Reinforcing the New South Wales Southern Shared Network

PSCR Submission

September 2019

19 September 2019

Regulatory Consultation
TransGrid

Dear Andrew Kingsmill,

Submission to the TransGrid 'Reinforcing the NSW Southern Shared Network' Project Specification Consultation Report

Smart Wires are pleased to make this submission in response to the TransGrid 'Reinforcing the New South Wales Southern Shared Network' 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 capability and utilisation of the southern New South Wales (NSW) transmission network in the context of the proposed expansion and reinforcement of the existing network. We welcome the opportunity to contribute towards the development of a robust, effective and efficient solution to address the future electricity supply needs of NSW and the wider National Electricity Market (NEM) as a whole.

Acknowledging the essential requirement to provide a significant increase in the transmission capacity between the Snowy/Victoria area, south-western NSW and the greater Sydney load area, and the objective of the RIT-T to identify the option that represents the most economic and technically feasible solution, we would like to propose the use of modular power flow control (MPFC) equipment as an integral part of the project. In doing so, we see the potential for MPFC to extract the maximum capability from the existing transmission system and the proposed transmission augmentations more economically and with greater flexibility.

Modular power flow control equipment

Modular power flow control technology provides the flexibility to duplicate the functionality of a number of traditional high voltage power system solutions. The technology possesses unique characteristics that offer clear advantages over traditional solutions and at the same time avoids some of their drawbacks. It allows previously unavailable options for network augmentation to be considered when planning and assessing solutions that are responsive and adaptable to the evolving needs arising from the renewable energy transition.

In this case, the equipment being proposed is Smart Wires' modular static synchronous series compensator (M-SSSC), commercially known as SmartValve™. Being a modular FACTS device that is installed in series with a transmission line, it provides the ability to modify the apparent series reactance of the line to either decrease or increase the power flow on a line. When compared to other traditional methods of power flow control and equipment, the M-SSSC technology exhibits a number of advantages:

- Controllable series reactance – the adjustable power flow control that is provided can 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 it to be adapted to future changes in network topology, readily expanded, reduced, or even be repurposed to another network need in future if required.

- Cost-effective – the M-SCCC equipment can be more cost-effective than other common solutions, while often allowing deferral of, or eliminating the need for, expensive network augmentations by increasing utilisation of existing assets through the balancing of flows on lines to increase transfer capacity of transmission corridors.
- Short installation outages – the technology comes to site pre-assembled and requires no power supply, no protection or control wiring, and normally no changes to existing protection schemes. As such it can be installed and connected to the existing network quickly, minimising the associated outages and potential for constraints on generation or increases to security of supply risk.
- No subsynchronous resonance – as the effective series capacitance provided by a M-SSSC is synthesised at system frequency only, the susceptibility to resonance at subsynchronous frequencies associated with series compensation using series capacitors does not exist.
- Management of sub-synchronous control interactions – The injection voltage generated by 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.
- Fails safe with inherent redundancy – the integrated bypass technology and modular design minimises the impact that failure of any one module has on the performance of the overall system. Modular building blocks can be easily and quickly replaced, while the cost of obtaining and maintaining system spares is significantly lower than some alternatives, such as phase-shifting transformers.

Application to Reinforcing the NSW Southern Shared Network

The solution proposed in the PSCR provides a significant increase in the transmission capability between Snowy and Bannaby, achieved by constructing two new circuits between a new Maragle substation in the Snowy region to Bannaby, optionally via Wagga. To derive the maximum possible increase in capacity from these two lines, high capacity conductors are specified, with phase-shifting transformers (PST) to be installed at Wagga to ensure power flows along the longer western line route. Our proposal is to employ the abovementioned modular power flow control equipment on the new lines to improve the performance of the augmentation and provide maximum capability improvement under the widest range of operating conditions and future scenarios. We also propose that the equipment be considered as an economic substituted for the proposed PST on the Bannaby-Sydney West 330 kV circuit.

Replacement of PST's on Wagga-Bannaby line(s)

We propose that in place of installing PST's on the Wagga-Bannaby line(s), consideration be given to installing MPFC equipment on this circuit(s) instead. By operating the MPFC in capacitive mode, flows on the circuit(s) could be increased, but with the following advantages over the PST solution:

- The cost of the MPFC is likely to be significantly less than the cost of the equivalent PST solution.
- Series compensation with MPFC would reduce the overall $I^2.X$ losses on the line, reducing the need for additional reactive support plant.
- Ongoing maintenance of complex tap-changers and oil management is avoided.
- A significant reduction in the cost of spares, as the modular nature of the MPFC means that failure of a module only results in an incremental loss of capability, in comparison to the costs of acquiring and maintaining a spare PST.

Installation of MPFC on Maragle-Wagga and/or Maragle-Bannaby

The installation of PST's on these circuits has not been proposed in any of the options contained in the PSCR. While the cost to acquire and install a PST remains relatively high even if only a small level of phase adjustment is required, smaller installations of MPFC equipment can be implemented at lower costs to economically provide power flow control in smaller increments. We therefore propose that installations of MPFC on the Maragle-Wagga and Maragle-Bannaby lines should also be considered to economically increase the utilisation of the new high capacity circuits and therefore maximise the capability provided by the project.

Installation of MPFC on Bannaby-Sydney West line

The control offered by the proposed PST on the Bannaby-Sydney West line might also be more economically provided by MPFC equipment. The flexibility provided by the modularity of the equipment would also allow for the MPFC installation to be adapted following any future augmentations involving the development of a substation at South Creek and associated parallel circuits. The advantages of MPFC over a PST regarding cost of installation, spares and ongoing maintenance would apply equally to this installation.

Further considerations in the southern network

The connection of significant levels of wind resources in the Southern Tablelands also impacts the occurrence and location of thermal constraints in the network between Bannaby/Marulan and Avon/Dapto. By strategically integrating power flow control into this network, any additional constraints that limit the benefits of the planned project may be able to be managed to optimise network capability across a range of renewable generation dispatch patterns.

We hope that this submission and the description of this application of our technology has provided an insight into the scope for an alternative solution option that could meet the network need as described in the ISP and PSCR. We look forward to collaborating with TransGrid on the Reinforcing the NSW Southern Shared Network RIT-T and to together exploring the solutions described in this submission.

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REIMAGINE THE GRID

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