

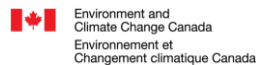
Upgrading Energy Regulations for the Energy Regulatory Commission (ERC) of the Philippines

Focus Group Discussion Amendment to PGC

28 February 2023
09:00-15:15 hours



The ETP brings together a range of partners focused on supporting the energy transition in Southeast Asia including:





Presentation of Ricardo: Summary of Proposed Amendments

General changes

- 1) PGC aligned to PDC, International Practice, IEC and IEEE
- 2) USAID proposed changes to PGC to ensure:
 - a) Alignment to IEEE 2800 – 2022
 - b) Alignment to IEEE 1547-2018

Specific changes

- 1) Energy Storage including Inverter Based Energy Storage System added
- 2) Power Quality and Power Measurement
- 3) Protection Arrangements
- 4) Reactive power range increased for Large Wind and PV technologies
- 5) Voltage control requirements
- 6) Fault ride through requirements
- 7) Frequency tolerance ranges
- 8) Conventional ESS Connection requirements
- 9) IBESS Connection requirements

Inclusion of Conventional Energy Storage Systems (ESS) & Inverter Based Energy Storage Systems (IBESS)



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Energy Storage Systems alignment to DOE circular No. 2019-08-0012 and Draft ESS policy 20 Jan 2023 and split into:

- 1) Conventional synchronous energy storage which includes:
 - Pumped-Storage Hydropower,
 - Compressed Air Storage, and
 - future hydrogen storage

- 2) Inverter Based Energy Storage Systems (IBESS) which includes
 - Battery Energy Storage Systems (BESS)
 - Flywheel
 - Variable Speed Generators

Power Quality and Power Measurement



Proposed updates to power quality based on IEC 61000 Series

1. Power Quality Instrumentation, assessment period, retained values and exclusions
2. Short and long term voltage variations
3. Harmonic levels
4. Flicker severity
5. Rapid voltage changes
6. Voltage dips
7. Voltage swells

Proposed updates to voltage measurements and accuracy thereof based IEEE2800-2022

Proposed Protection Arrangements:

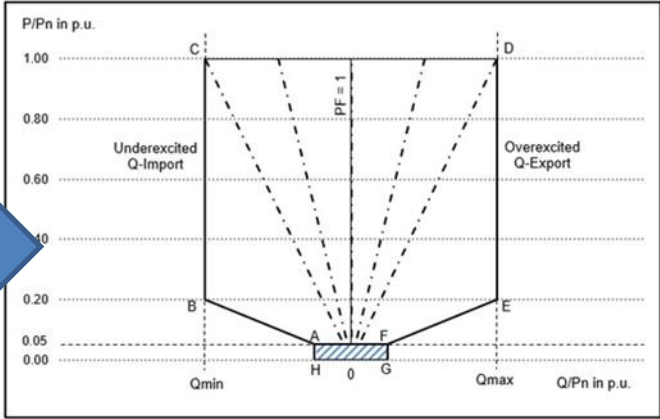
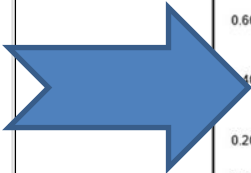
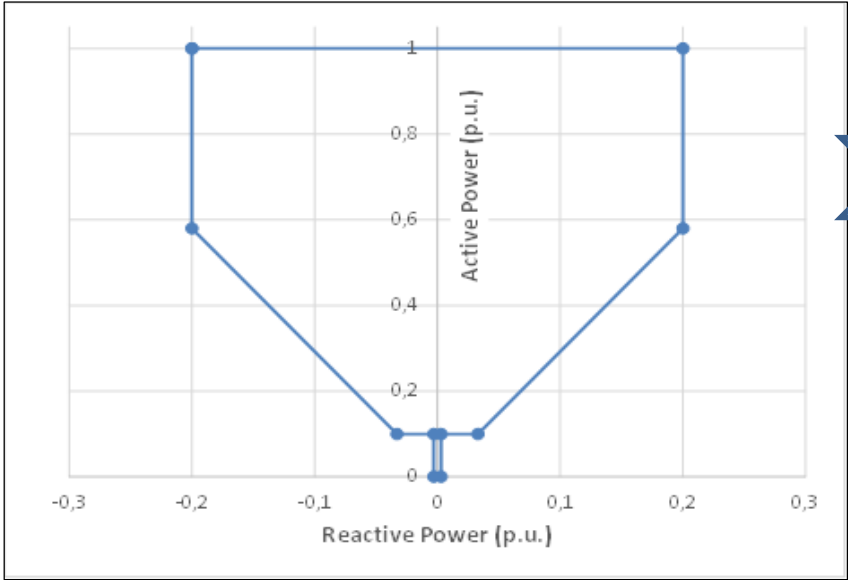
- 1) Protection coordination and prioritisation based on IEEE 2800-2022
- 2) The plant shall not energize the transmission system when the transmission system is de-energized. Except for Black Start.
- 3) The plant shall only enter into service or return to service when the frequency is in the range 59.5 Hz to 60.3 Hz and voltage is in the range 0.9 p.u. to 1.05 p.u.
- 4) Large Wind and PV shall not cause rapid voltage change at the POC to exceed 2.5% of nominal voltage.

Proposed Cyber Security requirements for generator owners based on IEEE 2800-2022

Inverter Based Reactive Power Range

Philippines reactive power capability for large wind farms and VRE – sections PGC GCR 4.4.3.3.2 and DGC 4.4.3.3.2

Proposal to align to IEEE 2800-2022 paragraph



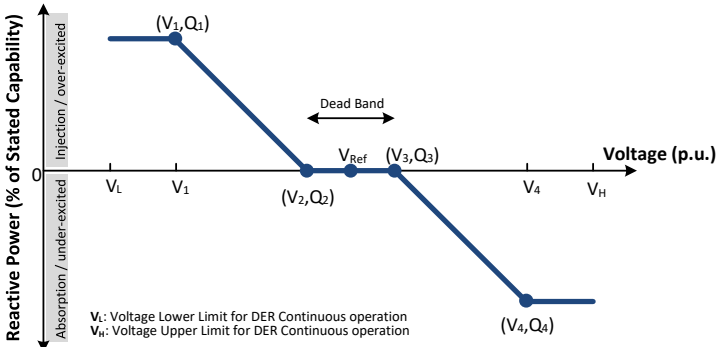
Proposed values

1. Threshold is 20%
2. Large Generators Q/Pmax range of ± 0.33 , equivalent to 0.95 leading and 0.95 lagging
3. Other Generators Q/Pmax range of ± 0.228 , equivalent to 0.975 leading and 0.975 lagging

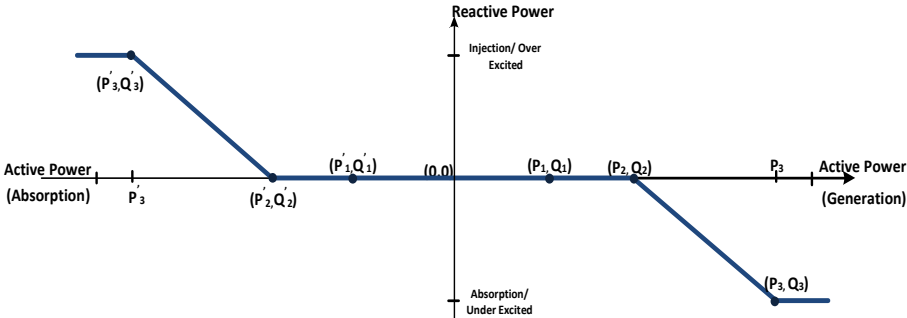
Voltage Control Requirements



IEEE 1547-1018 voltage-reactive power requirements



IEEE 1547-2018 active power reactive characteristic



Proposed to be applicable to IBESS including Large Wind, Large Solar, Conventional Energy Storage and Inverter Based Energy Storage System

Real power control proposed to be aligned with ACER IEEE2800 says TSO must decide

GCR 4.4.3.6.1 Large Wind Farms should be equipped with an Active Power regulation control system able to operate, at least, in the following control modes, provided that System Frequency is within the range ~~59~~ **58.8 Hz to 61.2 Hz**:

GCR 4.4.3.6.3 In case system Frequency exceeds ~~60.6~~ **61.0** Hz the Active Power control system should reduce the Active Power generated previously according to the following formula:

$$\Delta P = 45 \cdot P_m \cdot \left(\frac{60.6 - f_n}{60} \right)$$

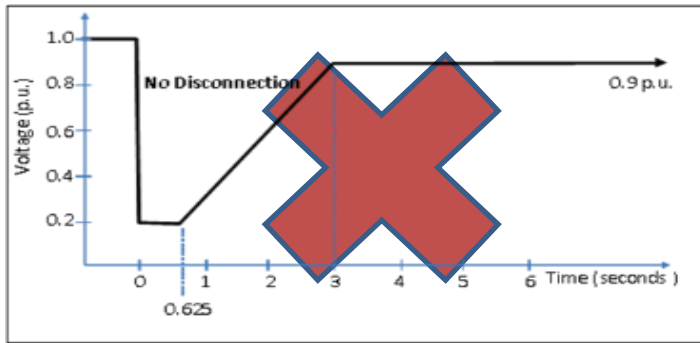
GCR 4.4.3.6.4 In case the System Frequency drops below ~~58.8~~ **59.0** Hz the Active Power control system should change to free Active Power production mode, generating the maximum possible Active Power output, compatible with the Availability of the primary resource.

Fault Ride Through Capability

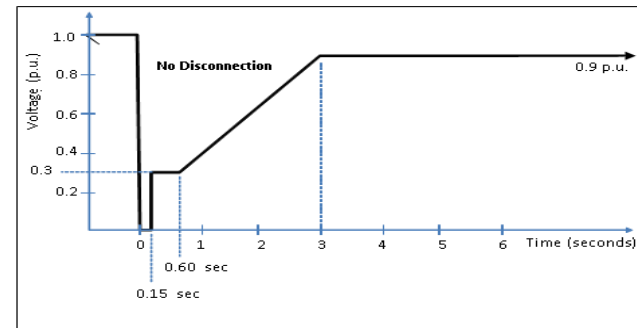


PGC Wind proposed to be aligned to PDC and IEEE 2800-2022

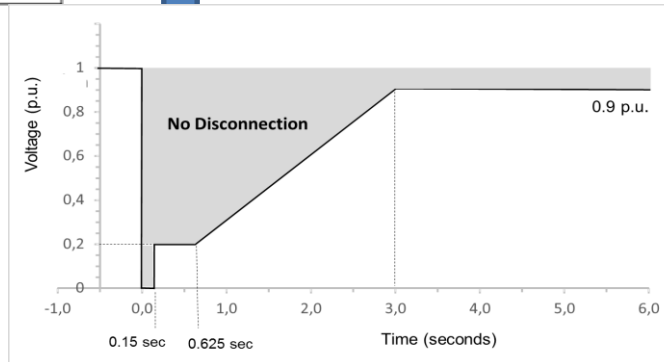
PGC Wind turbine fault ride through capability – section GCR 4.4.3.4.1



PGC Large PV fault ride through capability – section GCR 4.4.4.4.3



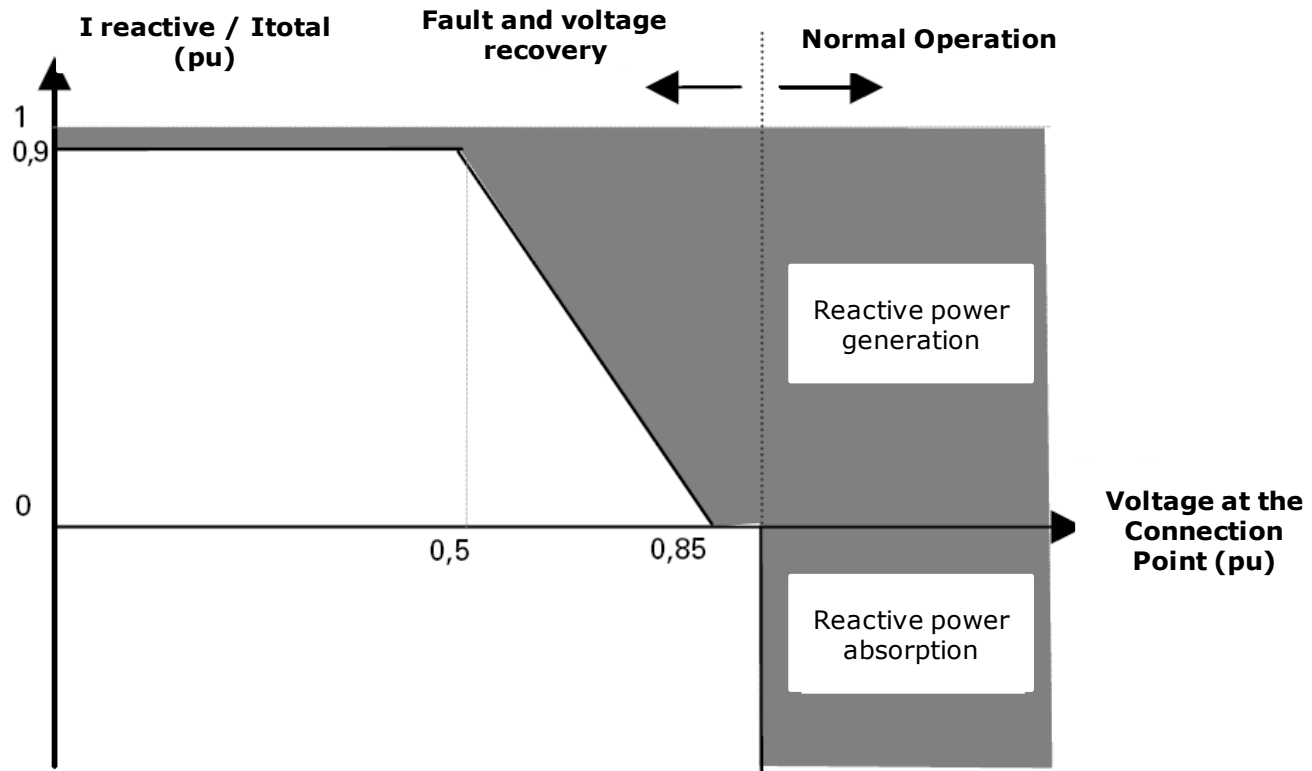
DGC Large, medium and intermediate VRE fault ride through capability – section 4.6.6.1



Inverter Based Reactive Power Generation During Faults



Proposed alignment to IEEE 2800-2022 7.2.2.3 and ACER



Recommendations for Frequency Tolerance



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The PGC requirements for frequency tolerance for continuous operation for all plant types are proposed to be aligned to

1. IEC60000 series specifically IEC60034-1 Rotating electrical machines - Part 1: Rating and performance
2. IEEE2800 - 2022

Frequency		Time
Hz	P.u.	
> 62.4 Hz	>1.04	Automatic Disconnection allowed, if so decided by the <i>VRE Generation Company</i>
> 61.2 – 62.4 Hz	>1.02 - 1.04	5 minutes
58.8 – 61.2 Hz	0.98 – 1.02	Continuous Operation
57.6 – <58.8 Hz	0.96 – <0.98	60 minutes
<57.6 Hz	<0.96	5 seconds

Conventional ESS Connection Requirements



Proposed Additional requirements to Conventional Generators are:

- 1) Synchronous Condenser Operation
- 2) Reactive power capability required when charging
- 3) Voltage control capability required when charging
- 4) No real power control required when charging
- 5) Additional data requirements such as energy storage capability, maximum charging capacity and maximum charging rate

IESS Connection Requirements

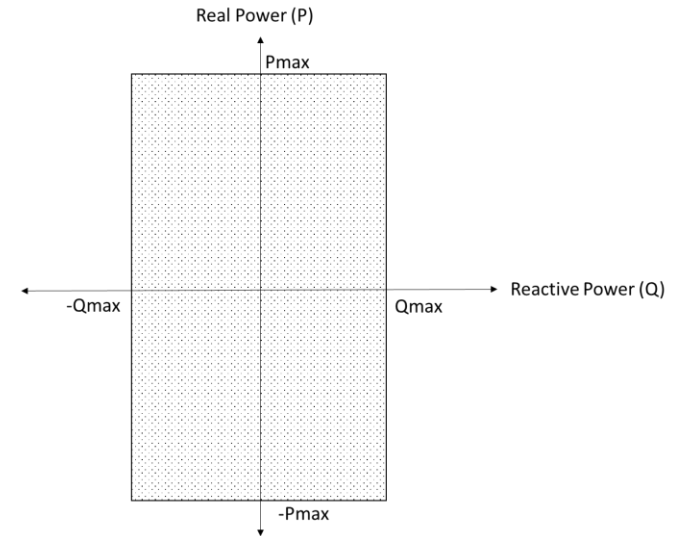


Proposed Additional requirements to Wind and PV are:

- 1) Reactive power capability required when charging
- 2) Voltage control capability required when charging
- 3) Real power control required when charging
- 4) Additional data requirements such as energy storage capability, maximum charging capacity and maximum charging rate

Proposed specific Battery Energy Storage Systems (BESS) and Flywheel Energy Storage (FES):

- 1) Battery Energy Storage Systems (BESS) and Flywheel Energy Storage (FES) shall be capable of achieving full Active Power requirement is less than a second.





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Thank You



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Key Points:

1) Compliance

- If there are new standards – be given time to carry out its own compliance assessment, prepare compliance plan (including technical competence, CAPEX and OPEX)
- 2016 Grid code
 - Allow 60 days to comply
 - But 60 days is not enough for applying compliance derogation
- Must have a separate tests (as COC requirements)
 - New plants
 - Renewal
 - Derated
- Legacy plants – **cannot comply and be exempted for compliance**
 - Include exemption in the PGC
 - Prospective application for the new amendments

2) Clarification on Process

2) Hydro

- Table for typical voltage duration
- IEC 61000- latest?
 - Allowable time is only 1 minute

3) PQ disturbance

- If to adopt IEC standard – affect equipment ratings
- There is no intention to change equipment standard

- N-0 condition
- How about for n-1 condition?
- Flicker severity – appears to have no limit
 - Planning = 0.9
 - There should be flicker severity in the figure

4) Use of standards

IEEE 1547 – embedded gen

IEEE 2800 – transmission

5) Definitions

- POC/DP = connection point
- Embedded generation = 100 kW

6) OATS rules

- 2022 edition
- If PGC is aligned

7) Harmonics

- Missing table

8) Alert and Emergency

- PGC – including in PSGG

9) Gas turbines

- Cannot comply with the proportionate value of frequency decay
- UK and others – compliance was written by turbine manufacturers – no issue on compliance

10) Inverters compliance fault ride through

- Grid forming
- Normal inverters + capacitor banks/statcoms

11) frequency response

- Is there a new study for frequency response
- Currently complying with PIS, awaiting for new AS rules

- Demand side – response
- Generation side
- AS should be designed to prevent automatic load shedding

12) GMC and DMC

- Reconstitution is being considered

13) Nuclear

- Additional provisions in PGC
 - Off-site supply
 - Reserved provision for large units
 - Unit size – dictated by manufacturer

14) large generators definition

- No change proposed

15) OSW and FSPV

- There are requirements for long-distance OSW, also requires connection codes

16) Pmax, Pmin

- Battery - charging and discharging

- 17) Align the upcoming policies re: AS Categories [with reference to PGC]
- 18) Primary frequency response should not be mandatory for those plants with no headroom.
- 19) Consider Fast Frequency Response & Inertia in the Amendments