SMART WIRES
REIMAGINE THE GRID

Victoria to New South Wales Interconnector Upgrade

PSCR Submission

February 2018

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Planning and Consultation
AEMO/TransGrid

Dear Nathan White, Andrew Kingsmill,

Submission to the AEMO/TransGrid 'Victoria to New South Wales Interconnector Upgrade' Project Specification Consultation Report

Smart Wires are pleased to make this submission in response to the AEMO/TransGrid Victoria to New South Wales Interconnector Upgrade (VNI) 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 VNI, and welcome the opportunity to contribute towards the development of a reliable, flexible and efficient solution to address the electricity supply needs of Victoria, New South Wales and the National Electricity Market (NEM).

The PSCR outlines the need for increased transfer capacity between Victoria and New South Wales to deliver both economic and technical benefits to the NEM, through more efficient sharing of generation resources, resulting in a more reliable and resilient power system. Amongst the prospective network developments required to achieve this, the PSCR lists an uprating of the Upper Tumut to Canberra 330 kV line, intended to increase the transfer capacity of the 330 kV transmission grid between Lower Tumut and Upper Tumut to the south, and Canberra and Yass to the north. It is this portion of the VNI development that we would like to consider in this submission.

Acknowledging the essential requirement of the solution, to improve the transfer capability of the Snowy to Canberra/Yass transmission corridor, we would like to introduce an alternative solution option for consideration that employs the use of modular power flow control equipment to address the core need, but potentially delivers additional benefits in a shorter timeframe and at lower cost.

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 either decrease or increase the power flow on a line.

In comparison to other traditional methods of power flow control and equipment, the M-SSSC technology has a number of beneficial characteristics:

- Controllable series reactance – providing adjustable power flow control to address varied operational scenarios, such as different generation patterns, changes in network configuration or line ratings over time, etc.
- Cost effective – defer or eliminate the need for expensive network augmentations, such as line upgrades, uprates, 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).
- Flexibility – the modular and controllable nature of the power flow control technology allows it to adapt to future changes in network topology, or even be repurposed to another network need in future if required.
- Fails safe with built in redundancy – the integrated bypass technology and modular design minimises the impact that failure of any one unit has on the performance of the overall system. Modular building blocks can be easily and quickly replaced, and spare units can be kept on site.
- No subsynchronous resonance or oscillation risks – the series inductance or capacitance is synthesised at system frequency only.

Application to VNI

The solution proposed in the PSCR increases the capability of the Snowy to Canberra/Yass transmission corridor by uprating the thermal capacity of the Upper Tumut to Canberra 330 kV line, the most commonly constrained of the corridor. Our proposal is to install the described power flow control equipment on the Upper Tumut to Canberra 330 kV line, achieving the required increase in capacity of the Snowy to Yass/Canberra transmission corridor by balancing flows more evenly amongst the four parallel 330 kV circuits. This alternate option offers the following benefits in comparison to the uprating option:

- Achieves a capacity increase on the Snowy to Yass/Canberra transmission corridor in excess of the 170 MW suggested in the ISP, when operated in conjunction with the SmartValve bank presently being installed on the Upper Tumut to Yass 330 kV line, as part of an approved TransGrid NCIPAP project.
- Addresses constraints that can occur on lines other than the Upper Tumut to Canberra 330 kV line under certain generation scenarios, and therefore provides a transfer improvement for those generation scenarios that would not be provided by the uprating of the Upper Tumut to Canberra 330 kV line. Examples include the constraint of the Lower Tumut to Canberra 330 kV line during times of high generation at Tumut 3 or solar farms in the Riverina, such as the 900 MW Yarrabee solar project.
- Has a short implementation timeframe, potentially allowing market benefits attributable to the capacity improvement to accrue earlier than otherwise possible.
- Does not require line work within protected National Park areas, with inherent risks to project delivery timing and budget.
- Is expected to be significantly cheaper than the proposed Upper Tumut to Canberra 330 kV line thermal uprating (i.e. less than AUD 28 M).
- The flexibility of the solution can be adapted to new patterns of generation and flow as they emerge, and could enhance any future line upgrades by continuing to optimise the transmission corridor.

Indicative installation

To achieve the transfer capability increase (170 MW) and other outcomes described above would require approximately 45 MVAr of SmartValve technology on the Upper Tumut to Canberra 330 kV line route, providing roughly 5 ohms of impedance injection, most likely installed at Stockdill or the prospective Snowy 2.0 construction supply (See Figure 1 below). This 45 MVAr figure is based on preliminary and independent power flow modeling of the NSW transmission system by Smart Wires. The SmartValve installation would be operated to increase impedance to reduce loading on the Upper Tumut to Canberra line when required, but could also be operated to decrease impedance to relieve overloads on other parallel 330 kV circuits if required due to varying generation patterns and network flows.

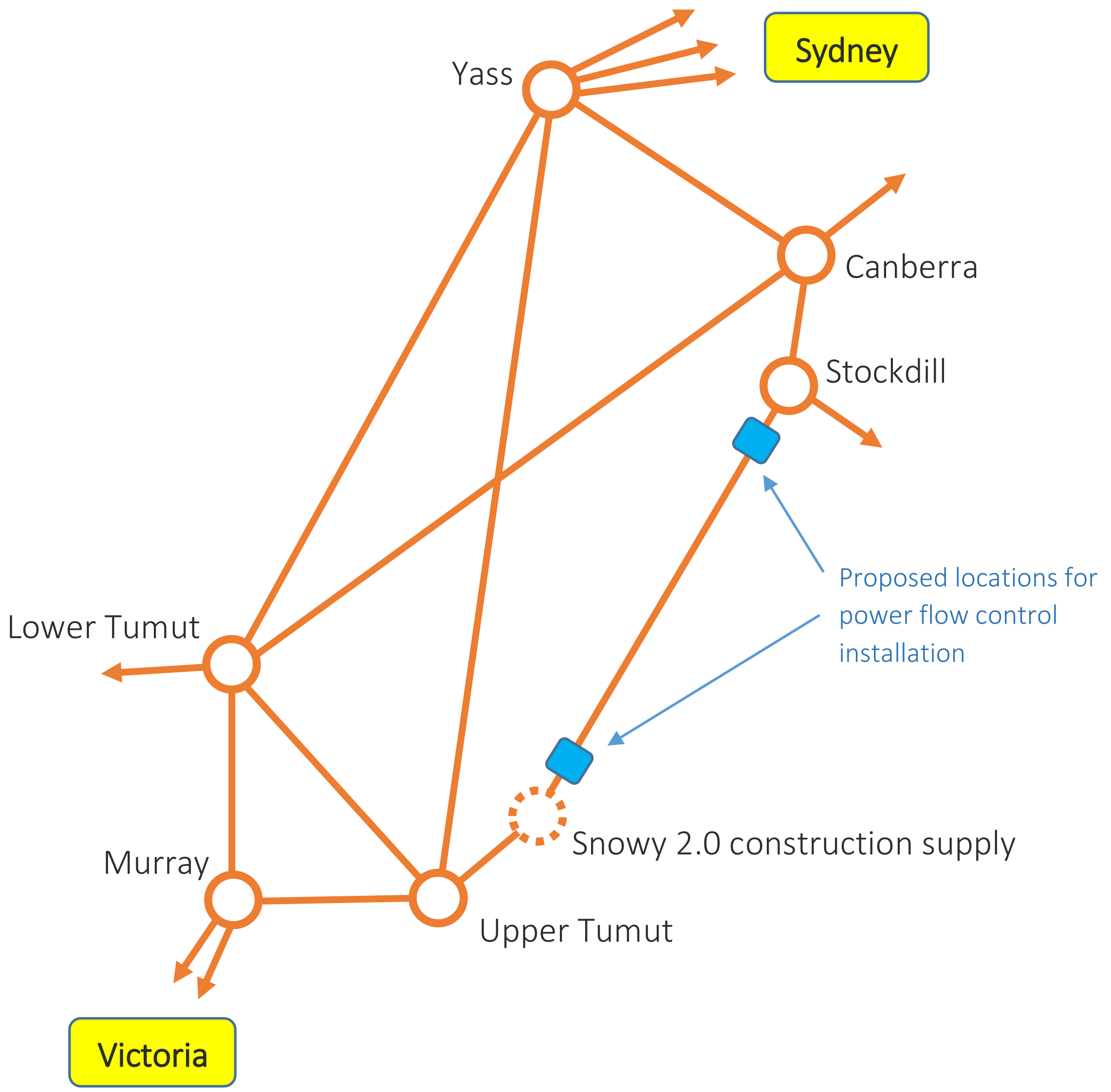

Figure 1 – Power flow control installation on Upper Tumut to Canberra 330 kV line route

Further considerations

The ISP and VNI PSCR also identify limitations in the 330 kV transmission network between Canberra and Sydney that are proposed to be addressed with targeted line upgrades to increase thermal rating. The connection of significant levels of wind resources in the Southern Tablelands also impacts the occurrence and location of thermal constraints in this part of the network. By strategically integrating power flow control into the line upgrade plans, the benefits obtained from the thermal upratings can be further improved and the operational flexibility provided by the power flow control can be used to optimise network capability across a range of renewable generation dispatch patterns.

We hope that 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 AEMO and TransGrid on the VNI RIT-T and to together exploring the solution described in this submission.

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