REQUIREMENTS FOR GRID CONNECTION OF GENERATORS (NC RFG 2.0)

Grid Connection Stakeholder Committee Meeting

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OUTLINE

1) Grid forming requirements for PPMs

2) Maximum export capacity and treatment of different technologies behind same connection point

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GRID FORMING REQUIREMENTS FOR PPMS IN LATEST DRAFT OF NC RFG

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Grid forming by renewables is still immature

- Proposal is a deviation from Directive (EU) 2019/944 mandate for market-based procurement of non-frequency ancillary services
- No industrial standards beyond few prototypes
- Technology being developed in parallel with the requirements

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Risks involved

For OEMs and asset developers

- Could increase wear due to stresses, needing adjusting turbines design
- Interactions between GFM units could lead to risks for oscillatory and transient stability
- Implications on hardware and lifetime of RES generators unknown for any level of GFM
- Cost impact imposed by grid forming requirements

For System Operators

- Possible resonances in sub-synchronous domain of GFM generators with other elements
- Risk of unintended electrical islands
- Lack of control robustness for all operational conditions considered (e.g. strong vs. weak grid)

These can delay the energy transition, especially when grid forming products will need to comply to 27 Member State variations across varied timelines

WindEurope recommendation on grid forming

Efficient approach

- Assessment by System Operators justifying and quantifying the need for grid forming in their systems
- Identify the most efficient and socio-economically beneficial sources of grid forming and other stability services
- Market based procurement of system services e.g., UK Stability Pathfinder, German way of inertia procurement

Technology deployment and requirements

- Iterative process for concurring requirements and technological solutions
- Pilot project for PPMs in contrast to a mass deployment of mandatory requirements

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CO-LOCATION OF DIFFERENT TECHNOLOGIES IN LATEST DRAFT OF NC RFG

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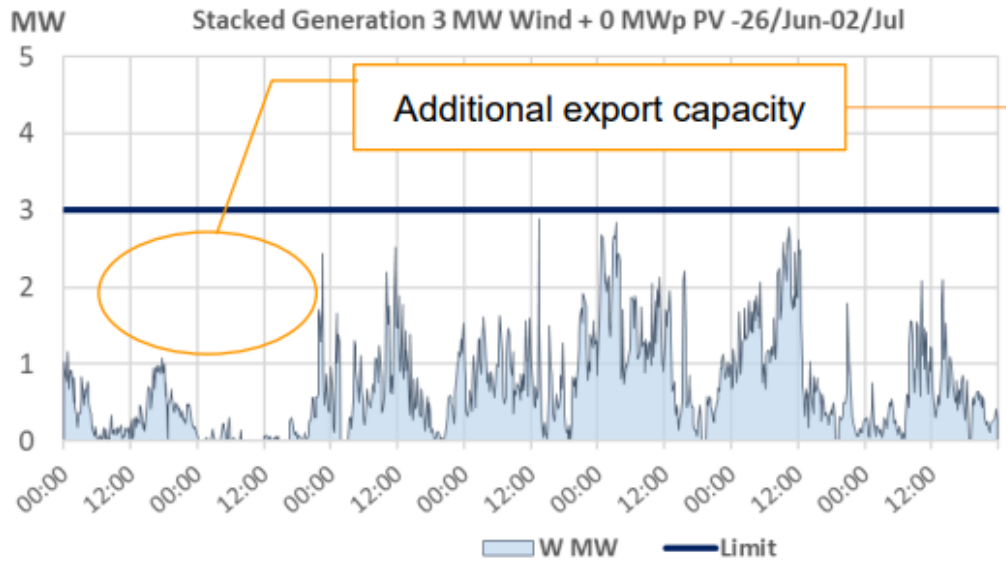
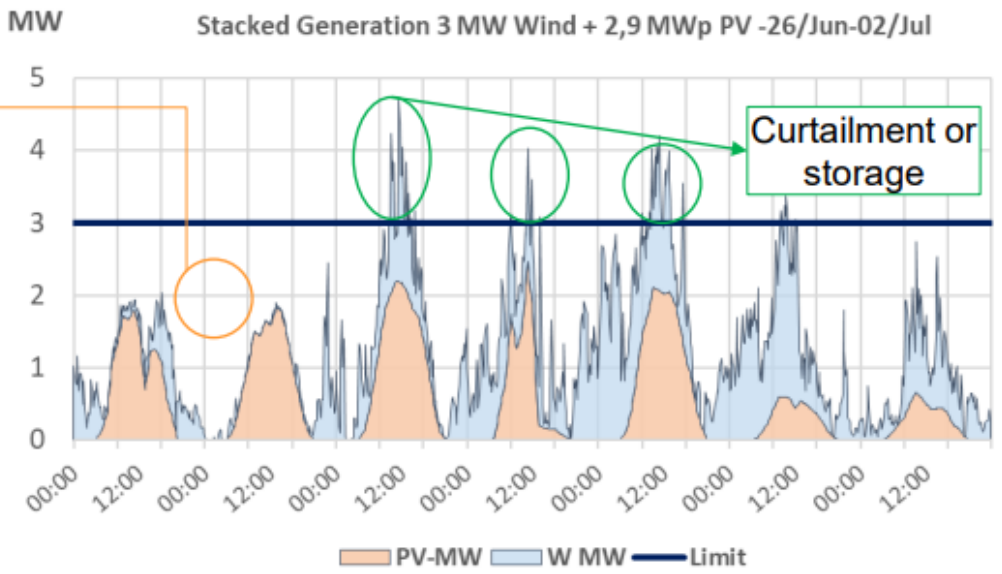
Better use of grid connections with hybrid power plants

3 MW – WTG in GER
3 MVA Trafo & NAP



Wind + simulated PV
3 MW WTG + 2.9 MWp PV
3 MVA Trafo & NAP



Yearly value	6 122 MWh	9 328 MWh

- Generation at site ↑ 48%
- Utilisation of grid-contracted capacity ↑13%
- Curtailed energy (or stored) < 3%

Co-location of different technologies needs better regulatory support

- 1 + 1 ≠ 2
- NC RfG Whereas 11 as it stands disincentivises co-location
- ACER explanation of various configurations is helpful but not harmonizing
- Need to define maximum export capacity, not necessarily as Pmax

Increased cost to society due to sub-optimal use of grid connection

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WindEurope recommendation on aggregation

- Flexibility to asset owner to install units of any technology of any capacity behind a single connection point

  → Asset exports power and complies with grid code requirements at the connection point based on maximum capacity agreed in the contract

- Differentiate when to use Pmax vs maximum export capacity to define requirements ensuring cost effective solutions

- Expert Group of stakeholders under ACER guidance to converge on open points

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Wishlist of actions

- System Operators assessment of **grid forming needs**
- Identify most efficient and **socio-economically beneficial sources** of grid forming and stability services
- **Market based procurement** of system services e.g., UK Stability Pathfinder, German way of inertia procurement
- **Pilot project for PPMs** in contrast to a mass deployment of mandatory requirements
- **Iterative process** for concurring requirements and technological solutions

- Flexibility to asset owner to install units of **any technology of any capacity** behind a connection point, as long as asset exports capacity as per contract
- Differentiate when to use Pmax vs **maximum agreed export capacity** to define which requirements
- **Expert Group** of stakeholders under ACER guidance to converge on open points

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