2023-24 System Strength Unit Prices

Calculation methodology for Transgrid's 2023-24 System Strength Unit Prices

Summary

Driven by the *Efficient management of system strength on the power system* rule change, new connecting generators have the option to pay a system strength charge to 'consume' system strength services provided by the regional System Strength Service Provider (SSSP), being Transgrid in NSW and ACT, or to self-remediate their plant's system strength impact. The system strength charge payable is dependent on the System Strength Unit Price, the location of the generator and the Short Circuit Ratio (SCR) withstand capability of the generator (i.e. the quantity of system strength being consumed).

Transgrid is required to publish a System Strength Unit Price for each system strength node in NSW, which is set for a period of 5 years and reset at the start of the second year of a regulatory control period. Transgrid published its System Strength Unit Prices on 15 March 2023, will republish prices on 15 March 2024, and every 5 years thereafter.

The System Strength Unit Price is intended to reflect the long run cost of providing the efficient quantity of system strength using scale-efficient solutions optimised across the network. Transgrid's System Strength Unit Price is calculated in line with Australian Energy Regulator (AER) guidelines and Transgrid's approved pricing methodology.

Regulatory Requirements

Transgrid's approach to calculating the System Strength Unit Price is dictated by:

(i) The National Electricity Rules, which sets out the requirements for the system strength charge, including definition and publication of the System Strength Unit Price;

(ii) The AER's System Strength Pricing Methodology Guidelines, published on 25 August 2022 which specify the *"permitted methodologies for determining the system strength unit price component of the system strength charge"*;

(iii) Transgrid's Pricing Methodology for the 2018 – 2023 regulatory period, as approved by the AER on 31 January 2023, which explains the methodologies that Transgrid will apply to determine the System Strength Unit Price, and how these methodologies comply with the AER Pricing Methodology Guidelines and the National Electricity Rules.

Given that this is a new obligation, Transgrid voluntarily engaged a third party to review and provide assurance over the approach and calculation of System Strength Unit Prices for 2023-24 to ensure consistency with these requirements.

System Strength Unit Price Methodology

Transgrid's System Strength Unit Price is calculated in accordance with the following formula:

$$SSUP_{node} = \frac{Total\ long\ run\ cost\ of\ system\ strength\ solutions\ at\ a\ node\ over\ 10\ years}{System\ strength\ hosting\ capacity\ provided\ at\ a\ node\ over\ 10\ years}$$

The System Strength Unit Price is represented as $/MVA$_{fault\ current}$.

Total long run cost of system strength solutions (numerator)

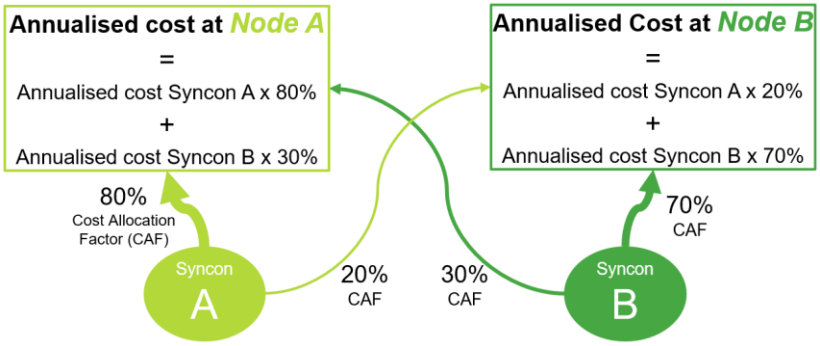
On 16 December 2022, Transgrid published its system strength Project Specification Consultation Report (PSCR), the first stage of the Regulatory Investment Test for Transmission (RIT-T), which identified a

portfolio of 22 synchronous condensers (or equivalent) would be required to meet NSW's system strength needs by FY2033. Transgrid's 2023-24 System Strength Unit Price was estimated based on this portfolio of network-owned synchronous condensers, given that the RIT-T had not yet been completed. The RIT-T will employ techno-economic and market analysis to identify the optimal mix of system strength solutions, including non-network solutions where they offer a superior cost-benefit to network capital investment.

Transgrid expects that non-network options are likely to play a key role in the provision of system strength – which may include services from existing market generators, plant conversions or modifications or new technologies such as grid-forming batteries. Once Transgrid completes its system strength RIT-T and finalises network investments and/or contracts for non-network services, future System Strength Unit Prices will reflect the *actual* mix of solutions employed.

Transgrid's approved pricing methodology states that "*the capital and operating costs of providing system strength capacity may be attributable to more than one system strength node".* System strength support travels throughout the network (rather than limited to a single node), though it degrades as you move further away from the source[1]. Transgrid's methodology recognises that solutions will contribute services to more than one node, and allocates costs based on the fault current contribution to each node, as represented by Figure 1.

Figure 1: Example allocation of annualised synchronous condenser costs to different system strength nodes



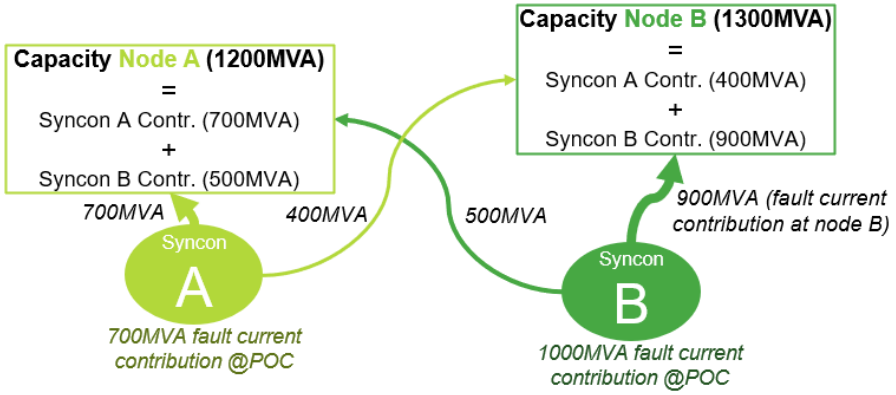
System strength hosting capacity (denominator)

The hosting capacity within Transgrid's System Strength Unit Price reflects the amount of system strength provided to each node, measured in $MVA_{fault\ current}$. As per Figure 2, the system strength hosting capacity is therefore calculated as the sum of the fault current provided to each system strength node by the portfolio of system strength solutions.

System strength solutions can provide fault current to all system strength nodes, rather than being limited to supporting a single node. This effectively means that system strength support from multiple solutions is 'shared', with solutions near one node also supporting additional inverter-based resources in multiple other locations. With all else being equal, this should reduce the unit cost of the central provision of system services, relative to the individual procurement of system strength for each new connecting generator.

[1] Fault current is inversely proportional to network impedance, the larger the impedance between the source and fault location, the smaller the fault current from that source.

Figure 2: Example fault current contribution of synchronous condensers to different system strength nodes



Other key assumptions

- **Efficient level of system strength:** Transgrid's System Strength Unit Prices reflect the provision of system strength services to meet both the minimum and efficient requirements. The Available Fault Level (AFL) methodology has been used to calculate the system strength requirements of AEMO's 2022 System Strength Report inverter-based resource forecasts.
- **Interstate contributions:** As determined in collaboration with AEMO and the other SSSPs, interstate system strength contributions will be freely shared between regional SSSPs. This means that contributions from other states will be provided at zero cost to Transgrid (and likewise, NSW contributions to other states will be considered at no cost to them). These contributions are therefore excluded from the SSUP calculation both in terms of cost (numerator) and their fault current contribution (denominator).
- **First two years of the 10-year forecast:** System Strength Unit Prices are required to be based on annualised capital and operating costs over a 10-year period. Transgrid assumes that we will not put solutions in place (or incur related costs) prior to 2 December 2025 when the new system strength rule obligations take effect. Hence, there are two years of zero costs included in the 10 year forecast used to calculated the average price. As a result, Transgrid's 2023-24 System Strength Unit Prices are slightly lower than they will be in future years (all else being equal).
- **Costs borne by Transgrid:** Transgrid has excluded from its cost estimates the small electrical losses associated with the operation of the (theoretical) portfolio of synchronous condensers. We consider that these losses are captured elsewhere as transmission system losses within Marginal Loss Factor calculations and therefore are outside the scope of costs that should be captured for system strength (in applying the AER's pricing methodology[2]).

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[2] The AER pricing methodology states that w*here the TNSP is the System Strength Service Provider for a region, its proposed methodologies for determining the system strength unit price component of the system strength charge must be based on a forecast of its long run average costs of providing system strength transmission services at the relevant system strength node.*