid Codes or defined according to definitions
- What to test: a tailor-made test plan will cover the needs, principles of test plan preparation is already standardized by DNV GL
- Scope: depending on the application
  - Component
  - Equipment
  - Type (or Model) of generating unit
  - Project, such as a power station
- Acceptance: depending on customers wish, 3 options available:
  - Full acceptance by system operator (GCC-Class I)
  - Fulfilling defined rules and grid codes completely (GCC-Class II)
  - Fulfil well-defined features only (list of feature definition available)



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# Grid Code Matrix – we offer sharing know-how, translations, news and contract-related update alerts

This GCC-Matrix service is currently in preparation. Please contact us upon interest

## Outside DNV GL

- Experts of:
  - Utilities
  - Manufacturers
- Grid Codes:
  - News
  - Translations
- Exchange about:
  - Means
  - News
  - Experience
  - Best Practice
  - Test
  - Etc.



## Customers and GCC-Matrix-Members

- Certificate updates
- Information services
- Alert services for new grid codes
- Monitoring of countries or areas
- Test plan services
- Second source updates
- Missing test monitoring
- Etc.

## Within DNV GL

- Local experts of:
  - Most countries
  - Simulation
  - Certification
  - Test
  - Consulting
- Grid Codes:
  - News
  - Translations
  - Evaluations
  - Extracted requirements
  - Test plans

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- Fulfilling the requirements from Grid Codes helps avoiding black-outs.
- Grid code listing is available at [www.dnvgl.com/GridCodeListing.pdf](http://www.dnvgl.com/GridCodeListing.pdf)
- Independent verification and certification helps to implement grid code requirements in countries, examples from Germany, Spain and India do exist.
- Main players are “rule makers”, “judges”, power producers and power end users.
- A well-balanced certification system grants transparency of market, keeps qualification of players on a high level as well as monitoring of implementation.
- Experience of DNV GL during more than 10 years grid code compliance certification improved the certification procedure again and again. It can be used for India or any other country or grid code. It is publicly available.
- Grid Code Compliance Certification should be made as a 2-step approach per site:
  1. generating unit model type (Type Certificate), once for all of the same type
  2. each power station based on the Type Certificates of the units used at the site
- Great co-operational services are currently developed as GCC-Matrix-Services

**Please let us support you.**

**Grid Code Compliance Services**

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**[www.dnvgl.com](http://www.dnvgl.com)**

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