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

Focus Group Discussion
Amendment to PDC

01 Mar 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

Key changes to PDC

General changes

1) PDC aligned to International Practice, IEC and IEEE
2) USAID proposed changes to PDC 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 Measurement
3) Distribution Technical, Design, and Operational Criteria
4) Reactive power range increased for Large Wind and PV technologies
5) Voltage control requirements
6) Fault ride through requirements aligned to international practice
7) Frequency tolerance ranges aligned to international practice
8) Conventional ESS Connection requirements
9) IBESS Connection requirements

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

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

Category	Installed Capacity and Characteristics
Small	Embedded Generating Plant including Embedded IBESS with Installed Capacity larger than 10 kW and equal to or less than 100 kW connected to LV networks.
Micro	Embedded Generating Plants including Embedded IBESS with Installed Capacity lower or equal to 10 kW connected to LV networks.
Conventional Energy Storage Systems (ESS)	Embedded Generating Plant with the capability to store Energy and use electrical Energy to charge and discharge the stored Energy.
Inverter Based Energy Storage System (IBESS)	Inverter Based Energy Storage System with Installed Capacity larger than 100 kW.

Power Quality and Power Measurement

Proposed updates to power quality based on IEC 61000 Series and IEEE 1547-2018

1) Power Quality Instrumentation, assessment period, retained values and exclusions
2) Harmonics
3) Flicker severity
4) Rapid Voltage changes
5) Voltage dips and swells
6) Proposed enter into service or return to service when the frequency is in the range 59.4 Hz to 60.3 Hz and voltage is in the range 0.9 p.u. to 1.05 p.u.
7) DC current injection limitations
8) Protection from electromagnetic interference (EMI)
9) Voltage Phase Angle Changes Ride-Through
10) Exemption for Embedded Generating Units for emergency systems

Proposed updates to voltage applicability, measurements and accuracy thereof based on IEEE 1547-2018

Distribution Technical, Design, and Operational Criteria

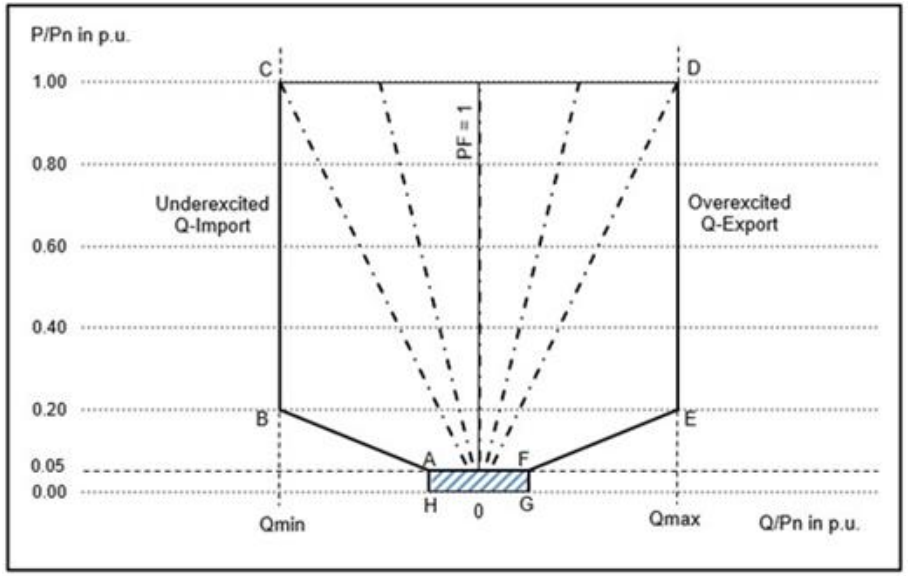
Proposed Protection Arrangements:

1) Protection coordination and prioritisation based on IEEE 1547-2018
2) Embedded Generator shall not energize the DUs Network when the DUs Network is de-energized. Except for Black Start.

Proposed Cyber Security requirements for generator owners based on IEEE 1547-2018

Inverter Based Reactive Power Range

Proposal to align to IEEE 2800-2022

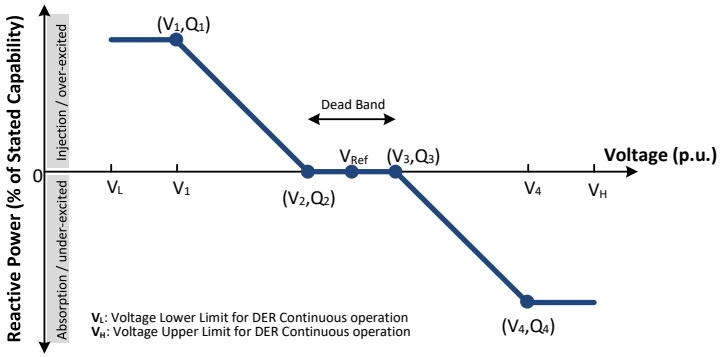


Proposed values

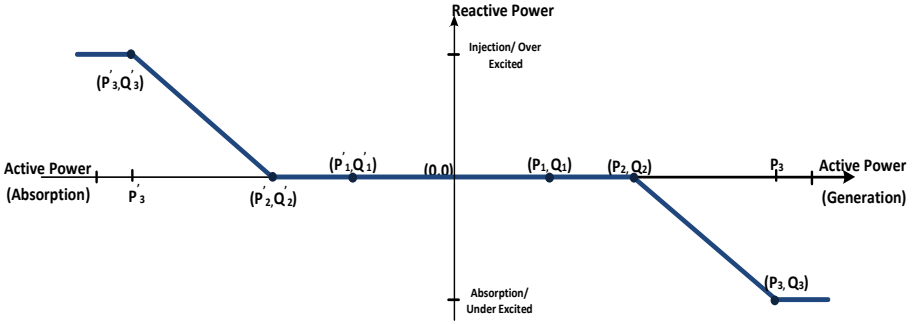
1. Threshold is 20%
2. Large Generators Q/Pmax range of ±0.33, equivalent to 0.95 leading and 0.95 lagging
3. Other Generators Q/Pmax range of ±0.228, equivalent to 0.975 leading and 0.975 lagging

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, Medium and Intermediate VRE, Conventional Energy Storage and Inverter Based Energy Storage System

Real Power Control Requirements

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

4.8.4.1 Intermediate Embedded Generating Plants should be equipped with an Active Power regulation control system able to reduce the Active Power in case System Frequency exceeds ~~61~~ 60.6 Hz. The reduction in Active Power to be achieved shall be calculated according to following formula:

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

Where:

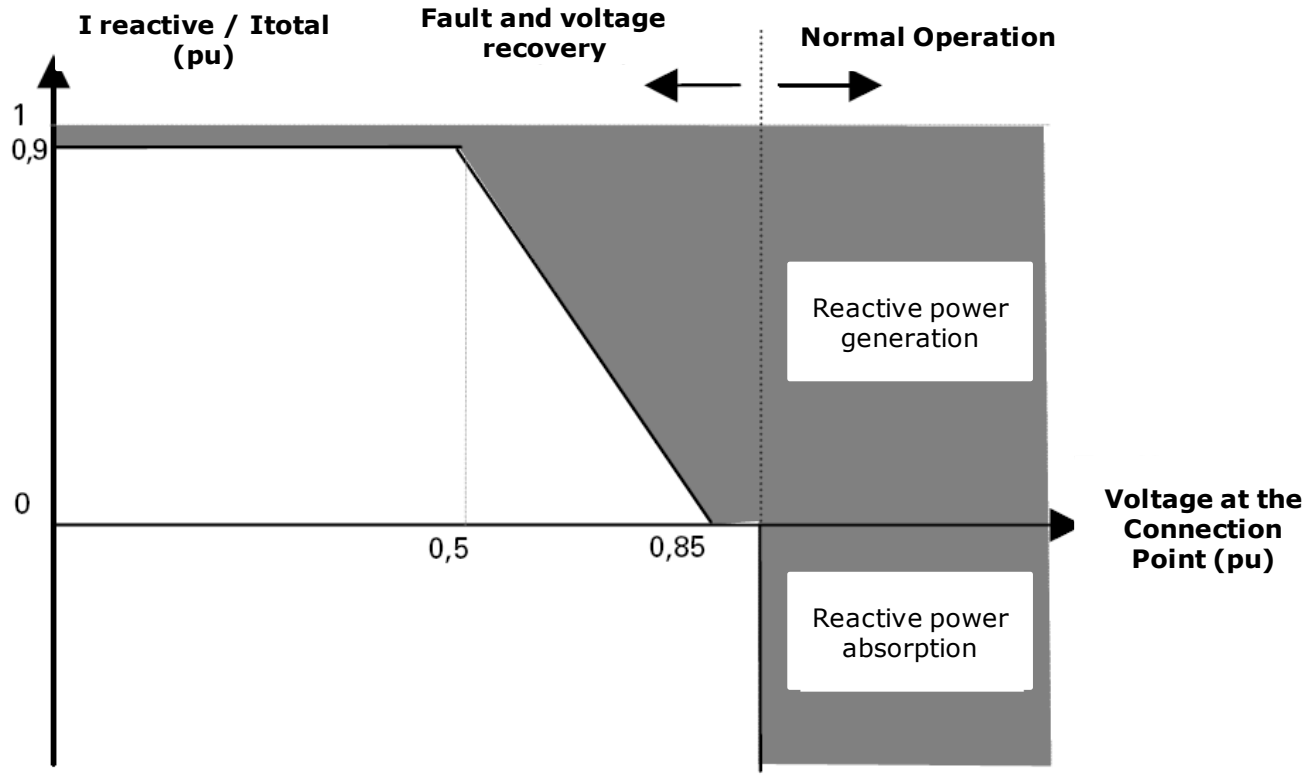
ΔP: is the variation in Active Power output that should be achieved

Pm: is the Active Power output before this control is activated

fn: is the network Frequency

Inverter Based Reactive Power Generation During Faults

Proposed alignment to IEEE 2800-2022 7.2.2.3 and ACER



Recommendations for Frequency Tolerance

The PDC 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 *VRE Generation Company*
> 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

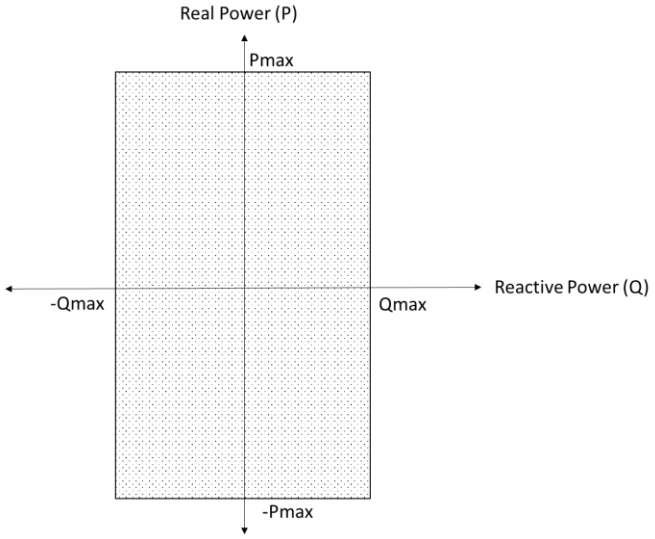
Proposed Additional requirements to Conventional Generators are:

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 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.

Thank You

Summary of Discussions

1) Harmonisation
   - DER rules and definitions with PDC
     - ESS and ESS company
   - Applicable rules is based on the connection points
   - Energy storage company/embedded generation

2) Matrix format
   - Indicate new provisions and amended provisions

3) Compliance to Power Quality
   - Specify compliance timeline
     - New standards – require training, quality meters – implication on costs
     - Major changes 'that will trigger compliance obligations for existing facilities'
     - Compliance plan, self assessment can be done during regulatory reset

4) Classification and compliance for ESS
   - Stand alone
   - Hybrid
   - ESS is generally considered as generator

5) Need to define

- **VRE as stand alone**
- **ESS as stand alone**
- **Hybrid facility**

6) Harmonics

- **standards**
  - **IEEE standard – limit the contribution to the grid**
  - **IEC standard – limit of individual equipment contribution**
  - **All equipment should comply with IEC standards**
    - **Who will take this analysis**

7) DOE ESS classification

- **Draft circular – 4 configurations**
- **Current PDC – stand alone, VRE**
- **Need for separate section for hybrid**

8) Connection requirement

- **Existing PDC only standards and policy**
- **No provision of technical connection requirement**
- **Any preparation to incorporate connection requirement for VRE?**

9) Reliability indicators

- **Updating of reliability indices**

10) Power quality standards

- **IEC 6100 vs EN 5160 vs IEEE**
- **Timeline of application of standards**
    - **Consideration on tariff impacts**

11) Proposal to Adopt PDC Generator Categorization for VRE/ESS