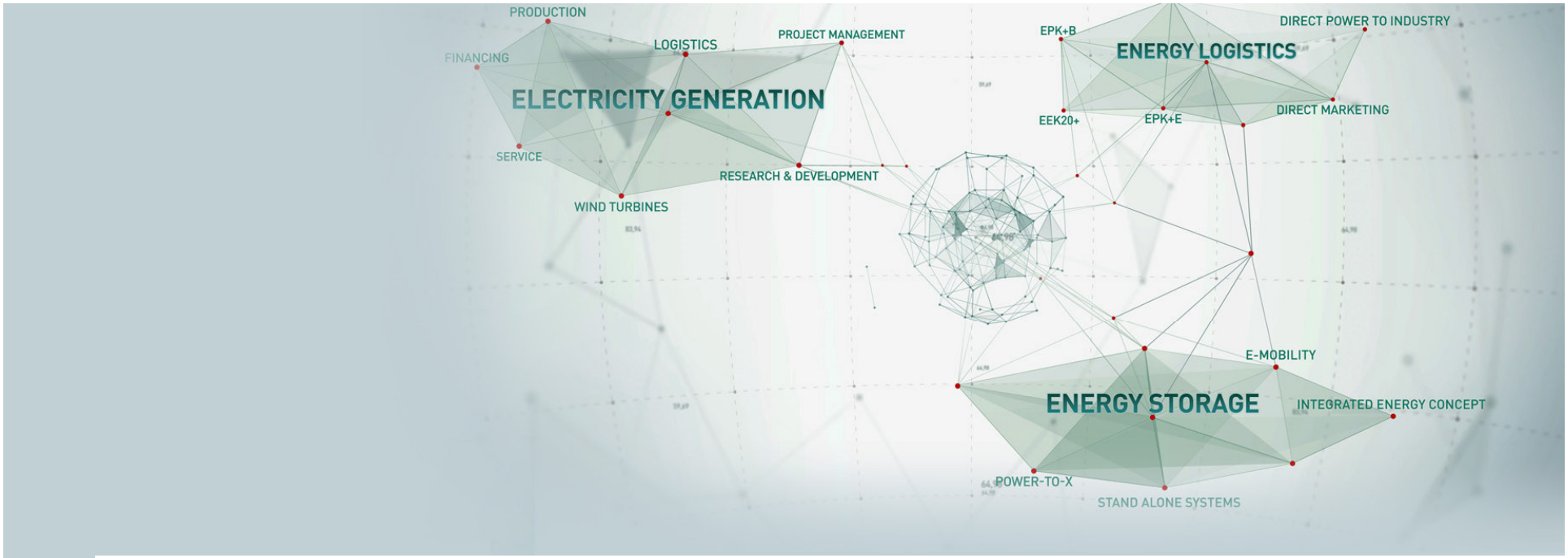


On the way to a 100% inverter-based power system

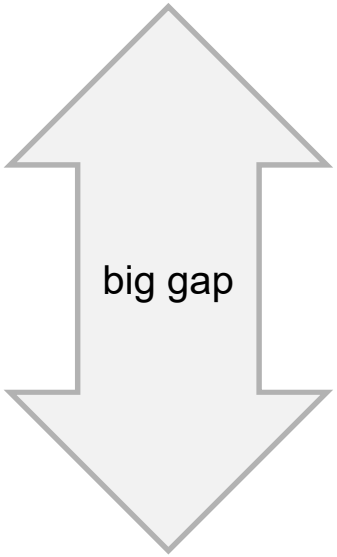
25.03.2020

Eckard Quitmann, head of S-GI

ENERCON
ENERGY FOR THE WORLD

Priority 1: Power system stability !

(+market based + cheap + sustainable + transparent + …)



Priority 1 for Power Plants: Make €€ ! = MWh

(+ sustainable + long term secured + …)

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Priority 1: Power system stability !

(+market based + cheap + sustainable + transparent + …)

Traditional way:
- Rotating generation
- Inherent nice features
- Unidirectional power flow
- € for f-services + blackstart

Priority 1 for Power Plants: Make €€ ! = MWh

(+ sustainable + long term secured + …)

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Priority 1: Power system stability !

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Priority 1 for Power Plants: Make €€ ! = MWh

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Priority 1: Power system stability !

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Improvement potential of today's inverters Wind/PV

Priority 1 for Power Plants: Make €€ ! = MWh

(+ sustainable + long term secured + …)

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Priority 1: Power system stability !

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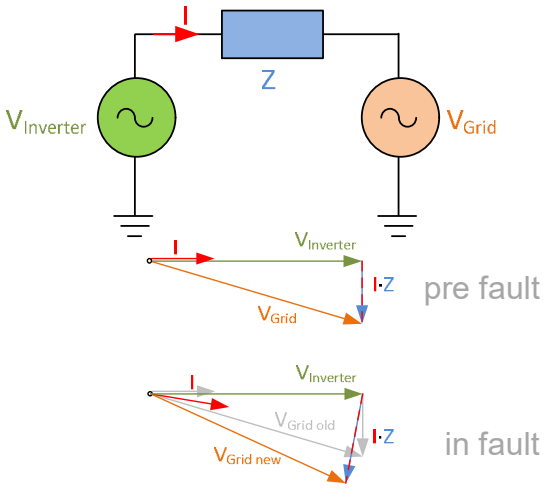
"Grid Forming converters"
- Like a U-source behind Z
- Inherent, fast response
- Current limited!
- Energy buffer needed
- Incompatible to MPP
- Helpful in severe events?



Priority 1 for Power Plants: Make €€ ! = MWh

(+ sustainable + long term secured + …)

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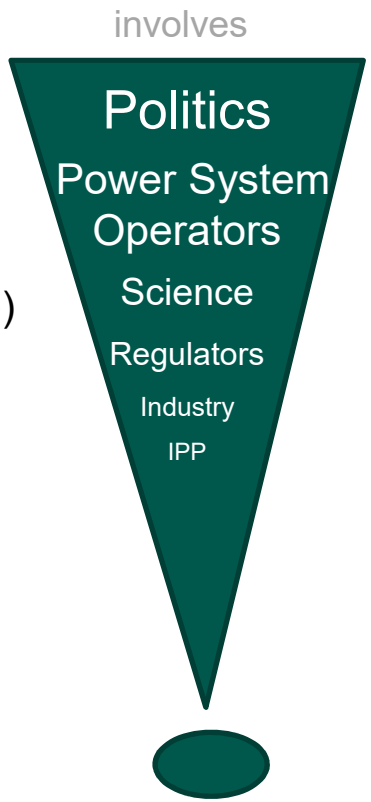
Top – Down approach to quantify system needs + services

1. Define target system (sources, loads, RES-penetration in P and E…)
2. Define dimensioning disturbance (-3 GW, system split …)
3. Study to determine the system needs (incl. urgency of different needs)
4. Technical formulation of requirements (system needs => tec. performance)
5. Determine the economically optimal form of provision & performance
6. Define technical benchmarking and organizational form
7. Realization (adapt AS schemes and Grid Codes)



or:

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Top – Down approach to quantify system needs + services

1. Define target system	The electrical target system is to be defined in terms of energy quantities, as well as the expected shares of the different power sources (RES, conventional, storage) and sinks (loads, e-mobility, storage). If necessary, different scenarios for several points in time with key data are to be politically specified.
2. Define dimensioning disturbance	System faults have to be defined, which the network specified under 1. should survive without blackout, or which maximum supply restrictions should be permitted (e.g. load shedding). This is a political decision.
3. Study to determine the system needs	Independent studies determine the type and scope of the minimum **power system supporting functionalities**; overall for the electrical system, as well as regional and local, in order to be able to operate under the conditions given in 1. and 2. in steady state conditions and in the event of faults, as well as with the desired voltage and frequency quality.
4. Technical formulation of requirements	Describe the necessary global/regional/local power system supporting functionalities identified under 3. in a technology-neutral manner. These system needs are to be translated into quantifiable contributions, which in principle can be provided by individual network participants or groups of network participants. Objective: To enable as many network participants as possible to provide system-supportive behavior.
5. Determine the economically optimal form of provision	For each of the network service functions identified under point 3, decide specifically how to meet the demand in the most economically advantageous way through contributions of network participants (or groups of them). a. market-based provision b. Mandatory capability and/or provision
6. Define technical benchmarking and organizational form	For a. and b. define detailed technical benchmarking For a. additionally define organizational and remuneration form (tender, bid invitation, pricing regulated or free, payment based on capability and/or provision, ...)
7. Realization	To a.: Execute tender or other selected market forms for the procurement of non-frequency ancillary services. To b.: Determine date of application for new grid codes, if necessary define transitional arrangements

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Court of jurisdiction: Aurich ▪ Commercial register number: HRB 411 ▪ VAT ID No.: DE 181 977 360

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Document details

Document-ID	20180711_ppt-template_169_en
Note	This is a translation 20180621 ppt-template_169_de

Date	Language	DCC	Plant / Department
20180711	en		Marketing

Revisions

Rev.	Date	Change
0	20180711	Document created
1	20190712	Document updated