The path to a net-zero emission power system: Grid-forming technology

HUAWEI

High Wind and Solar Development Target in EU



Europe will ramp up wind and solar power installations, adding 900 gigawatts between now and 2030, according to the REPowerEU plan announced Tuesday. That's nearly double what it was expected to add, Morgan Stanley analysts said in a Wednesday note.



farm tripped caused by typhoons and rainstorms.
Voltage drops occurred for 6 times and caused voltage and frequency collapse. South Australia suffered a 50-hour blackout.





Grid Forming is considered a vital technology for weak power systems



CLC TC8X EN 50549-20 development



Guidelines and pilot projects are emerging

UK、USA、Italy, Australia has released guidelines for GFM







2021. Feb, UK Grid Forming standard

2021. Dec, USA NERC Guideline for Grid Forming

2021.Aug, Australia, AEMO 'Advanced grid-scale inverter'

Completing the map

2022 ENTSO-E GF definition

Grid-forming Converters (GFC) are power electronics devices designed in control and sizing in order to support the operation of an AC power system under normal, disturbed, and emergency conditions without having to rely on services from synchronous generators. Future capabilities of GFC, in order to allow up to 100% penetration of power park modules (PPM) can be classified exhaustively as follows: 1. Creating system voltage, 2. Contributing to Fault Level,

- 3. Contributing to Total System Inertia (limited by energy storage capacity),
- 4. Supporting system survival to allow effective operation of Low Frequency
- Demand Disconnection (LFDD) for rare system splits, 5. Acting as a sink to counter harmonics & inter-harmonics in system voltag
- 6. Acting as a sink to counter unbalance in system voltage,
- 7. Prevent adverse control system interactions.

High Penetration of Power Electronic Interfaced Power Sources and the Potential Contribution of Grid Forming Converters Technical Report



Grid forming - Necessary Enabling Technology

Promoting Renewable Energy from Grid Following to be Grid Forming

Grid following basic function:

Current source Grid voltage dependent Current time response range: 20-40 ms



Grid forming basic function:

Voltage source Grid voltage independent Current time response: instantaneous - 5 ms





Huawei GFM BESS Solution for enhancing grid strength



Three Major Stability Enhancement

Voltage Stability

- 3 times short-circuit capacity
- 10 ms fast reactive power response, transient voltage regulation
- Voltage source, support standalone off-grid operation

Frequency Stability

- Higher precision of active power control
 of inertia response
- Higher precision of active power control in the primary frequency modulation

Phase Angle Stability

- Wide frequency oscillation suppression
- Power Oscillation Damping
- Stable operation in weak power grids



Huawei Milestones of Utility Grid Forming (GFM) Solution

- Huawei always highlights the importance of grid control technologies.
- Globally, first and the only 100MW-scale island system GFM provider
- Domestically, first and the only GFM provider with grid operator's verification.



- Published Top 10 Trends of Solar PV, highlighting grid control technology importance
- Launch GFM 1.0 Development (Utility scale standalone operation, instant voltage/frequency control, load sharing)
- Largest grid forming BESS Red
 Sea Microgrid 287MW
- Define grid forming standard with State Grid Corporation of China.
- Launch GFM 2.0 Dev (featuring high overcurrent and stability enhancement)

- Red Sea Microgrid Commissioning
- 1MW GFM verification with SGCC
- 2x100MWh commercial GFM
 BESS projects in China



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Huawei GFM in China Resources Qinghai Poverty Relief





Huawei GFM in China Resources Qinghai Poverty Relief 100MW PV











Saudi Arabia Red Sea ProjectWorld's Largest 100% PV + ESS Microgrid Project

400 MW PV + 1.3 GWh BESS

Serving 100% PV + ESS power supply for 1 million people in Red Sea new city Grid Forming enabling 100% PV & ESS grid

COD: 16MWh ready around Dec. 2022, others shall be ready around middle of 2023

Grid Forming

FusionSolar Grid Forming Solution, Redefine Grid Stability with High Penetration of Renewables



Thank you.

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