



Queensland to New South Wales  
Interconnector Upgrade  
PSCR Submission

February 2018

22 February 2019

Regulatory Consultation  
TransGrid/Powerlink

Dear Vincent Ong and Manesh Narotam,

**Submission to the TransGrid/Powerlink 'Expanding New South Wales – Queensland Transmission Transfer Capacity' Project Specification Consultation Report**

Smart Wires are pleased to make this submission in response to the TransGrid/Powerlink Expanding New South Wales – Queensland Transmission Transfer Capacity (“the expansion”) Project Specification Consultation Report (PSCR). As the leading provider of modular power flow control solutions, we believe we are in a position to provide a unique and valuable perspective on the practical integration of state of the art power flow control technology to maximise the utilisation and capability of the existing transmission network in the context of the expansion, and welcome the opportunity to contribute towards the development of a reliable, flexible and efficient solution to address the electricity supply needs of New South Wales, Queensland and the National Electricity Market (NEM).

The PSCR outlines the need for increased transfer capacity between New South Wales and Queensland to deliver an increase in overall net market benefits to the NEM through more efficient sharing of generation resources, including greater use of existing, relatively modern, coal-fired generation in Queensland to reduce the need for new gas fired generation in New South Wales following the planned retirement of Liddell power station, and by opening up targeted geographical areas for development of renewable energy resources to help meet the Queensland Renewable Energy Target (QRET) and assist the nation to meet carbon emission targets at lowest long-run cost. The strengthened interconnection is consistent with the recommended longer term strategy outlined in the Australian Energy Market Operator (AEMO) Integrated System Plan (ISP) to increase the transfer capacity between New South Wales and Queensland, and in doing so is expected to provide benefits derived from improved competition between regions and enhanced system reliability and system security.

**Proposed options and an alternative**

The PSCR describes a number of possible options for upgrading the interconnection between New South Wales and Queensland, including line upgrades, new line construction, dynamic and static reactive support, HVDC options, grid-connected battery storage, as well as a range of non-network options that include both demand and supply side solutions. A potential solution that is conspicuous by its absence is the consideration of series compensation in any of the options. As explained during the recent webinar jointly hosted by TransGrid and PowerLink, the exclusion of series compensation from the prospective options is due to technical concerns that were considered during the 2014 Queensland – New South Wales interconnector (QNI) upgrade Regulatory Investment Test for Transmission (RIT-T). These concerns included the possibility of Sub-Synchronous Resonance (SSR) and the exclusion of renewable generation connections along the series compensated line route, potentially requiring thyristor switched capacitors to eliminate SSR issues and long line connections for renewable generators to bypass series compensated line sections.

Recognising the objective of the RIT-T process to assess a range of feasible options and identify that which represents the best value to the market, we would like to introduce an alternative solution that employs the use of modular power flow control equipment to effectively provide series compensation services without the negative technical restrictions previously described. The equipment could potentially be used on its own to provide new options, or combined with existing options to optimise the benefit they provide.

### Modular power flow control equipment

Modern power flow control technology duplicates the function of a number of traditional high voltage power system solutions, while possessing unique characteristics that can be used to offer considerable advantages in the development and operation of the transmission network. It allows previously unavailable options for network augmentation to be considered when planning and assessing solutions that are responsive and adaptable to the rapidly changing needs of modern power systems arising from the energy transition that is currently being experienced both in Australia and across the globe.

The power flow control equipment that we propose to be considered in this case is Smart Wires' modular static synchronous series compensator (M-SSSC) technology, commercially known as SmartValve™. The SmartValve is a modular FACTS device that is installed in series with a transmission line, providing for control of power flow along the line by modifying the apparent series impedance of the line. Able to synthesise both a positive or negative reactance, it can be used to replicate the effect of series capacitors or series reactors in steady state with enhanced functionality while eliminating some of the technical concerns that accompany the traditional series compensation equipment.

### Characteristics of series compensation provided by M-SSSC

In comparison to conventional series capacitors, the series compensation services provided M-SSSC technology has a number of unique, beneficial characteristics:

- No sub-synchronous resonance – As the effective series capacitance provided by a M-SSSC is synthesised at the main system frequency (50 Hz), there are no sub-synchronous resonant frequencies resulting from the equipment being installed in the network, and therefore no associated risks of SSR occurring.
- Management of sub-synchronous control interactions – The injection voltage generated by the voltage-sourced converter within the M-SSSC can be controlled to be independent of the line current, thus decoupling the control system of the M-SSSC from the control systems of inverter-based renewable generators and eliminating the risk of sub-synchronous control interaction occurring.
- Controllable series reactance – The level of series capacitance provided by the M-SSSC can be continuously varied, and even operated as a series inductance if required, to provide adjustable power flow control to balance line flows in addition to providing series compensation services. This can be used to address varied operational scenarios, such as different generation patterns, changes in network configuration or line ratings over time, etc.
- Flexible – The modular and controllable nature of the power flow control technology allows the system to be adapted to future changes in network topology, or even be repurposed to another network need in future if required.

- Cost effective – Defer or eliminate the need for expensive network augmentations, such as line upgrades or new builds, by increasing utilisation of existing assets through the balancing of flows on lines to increase transfer capacity of transmission corridors.
- Timely implementation – Address network constraints and deliver network benefits in timeframes that are considerably shorter (e.g. under one year) than those required by traditional network augmentation (several years for planning, permitting, and construction).

### Application to the Expanding the New South Wales – Queensland Transmission Transfer Capacity project

Previous work performed during the 2014 RIT-T evaluation of options to further develop the QNI identified and quantified the benefits that could be obtained from the use of series compensation on various QNI lines.<sup>1</sup> The series compensation based options provided a substantial improvement to the QNI transfer capacity and were amongst the preferred options, ranking highly under a number of the considered scenarios. However, the work also cited the concerns surrounding SSR and potential costs resulting from renewable generator connection exclusion zones. By exploiting the characteristics of the modern power flow technology described within this submission, the potential benefits of series compensation that have already been identified can be obtained without the drawbacks that accompany conventional series compensation equipment.

The previous work also identified the existing thermal constraints, particularly those that exist on 330 kV lines in Northern NSW, near Muswellbrook and Tamworth. It is expected that the potential benefit to be gained from series compensation could be maximised by combining it with other line works; either on existing line routes where thermal line rating upgrades are combined with series compensation of the QNI line route, or in conjunction with new line construction, where the controllable series compensation provided by M-SSSC technology can also be used to balance flows between the existing and new interconnection circuits under different operating conditions.

We hope that the description of this application of our technology has provided fresh insights into how series compensation may still be integrated into the scope of the proposed solutions, potentially offering a greater and more economical expansion of the New South Wales – Queensland interconnector transfer capacity than would otherwise be possible. We look forward to collaborating with TransGrid and Powerlink on the expansion RIT-T and to together exploring the concepts described in this submission.



**James J. Codd** | Business Development Associate, APAC  
+61 (0) 45 1123 115 (AUS) | [james.codd@smartwires.com](mailto:james.codd@smartwires.com)

**Paul Harrington** | Manager of Customer Solutions, APAC  
+61 (0) 405 510 872 | [paul.harrington@smartwires.com](mailto:paul.harrington@smartwires.com)

**Yves Meyer** | Vice President, International Business Development  
+1.415.859.1270 | +61.0.437.413.935 | [Yves.Meyer@smartwires.com](mailto:Yves.Meyer@smartwires.com)

---

<sup>1</sup> Development of the Queensland – NSW Interconnector: Project Assessment Conclusions Report