EnergyCo

Centralised System Strength fee reduction methodology

Hybrid projects allocated Access Rights in Central West Orana REZ Application Process

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Centralised System Strength fee reduction methodology

Executive Summary

The Centralised System Strength (CSS) fee reduction methodology provides a pathway for hybrid projects with a grid forming component to reduce their CSS charges.

This methodology requires the grid forming component of the plants to pass a number of tests, modelled on the AEMO System Strength Impact Assessment Guidelines (SSIAG), to prove their reduced system strength impact. These tests are detailed below.

Summary of terms

3PHG. Three-phase to ground

AEMO. Australian Energy Market Operator

BESS. Battery Energy Storage System

CSS. Centralised System Strength

DMAT. Dynamic Model Acceptance Test

EMT. Electromagnetic Transients

PoC. Point of Connection

PU. Per Unit

SCR. Short Circuit Ratio

SMIB. Single Machine Infinite Bus

SSIAG. System Strength Impact Assessment Guidelines

X/R. Reactance/Resistance Ratio

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Overview of assessment criteria

Self-remediation and Reduced SCR assessment for hybrid projects

This section clarifies which components of the hybrid plant (i.e. the BESS component and the solar/wind component) are required to meet which levels of performance.

Evidence required for Grid forming plant

This section details the evidence expected for the BESS component of the plant to demonstrate that it is “grid forming”.

Withstand SCR tests 1-3

This section details the specific tests required to prove that the grid forming element of the plant is stable at an SCR of 1.2, in a SMIB environment.

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1. Self-remediation and Reduced SCR assessment for hybrid projects

Table 1: Testing and system strength charges discount subject to assessment

Type of plant	Type of tests required when discount sought	Discount in System Strength component of access fees
Hybrid project	BESS component of the plant must be compliant with Table 2 Grid following component of the plant must prove withstand SCR <= 2.2 (as per section 3) **without BESS connected**	As per formula in Access Fee Determination

2. Evidence required for Grid forming plant

Table 2: Tests required for Grid Forming plant at time of applying for discount

	Description of the test	Evidence required at the time discount sought
1	Inverters should have at least 20% current overload capacity (continuous) that is not used under steady state.	OEM data sheet
2	Inverters should act as an internal voltage source behind an impedance. a) withstand SCR of 1.2. b) withstand SCR of 1.0 at active power output reduced to 0.8pu. c) Oscillation rejection tests with other sources of oscillation in the system connected. The magnitude of oscillations should reduce after the connection of the Grid Forming inverter. The test can be done in a Single Machine Infinite Bus environment. The source voltage is modulated with variety of frequency (0.1 HZ – 50Hz). Magnitude of the variation is kept at 1-2%. The expected plan shall respond to the forced oscillation and voltage oscillations at plant terminal shall be less than the injected oscillation in the infinite source.	Electromagnetic Transients (EMT) model of the plant and Single Machine Infinite Bus (SMIB) EMT study results.

Review of the Grid Forming Test results (based on the report submitted) can be done in **3 business days**.

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3. Withstand SCR tests (1/3)

The following tests can be used to prove the withstand SCR.

1. Test as per Table 3 and 4 below

Table 3 Minimum set of tests for demonstration of stability [at SCR of 1.2 or lower]

Test	Fault duration	Fault type	Fault impedance Zf [pu]	Applied Fault Voltage [pu]	Withstand SCR [pre-fault] to [post-fault]	X/R	Active Power [pu]	Reactive Power [pu]
1	0.43	3PHG	Zf=0	0	For tests 1 to 4: Single SCR value is applied (1.2 or lower)	Single applicable value at POC, expected or estimated range. (in absence of estimated range, use X/R of 3 and 10)	1	0
2	0.43	3PHG	Zf=0.66 x Zs	~0.4			1	0
3	0.43	3PHG	Zf=4 x Zs	~0.8			1	0
4	0.43	3PHG	Zf=9 x Zs	~0.9			1	0
5	0.43	3PHG	Zf=0	0	For Tests 5 to 8: change from pre-fault Withstand SCR of 10 to the post-fault Withstand SCR (1.2 or lower)		1	0
6	0.43	3PHG	Zf=0.66 x Zs	~0.4			1	0
7	0.43	3PHG	Zf=4 x Zs	~0.8			1	0
8	0.43	3PHG	Zf=9 x Zs	~0.9			1	0

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3. Withstand SCR tests (2/3)

Table 4 Minimum set of tests for voltage step tests [at SCR of 1.2 or lower]

Test	Event	Withstand SCR	X/R	Active Power [pu]	Reactive Power [pu]
1	Grid voltage is stepped from 1 pu at time = 10 s to 0.95 pu, and stepped back to 1.0 pu	1.2 or lower	Single applicable value at POC, expected or estimated range. (in absence of estimated range, use X/R of 3 and 10)	1	0

3. Withstand SCR tests (3/3)

2. Unbalanced faults as per AEMO Dynamic Model Acceptance Test (DMAT) tests 42, 53 and 62 with the following details.

Table 5 Minimum set of tests for unbalanced faults [at SCR of 1.2 or lower]

Test	Fault duration [s]	Fault type	Fault impedance Zf[pu]	Withstand SCR	X/R	Active Power	Reactive Power
42	0.43	2PHG	Zf = 0	1.2 or lower	PoC X/R of minimum fault level. OR If PoC X/R is not known, X/R of 3 and 10	1.0	0.0
53	0.43	2PHG	Zf = Zs			1.0	0.0
62	0.43	1PHG	Zf = 0			1.0	0.0

3. Grid phase angle jump test as per AEMO DMAT test 195 with angle jump of ±30 degrees.

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