



**The German BDEW technical guideline for generating plants  
connected to the medium voltage grid  
– an overview of its requirements and their implementation  
in SMA inverters**

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# the BDEW guideline

## structure and additional guidelines



### the BDEW guideline

- > is not a law, but a recommendation
- > refers to other guidelines, such as
  - > **TransmissionCode 2007** for the definition of dynamic grid support
  - > **FGW-TR3** (Technical Guidelines Part 3) for the determination of electrical characteristics
  - > **FGW-TR4** (Technical Guidelines Part 4) for the modeling and validation of simulation models of the electrical characteristics
  - > **FWG-TR8** (Technical Guidelines Part 8) for the certification of electrical characteristics ... of power generating units and systems in medium and high voltage grids



Sources: [www.bdew.de/bdew.nsf/id/DE\\_7B6ERD\\_NetzCodes\\_und\\_Richtlinien](http://www.bdew.de/bdew.nsf/id/DE_7B6ERD_NetzCodes_und_Richtlinien) and [www.wind-fgw.de/tr\\_engl.htm](http://www.wind-fgw.de/tr_engl.htm)

# the BDEW guideline

## background and history



- > draft and publication by the German association of grid operators (BDEW)
- > consultation of PV-industry as “junior partners”
- > effective from **January 1, 2009**
- > transitional periods defined in **two amendments** (for some requirements until **April 1, 2011**)
- > defines requirements for **grid integration of distributed energy resources (DER)**
- > need for **certification** of “units” (e.g. PV inverters) and plants (as a combination of one or more “units” and further equipment i.e. transformers, cables, etc.)
- > **limited capacities of the certification entities currently represent a serious bottleneck!**



Source: [www.bdew.de/bdew.nsf/id/DE\\_7B6ERD\\_NetzCodes\\_und\\_Richtlinien](http://www.bdew.de/bdew.nsf/id/DE_7B6ERD_NetzCodes_und_Richtlinien)

## requirements & implementation into SMA inverters



- > **required features for grid management and grid integration of distributed energy resources (DER)**
  - > generation control
  - > frequency control
  - > voltage control
  - > dynamic grid support  
AKA: "fault ride through" (FRT)  
or "low voltage ride through" (LVRT)

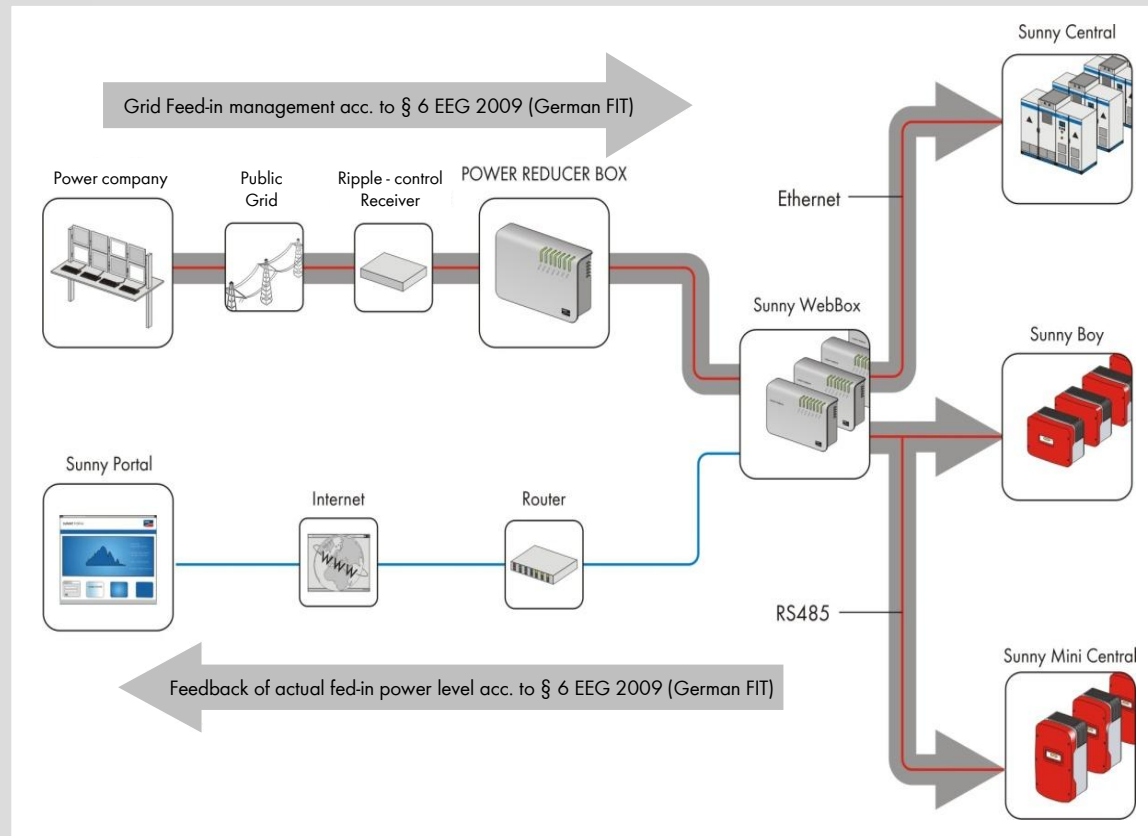


# requirements & implementation into SMA inverters

tools for grid management and grid integration: **generation control**



- > manage temporary generation/load **imbalance** conditions in **local grid sector**
- > limit power generation via remote control and SMA Power Reducer Box to e.g. 100%, 60%, 30% or 0% of maximum power
- > available for all SMA inverters of SC, SMC and STP series
- > also available for most SMA inverters of the SB series.

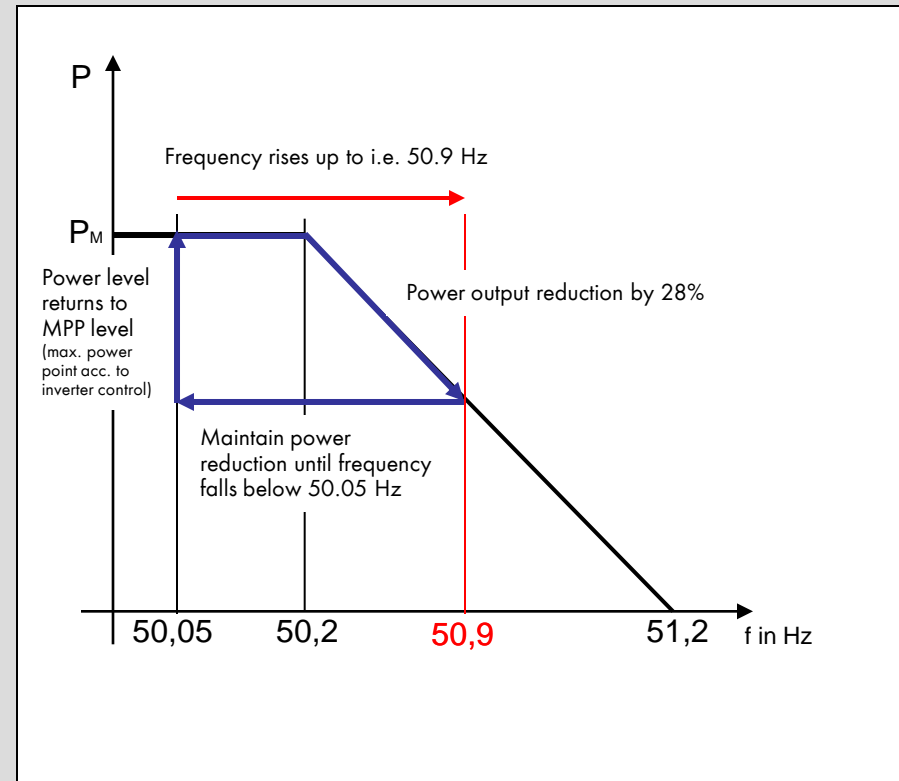


# requirements & implementation into SMA inverters

tools for grid management and grid integration: **frequency control**



- > temporary reduction of generated power depending on frequency
  - > in case of emergency
  - > in case of a **system wide** generation/load **imbalance**
  - > to avoid instability
- > available for all SMA inverters of SC, SMC and STP series
- > also available for most SMA inverters of the SB series.

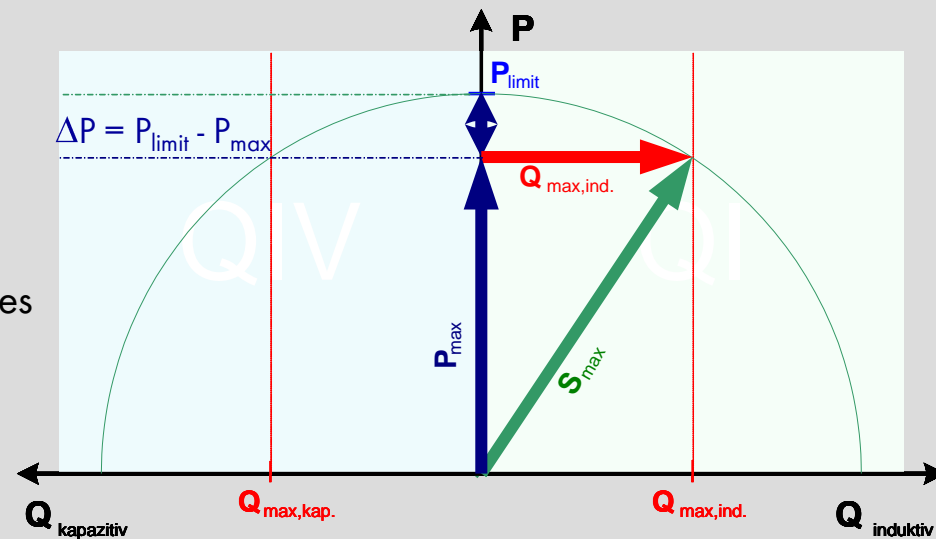


# requirements & implementation into SMA inverters

## tools for grid management and grid integration: **voltage control**



- > feed-in of **active power** has influence on voltage (voltage rise)
- > **voltage rise can be compensated** via feed-in of **reactive power**
- > available reactive power modes:
  - > **cos  $\varphi$  = const.**
  - > **Q = const.**
  - > **cos Phi (P)**
  - > **Q(V)**
- > available with SMA inverters of SC xxxHE-11, SC xxxCP, STP and SMC<sup>1</sup> series
- > **influence on dimensioning of inverters!**

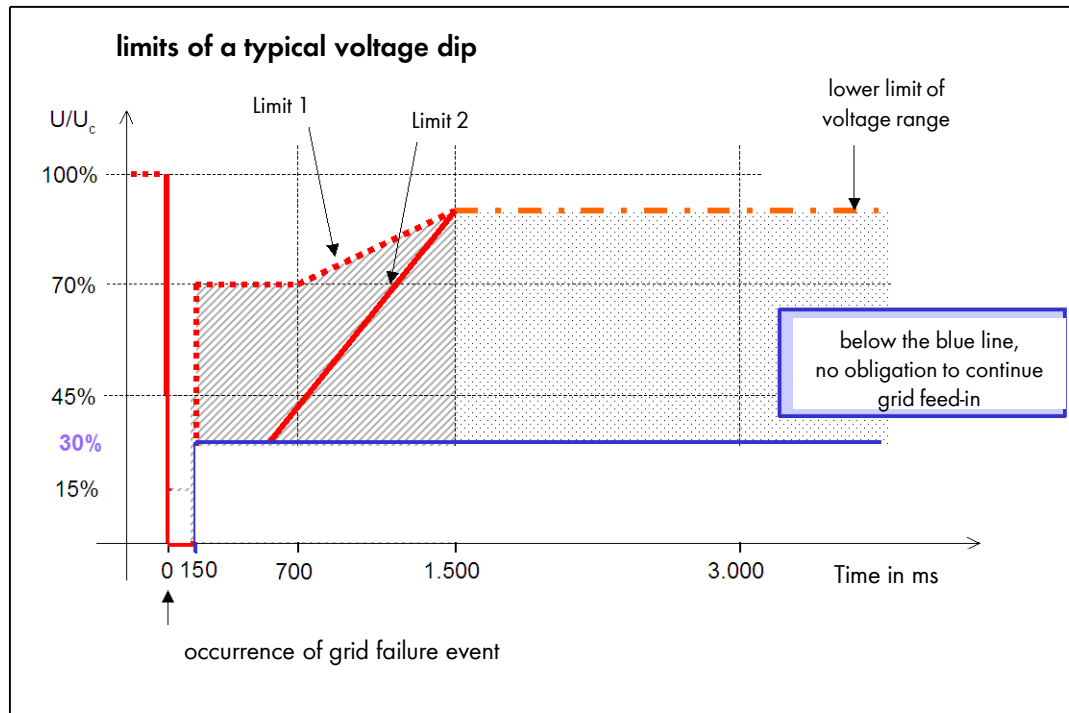


<sup>1</sup> cos  $\varphi$  = const. only

# requirements & implementation into SMA inverters

tools for grid management and grid integration: **dynamic grid support**

AKA: "fault ride through" (FRT) or "low voltage ride through" (LVRT)



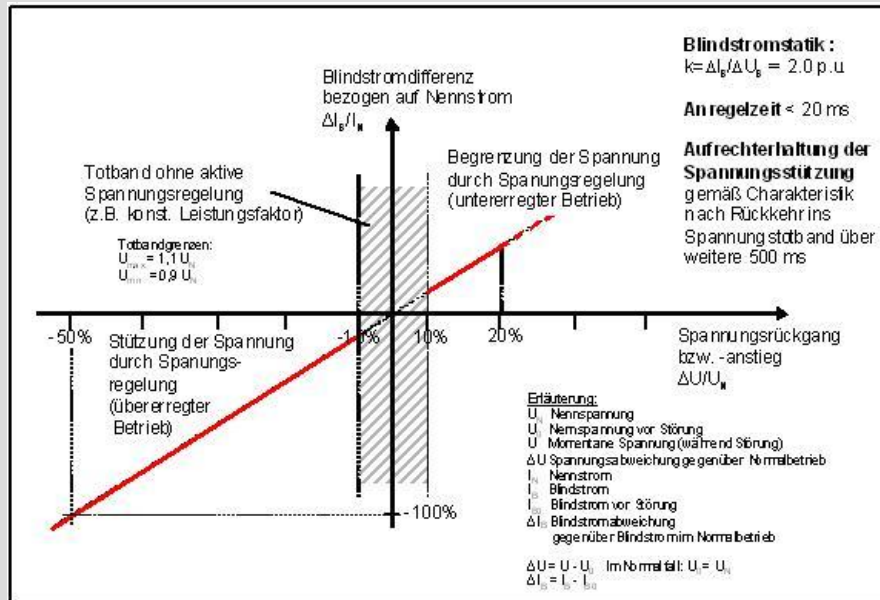
- > generating facility **must not disconnect** during voltage dip
- > required behavior:
  - > above „Limit 1“  
→ *continuous, stable operation*
  - > between „Limit 1“ and „Limit 2“  
→ *may disconnect in accordance with grid operator*
  - > below „Limit 2“ and below 30%  $V_{nom}$   
→ *may disconnect*

Source: German BDEW technical guideline for generating plants connected to the medium voltage grid. BDEW, June 2008

# requirements & implementation into SMA inverters

tools for grid management and grid integration: **dynamic grid support**

with provision of reactive current for highly dynamic voltage control



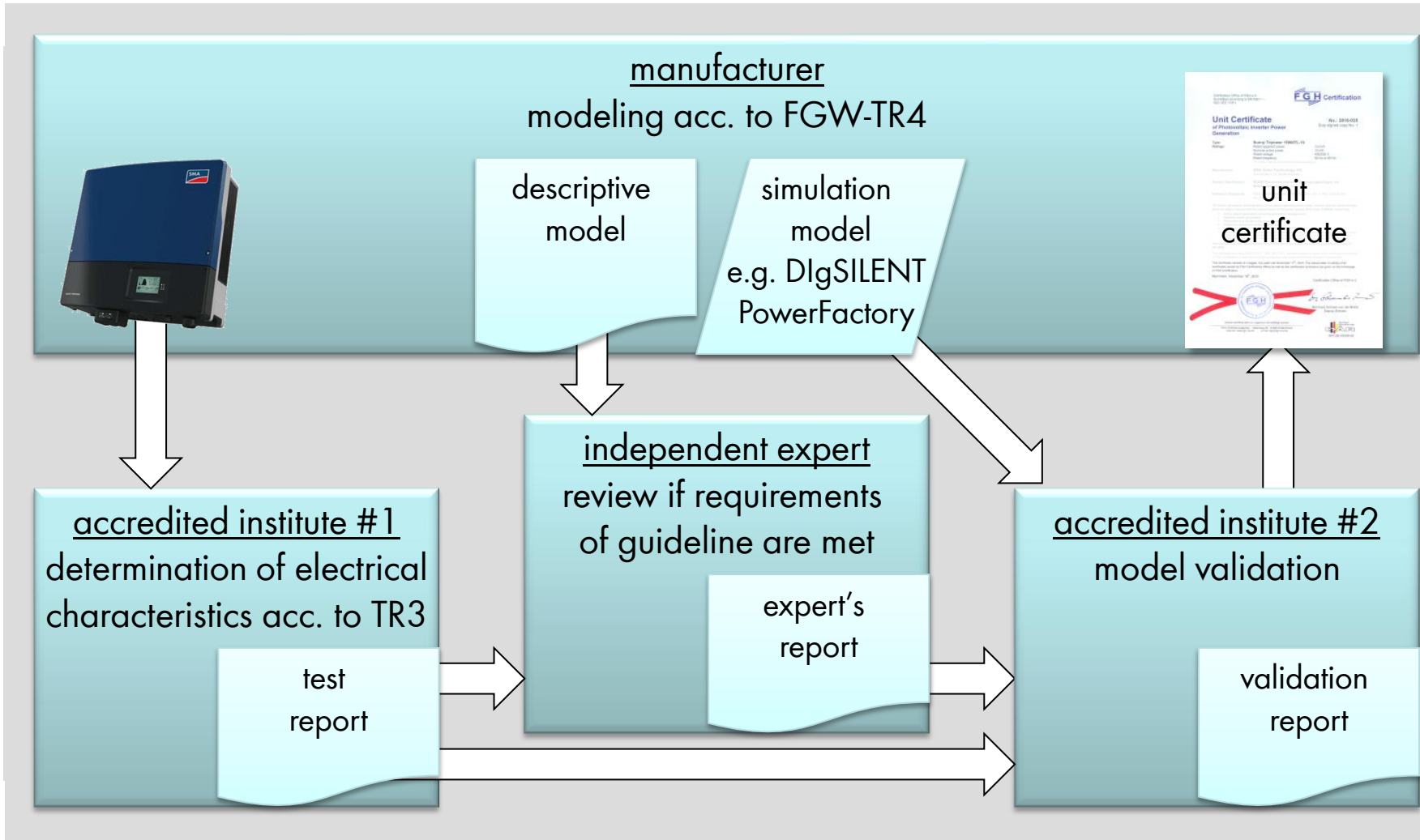
Source: German TransmissionCode 2007

- > provide reactive current during voltage dips
- > limits the influence of voltage faults (dips) in transmission lines on the grid
- > **prevention of**
  - > *simultaneous disconnection* of large generating facilities
  - > *and subsequent blackouts!*
- > available with SMA inverters of SC xxxHE-11<sup>1</sup>, SC xxxCP, STP and SMC<sup>1</sup> series
- > **no influence on dimensioning of inverters**

<sup>1</sup> limited dynamic grid support only (no reactive current during fault)

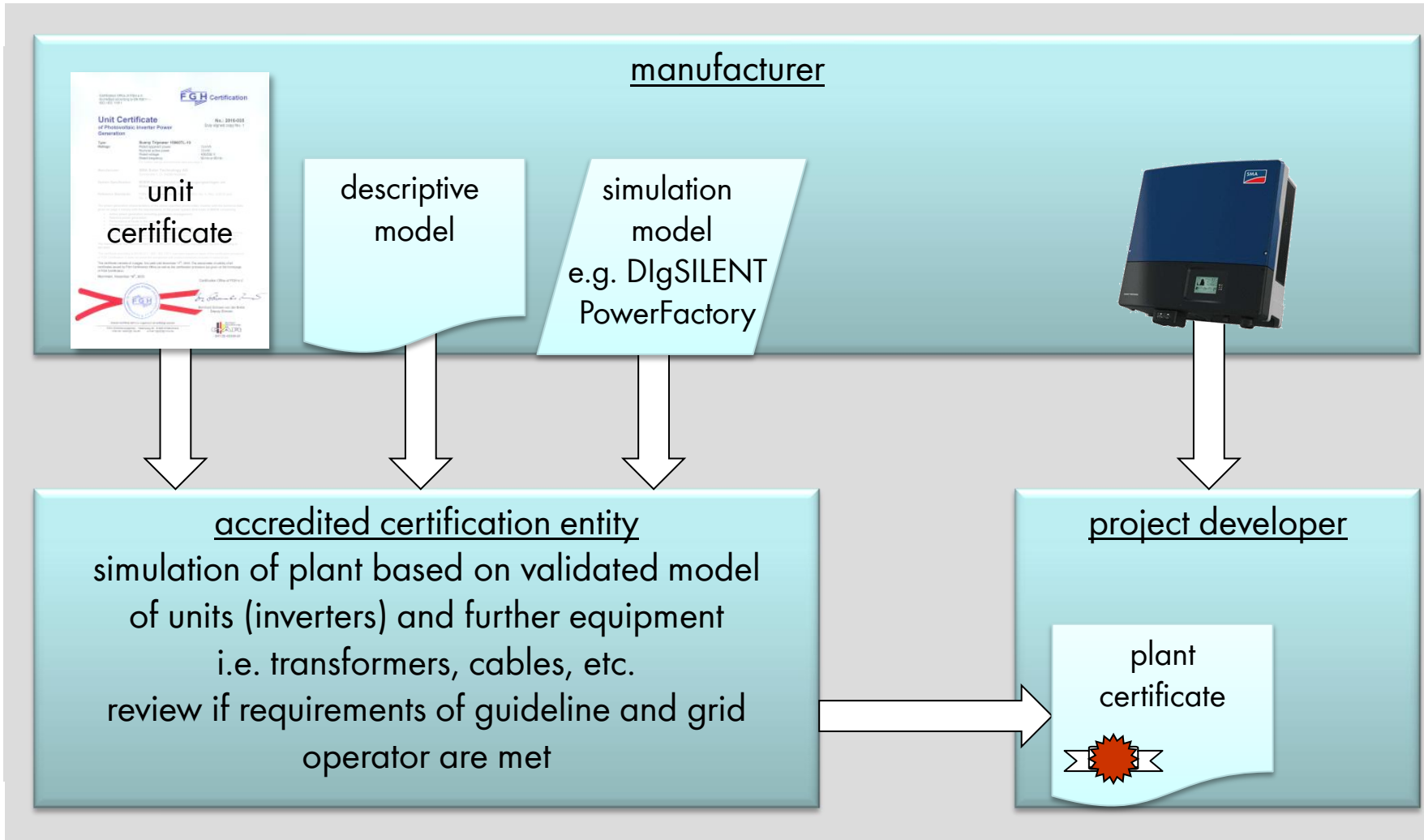
# certification process

certificates for generating units (acc. to FGW-TR8)



# certification process

certificates for generating plants (acc. to FGW-TR8)



## summary



- > the German BDEW guideline defines the requirements for the interconnection of generating plants with the medium voltage grid
- > it requires features such as generation, frequency, and voltage control for the integration of PV-DER at high penetration levels
- > all required features are fully implemented in SMA's SC-CP and STP series inverters
- > the BDEW guideline refers to additional guidelines for the definition of a required certification process
- > the certification process is split into unit and plant certificates
- > limited capacities of the certification entities currently represent a serious bottleneck
- > the BDEW guideline it will be fully effective starting April 1, 2011

**> > thank you for your attention! < <**



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