

Grid Forming Converters – a solution to future grid

B4: DC systems and Power Electronics

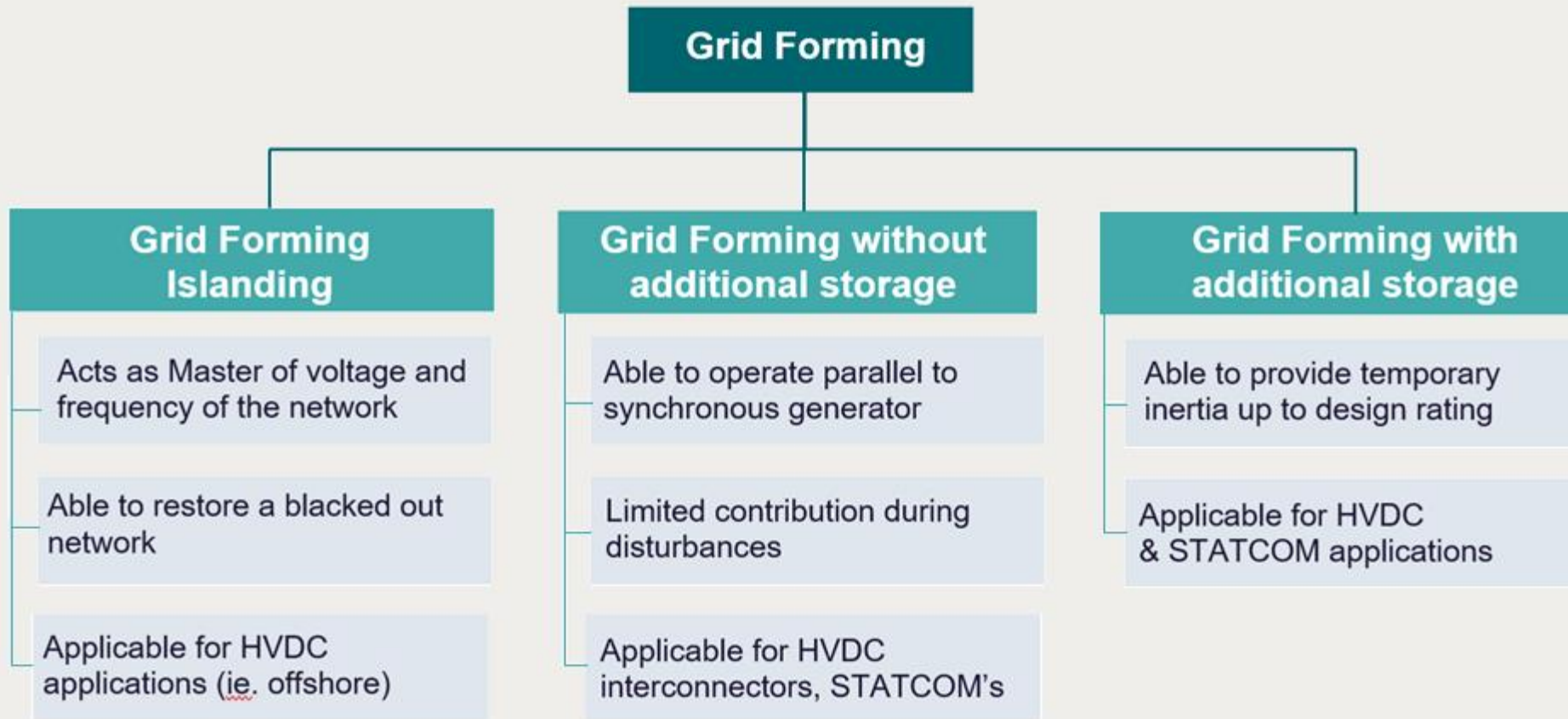
PS1: Grid Forming Applications

Q S.1

Iftekharul Huq, Germany
Sebastian Schneider, Germany



Requirements & application driven definitions



Major Features include in all types:

- Providing inherent reaction to system disturbances on the AC network
- Short circuit contribution up to device rating including temporarily usage of HW limits
- Ability of operating in very weak network conditions

Technically Feasible Ramp Rate and Response time could be generalized

Changes & Challenges

Present

Future

Major Changes/Trends

- Decarbonization
- Decentralization
- Digitalization
- Energy demand

CONSEQUENCES

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Decreasing short circuit power levels
 Increasing Rate of Change of Frequency rates
 Lack of instantaneous inertia

Security of supply



Energy storage



Transmission capacity



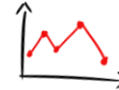
Utilization of existing assets



Grid planning



Decreasing predictability



Industry contribution

- Pioneering new technologies
- Co-development where necessary
- Better utilization of hardware
- Be part of the change

CO2 neutral

Will the load follow the weather?



rethink redesign reinvent

SHAPING AND INFLUENCING THE CHANGE !!!

room for innovations

Transmission system

Integration of large renewables

Backbone AC-DC grids providing energy balancing support

Sub-Transmission system

DC applications and grid stabilization

Large scale storage

Distribution system (MV)

(semi-) autonomous micro grids

MV DC grids and hybrid networks

CIGRE

Distribution system (LV)

Automated nano grids

AC grids?
DC grids?
gas networks?

Experiences in Grid Forming

Grid Forming Core Control

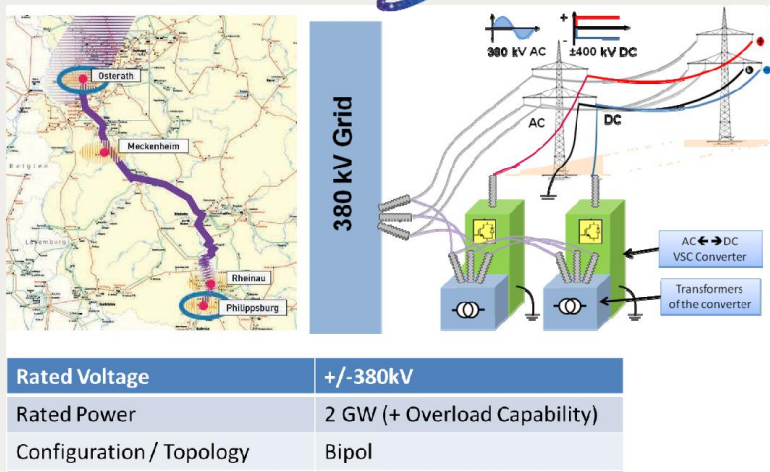


Fig: Project Ultratnet



Fig: German Corridor Projects (SLV3 and SOL)



Fig: NeuConnect

- Tailor made solutions to meet customer demand for individual projects from single core solution of Grid Forming
- Accurate EMT models including actual software solutions for investigations
- Real time simulation with actual hardware setup & HIL with simplified setup
- Bridging the two “Following” & “Forming” technology

CIGRE Centennial Session 2021