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Call for non-network options – VNI West

March 2020

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To: AEMO and TransGrid teams

Reference from email correspondence:
Tania McIntyre, Senior Stakeholder Engagement Advisor
Victorian Transmission Planning

Dear Sir/Madam,

Fluence Energy Pty Ltd. ("Fluence") is pleased to submit this response to call for non-network options for VNI West. As addressed in the Draft 2020 ISP and PSCR, the identified need is for additional transfer capacity between New South Wales and Victoria to realise net market benefits, including maintaining supply reliability in Victoria, optimizing development and dispatch of generation in areas with high quality renewable resources in Victoria and southern New South Wales and improving sharing of resources between NEM regions.

As a response to support the VNI West PSCR consultations, we propose the installation of 2 battery-based energy storage solutions (BESS) at two substations to act as a Virtual Transmission Line (VTL), one in Victoria and one in New South Wales, to relieve the limitations on the existing New South Wales-Victoria interconnector (VNI):

- 250MW/125MWh system at South Morang
- 250MW/125MWh system at Wagga Wagga
- Further expansion to accommodate to increase import and export capacity capabilities, similar to options considered in the PSCR, have been addressed in the section 3

These solutions can be built within 14-18 months on a standard timeline – or faster if an accelerated schedule is required – at a lower cost to traditional network solutions and providing optionality for further expansion in the future as network needs are re-assessed.

The enclosed submission includes:

(i) an overview of Fluence's organizational details and examples of relevant experience in Australia and internationally;

(ii) an explanation on the value of a Virtual Transmission Line expansion; and

(iii) A comparison showing how the Advancion BESS system can be implemented in a faster and more cost-effective manner than traditional network solutions.

To give a sense of our background and qualifications, Fluence, a joint venture of its parent companies Siemens and the AES Corporation, is the world's leading energy storage integrator and regularly works with utility and industrial customers around the world to provide industrial-grade energy storage assets that deliver high-quality power services. Fluence has operated utility scale grid-connected battery projects for over 12 years and we currently have over 1,600 MW of battery-based energy storage operating or

under contract in 20+ different countries, which, to date has provided more than 6,500 GW-hours of delivered service.

Rather than offering a single product or configuration, Fluence's focus is being the best partner possible to utilities and networks, focused on long-term collaboration that solves customers' energy challenges, delivering the right solution for those needs, and offering flexibility as market conditions change.

The Fluence team brings a deep understanding of how to optimize proposed energy storage solutions, especially in high- and medium-voltage, transmission-connected applications, and can provide access to knowledge, products and services key to the success of this, and future, energy storage projects. These include:

- Proven utility-grade technology platforms optimized for a variety of needs, including speed of response, long-term dependability and integration with other power resources;
- Comprehensive services and warranties covering the entire energy storage journey, from early-stage commercial analytics through the full operations and maintenance life-cycle of a project;
- A partner who works with customers on an ongoing basis to identify ways to optimize and create value across energy transmission and storage assets. In addition, we have locally-based O&M technical teams, ensuring a quick response during the operations phase of each project;
- Proven solutions operating on transmission- and distribution- connected systems in the Australian market and elsewhere;
- Direct experience with developing and delivering standalone, grid-connected BESS solutions in Australia and in other markets;
- The financial backing and support of our two parent companies, with combined annual revenues of approximately USD $100 billion, providing the financial stability needed to stand behind our product and service guarantees over the lifetime of our contracts.[1]

In summary, our experience and proven technology make Fluence well-positioned to help AEMO and TransGrid address the transmission network issues that Victoria is currently facing. We look forward to developing a productive partnership with AEMO and TransGrid to help make this and future projects a success.

[1] Siemens has a long track record of maintaining an investment grade credit rating (A+ form S&P). AES' S&P credit rating is BB+ and rising as it deleverages balance sheet and expects to have an investment grade credit rating (BBB and above) by 2019. https://www.siemens.com/investor/en/bonds-ratings/ratings.htm and https://www.businesswire.com/news/home/20180320005784/en/AES-Upgraded-SP-BB-Closes-1-Billion

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Please direct any inquiries pertaining to the enclosed submission to me on at my contact details below or my colleague Jaad Clifford-Bolt on 0448 884 954 or at jaad.clifford-bolt@fluenceenergy.com

Sincerely,

Achal Sondhi
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1. ORGANISATIONAL INFORMATION

	Response
Trading Name	Fluence Energy Pty Ltd.
Registered Name	Fluence Energy Pty Ltd.
ACN	627 071 461
ABN	18 627 071 461
Address of registered office	Suite 703 / 530 Little Collins St, Melbourne VIC 3000
Key Personnel (e.g. directors, chief executive officer, principal of business etc.)	Stephen Coughlin, Chief Executive Officer Jan Teichmann, Vice President, Global Sales
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2. RELEVANT EXPERIENCE

2.1 Project One

	Response
Project name	Ballarat Terminal BESS for AusNet Services
Location	Ballarat Terminal Station, Warrenheip, VIC, Australia
Project description	Fluence's 13-year history of delivering and operating grid-scale energy storage technology solutions ensured that it was the partner of choice for AusNet Services, the owner and operator of Victoria's transmission network, leading energy retailer EnergyAustralia, and engineering, procurement and construction company Spotless/Downer in deploying an integrated battery storage solution to address certain issues facing Victoria's electricity grid. The project was a successful applicant for the Victorian Government's Energy Storage Initiative as well as grant funding from the Australian Renewable Energy Agency (ARENA). Fluence supplied a 30 MW/30 MWh Advancion BESS that was installed in the Ballarat Terminal Station. The BESS is owned by AusNet Services but is operated by EnergyAustralia, which uses it to provide a number of market and grid benefits, including: a) flexible peaking capacity to respond to periods of high load; b) ancillary frequency control services The layering of these services enables the BESS to deliver maximum value to the benefit of all customers in the region.

	Figure 1: Ballarat 30 MW/ 30 MWh 
Commencement and completion	Commencement of installation: January 2018 Completion and commissioning: December 2018
Partnership organisational structure	The Ballarat Terminal BESS project was delivered by a consortium comprised of Spotless (as EPC contractor), AusNet Services (as owner), EnergyAustralia (as operator) and Fluence (as energy storage technology supplier). The Ballarat Terminal BESS Project was commissioned by the Victorian Government and was partly funded by the Australian Renewable Energy Agency.

2.2 Project Two

	Response
Project name	Kilathmoy (Owned by Statkraft)
Location	Republic of Ireland
Project description	The Republic of Ireland's first grid-scale battery-based energy storage project, the 11-megawatt (MW) Fluence-supplied system is part of a 34 MW hybrid wind-battery project in Kilathmoy, developed and owned by Statkraft, Europe's largest producer of renewable energy. The Kilathmoy project is helping manage the Republic of Ireland

	manage network volatility as the island nation ramps up deployments of solar and wind projects, the first battery in the world specifically engineered to guarantee a lightning-fast 150-millisecond (ms) response time. The Fluence solution is over 40 times faster than Australia's Fast FCAS service (which requires a response within 6 seconds), and over 2,000 times faster than a fast-starting Open Cycle Gas Turbine (i.e. if the turbine is not already serving as spinning reserve). **Figure 2: 34MW Wind-Battery hybrid Kilathmoy plant** **(11MW/5.5MWh BESS)** 
Commencement and completion	Commencement of installation: March 2019 Completion and DS3 grid testing: January 2020
Partnership organisational structure	Fluence provided Engineering, Procurement and Construction services as well as the Advancion technology and software platform.

2.3 Project Three

	Response
Project name	Escondido and El Cajon BESS for San Diego Gas & Electric

Location	San Diego Region, California, USA
Project description/	Fluence supplied and installed two Advancion BESS in just six months, providing combined flexible capacity of 37.5 MW/150 MWh for SDG&E, a leading energy company delivering clean power from renewable resources. SDG&E decided to procure the two BESS projects in an effort to enhance regional grid reliability and allow greater integration of renewable energy going forward. **Figure 3: Escondido 30 MW/ 120 MWh** **Figure 4: El Cajon 7.5 MW/ 30 MWh**  
Commencement and completion	Commencement of installation: August 2016. Completion and commissioning: February 2017.
Partnership organisational structure	Fluence provided Engineering, Procurement and Construction services as well as the Advancion technology and software platform.

3. NON-NETWORK OPTION SUBMISSION

3.1 Overview of the solution

Fluence proposes the installation of 2 BESS at two substations, one in Victoria and one in New South Wales, to relieve the limitations on the existing New South Wales-Victoria interconnector (VNI):

- 250MW/125MWh system at South Morang[2]
- 250MW/125MWh system at Wagga Wagga[3]

The proposed solution of BESS assets at each substation, each with 30-minute duration, can be installed, commissioned and online before December 2021[3]. The size of the solutions has been estimated to alleviate interconnector limitations in the near term, providing value for 7 years through 2028 and provide optionality for system planning.

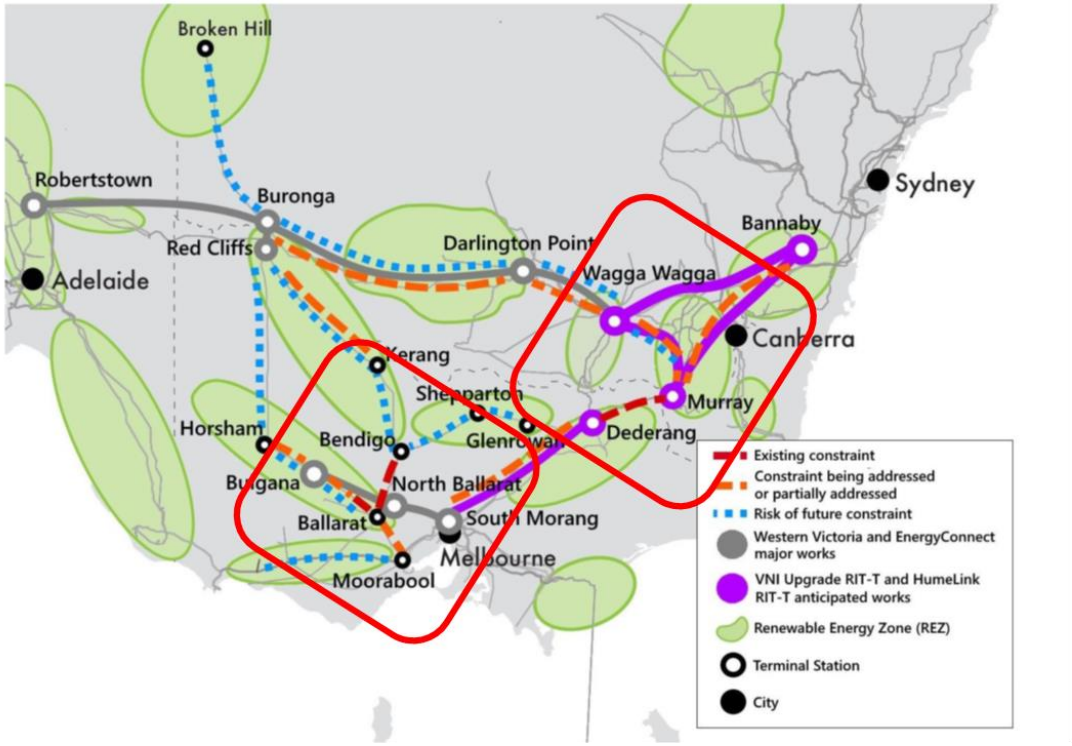
The proposed BESS solution approach will enable further modular expansion at either the suggested substations or other substations in the area to optimize for thermal generation dispatch, capacity constraints and renewable energy developments. We propose modelling our above proposal and in addition phased increases to installed BESS capacity in 2026 to achieve the target import/export capability outlined in Figure 6 (see section 3.3).

3.2 Rationale for proposed location

After evaluating the PSCR, the Fluence team has determined that one BESS system in each of the Red highlighted zones in Figure 5 below would be required to effectively support the VNI West constraints identified. Fluence suggests placement of the two assets at the Wagga Wagga and South Morang substations respectively.

[2] The Fluence team has suggested substations based on proximity to the interconnector, but Fluence offers to support further detailed evaluation to determine the most optimal location/alternate substations.
[3] As mentioned previously, this is on a standard program timeline; an accelerated timeline can be provided if required.

Figure 5: Proposed location of both BESS[4]



Wagga Wagga is a critical substation in TransGrid's transmission network providing a potential pathway for power transfer from New South Wales to Victoria, as well as from New South Wales to South Australia in the near future pending the successful development and installation of a new NSW-SA interconnector. The importance of this location in enabling large-scale power transfers with neighbouring states is highlighted by the fact that two key projects identified in the 2018 TransGrid Transmission Annual Planning Report (TAPR) (namely the Darlington Point to Wagga Wagga, Wagga Wagga to Ballarat, and Melbourne capacity upgrades) have a connection with the Wagga Wagga substation.

The 2019 Victoria Annual Planning Report (VAPR) identified the need to increase the thermal capacity between Dederang and South Morang. The proposed solution by Fluence can provide a solution quicker than the proposed Dederang to South Morang upgrade and eventually can supplement the upgrade to provide long-term benefits.

[4] Technical analysis has not been conducted but in review of the constraints identified the regional locations of potential BESS have been highlighted; Fluence offers to support further evaluation to determine the most optimal location/alternate substations.

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Operating BESS units at Wagga Wagga and South Morang in tandem to create a virtual transmission line (one system discharging, the other charging) can help both import and export capability between New South Wales and Victoria. This additional support on either end of the transmission interconnector will enable more efficient use of the existing lines, alleviating current and future limitations.

The BESS assets as proposed will offer benefits starting far sooner than proposed traditional network solutions – starting operations in 2021 rather than 2028.

Additionally, investment in such a solution provides the parties involved flexibility to wait and evaluate load growth and dispatch profiles in the region and deploy capex more appropriately if or when the network need manifests. Alternatively, the BESS assets can be scaled or additional BESS can be deployed at other sub-stations to fit the need if or when additional load growth occurs, and adjustments can be made to the existing solutions' applications and operations to adapt to changing network needs.

Consideration of future flexibility and augmentation options should be made in light of:

- According to Bloomberg New Energy Finance, battery prices have already declined 87% in real terms since 2010 and are expected to further decline over the next decade, which will provide a more feasible cost to increasing the BESS capacity as needed to meet new load forecasts. Augmentation, coupled with the speed of deployment mentioned in 3.3 and 3.4 below, provides flexibility to the solution solved today, and ability to meet the forecast in the future;

- If demand does accelerate at a very high growth rate, a T&D solution may be feasible to implement at the time with more clarity on utilization of the capex investment; at the same time, the current BESS installations could be repurposed for other network services and reliability needs.

Partnering with Fluence: Fluence believes with further joint analysis of the substations, nearby load centres, and capacity on connected lines in conjunction with TransGrid and AEMO, there can be a further optimisation of the sizing, configuration and applications of the BESS assets.

Fluence Role: Fluence will act as a project partner and solution supplier. Fluence believes the storage solution could be procured either through a fully regulated manner or through a 3rd party ownership model.

Around the world, grid planners are beginning to see the value Virtual Transmission lines can provide. However, as is often the case in such transitions, market adoption is moving at different speeds in different regions.

Germany has taken a particularly proactive approach. The country's Gridbooster plan aims to put 900-1,300 MW of energy storage on the grid by 2025, to relieve congestion on transmission

lines and reduce costs due to the resulting inefficient dispatch of power. Analysis of the increased market efficiency from better dispatch of least-cost generation has estimated savings of 130 million euros per year. Another example where a VTL is already being constructed is by France's RTE (dubbed "Project Ringo[5]"), a 12 MW asset in a high wind output area.

In the United States, we have also seen storage proposed to relieve congestion and improve efficiency in markets such as PJM Interconnection. In addition, the American Transmission Company (ATC) received preliminary approval from the Midcontinent Independent System Operator (MISO) for its first storage as a transmission asset project.

Several forward-leaning transmission companies are also beginning to include energy storage as a resource in their grid planning activities, based on the value storage provides against traditional wires options.

The growth of storage as a transmission asset will ultimately depend on the freedom transmission planners have to use it as an option to provide reliability, without building new wires, when and where such an approach is truly the best solution. It should not be an either/or proposition, but one in which all parties work together to ensure an orderly energy system transition for the Australian network that is increasingly powered by renewable energy.

3.3 Phased approach

Fluence proposes a phased approach to meeting the needs on the interconnector. Deploying BESS assets today to address near-term issues enables AEMO and TransGrid to evaluate the situation in ~3 years, and adapt accordingly at potential minimal cost, before determining a large capex expenditure is required.

If demand projections, dispatch profiles, DSM amounts and/or distributed generation change, this would certainly change the transmission limitations, potentially leaving a large T&D investment underutilized. It is important to note that the phased approach outlined here builds on existing capacity, offering flexibility that other network options will not.

Below are the options considered in the PSCR. The current Fluence proposal suggests increasing certain MW capability across the interconnector that can be further expanded to match the export/import capability shown below, at the same substations or alternate substations[6] in regions highlighted in Figure 5.

[5] https://energystorageforum.com/news/energy-storage/french-utility-rtes-ringo-virtual-power-line-will-come-online-in-2020

[6] Alternate Substations may be evaluated for expansion of capacity to improve reliability, better use space, provide broader benefits; Fluence offers to supporting further evaluation to determine the most optimal location with AEMO and TransGrid.

The expansion can be determined at a later date, given the far shorter lead time required for BESS deployment. For example, our proposal for two 250MW BESS of 30-minute duration can be deployed and in 2023, 2025 and 2027, expansions can be evaluated that may eventually provide the same capacity increases illustrated in the options below.

If the network flows change significantly by 2023, it may be that none of the options below would be adequate and a larger investment would be needed, and BESS deployment offers that flexibility. Alternatively, the BESS investment today enables AEMO and TransGrid to then evaluate a more "right-sized" upgrade of the transmission line, while receiving the benefits of the already installed BESS until and after the upgrade of the transmission line is completed.

Figure 6- Summary of traditional options considered in the PSCR

Option	VNI Export Increase	VNI Import Increase	Capital Cost ($MM)	Lead Time	Completion Date
VNI 5A	380	1000	815	6-8 yrs	2028-2030
VNI 6	1930	1800	1335	6-8 yrs	2028-2030
VNI6-Variation 1	1930	1800	1290	6-8 yrs	2028-2030
VNI6-Variation 2	1930	1800	1455	6-8 yrs	2028-2030
VNI 7	1930	1800	1855	6-8 yrs	2028-2030
VNI8	1130	800	1445	6-8 yrs	2028-2030

3.4 Speed of Deployment

The speed of installing and commissioning BESS assets is a significant advantage to planning, building and commissioning network assets. Fluence believes that BESS of these scale and sizes could be installed and commissioned within in a 14-18 month timeframe – likely faster than network assets and requiring far less effort in securing easements and rights-of-way – which can bring significant benefits for the overall network. No other traditional transmission option can be implemented in such a short timeframe to provide additional dispatchable capacity.

Once a BESS is deployed, TransGrid/AEMO can increase the required capacity in a very short timeframe in the future, as prices continue to fall and if the investment case for a T&D solution is not still clear. As indicated previously, 14-18 months is a standard programme, and an accelerated programme can be designed if required.

3.5 Capacity and reliability

Fluence can provide additional confidence to all the relevant stakeholders that BESS options can be provided into the market with highly certain lifetime costs. The approach of augmentation of the BESS with additional battery modules over its life ensures that the system stays at rated capacity during all times. This augmentation can be done for a period of 10, 15 or 20 years as

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desired by the asset owners and operators. Different options are available to ensure that BESS assets provide guaranteed capacity.

The Advancion platform used by Fluence is agnostic to battery technology or suppliers, which maximizes optionality over time and enables different approaches with respect to augmentation of battery modules. In practice, Fluence has strict certification frameworks and processes to qualify OEMs and vendors for major equipment so that only the highest-quality credible suppliers are used.

To offer an example at a comparable scale, Fluence is currently delivering a 100 MW, 4-hour duration energy storage solution in Long Beach, California, which will have a 20-year contract for firm capacity.

In addition to speed and modularity, the minimal environmental approvals required to deploy batteries compared to poles and wires assets accelerates the permitting process, a significant advantage for the proposed BESS solution. A BESS uses no water, creates little noise, has no fuel and no direct emissions, so can be deployed in urban or residential areas. In addition, there are no Right of Way (ROW) requirements for the BESS solution.

3.6 Cost of service and timeline

Proprietary Analysis provided separately for this consultation

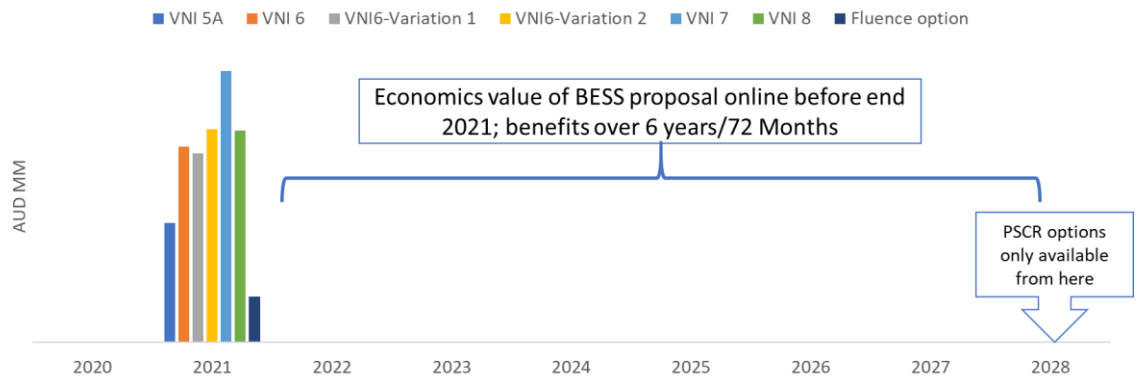
3.7 Net Benefit of BESS option vs Network solution

Benefits Highlighted by Fluence

Fluence has not conducted a full network benefit of the proposed solutions. Having a BESS solution that is scalable and can be located in two sites or more if desired can provide flexibility to the network enhancing system reliability as well as security. Dispatch from power plants, renewable generation can be optimized across the two NEM regions, potentially optimizing fuel consumption at plants, avoiding curtailment and improving loss-factors.

Fluence's proposal offers a faster solution to alleviate near-term interconnector constraints, and yield economic value starting next year. Fluence used historic pricing in the NEM to calculate the value of each MW unlocked on the interconnector from NSW to VIC to be around AUD 13-15/kW-month based on historic price difference between the two States. Looking at Phase 1, the 250 MW of additional capacity that our BESS solution would create across this transmission corridor would be valued at approximately AUD 3.2MM to AUD 3.7MM of economic value each month (i.e., the value created by enabling additional transfers, bridging the high price difference that currently exists).

Figure 7. Value-Add of Fluence proposal



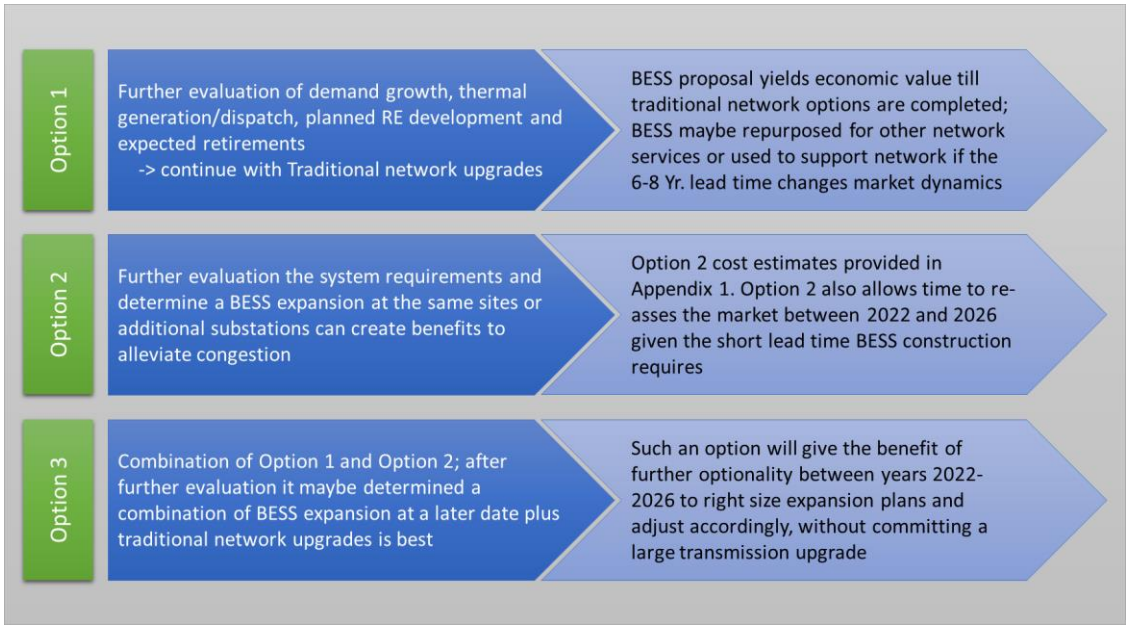
Benefit 1: Bridging price differences:

- Current options being considered in the PSCR may only be online as early as 2028 and as late as 2030. With this the value of deploying 2 BESS as proposed can yield AUD 230MM to AUD 266MM over 72 months till other expansion options are in place

- If the traditional network options come online 2030, this would mean the Fluence proposal would yield AUD 307MM to AUD 355MM

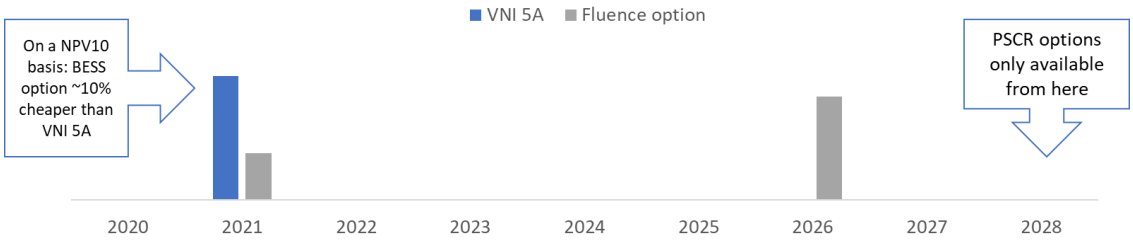
Benefit 2: Creating optionality

The Fluence proposal creates optionality:



If Option 2 was the route selected: Fluence has carried out proprietary analysis, in the event an expansion is to be considered to address the same capacity requirement addressed in the options considered.

Figure 8. Value of Phase 2 expansion of proposed BESS



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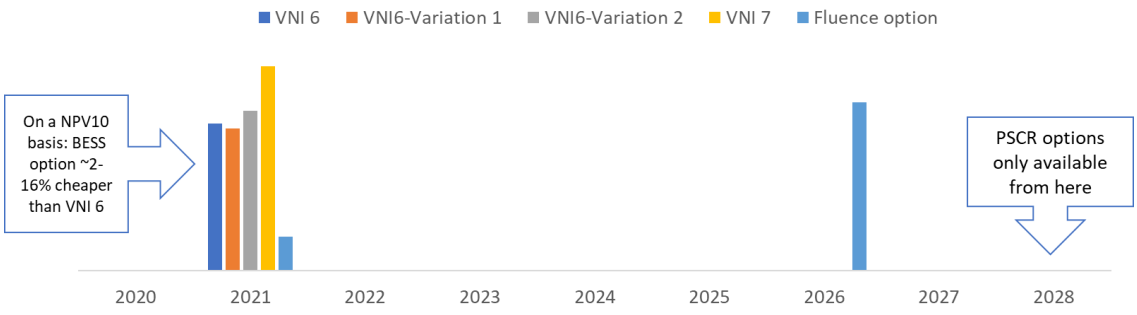
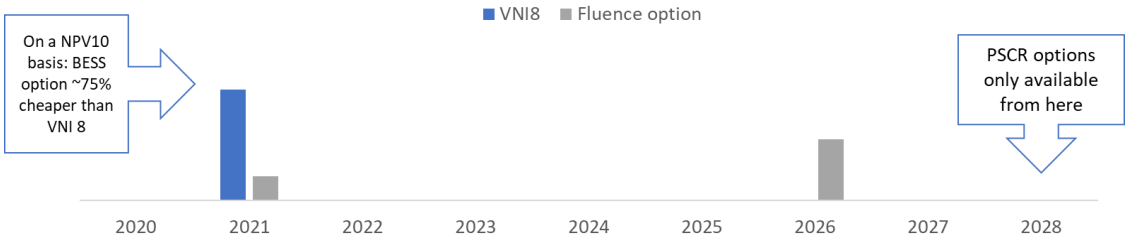
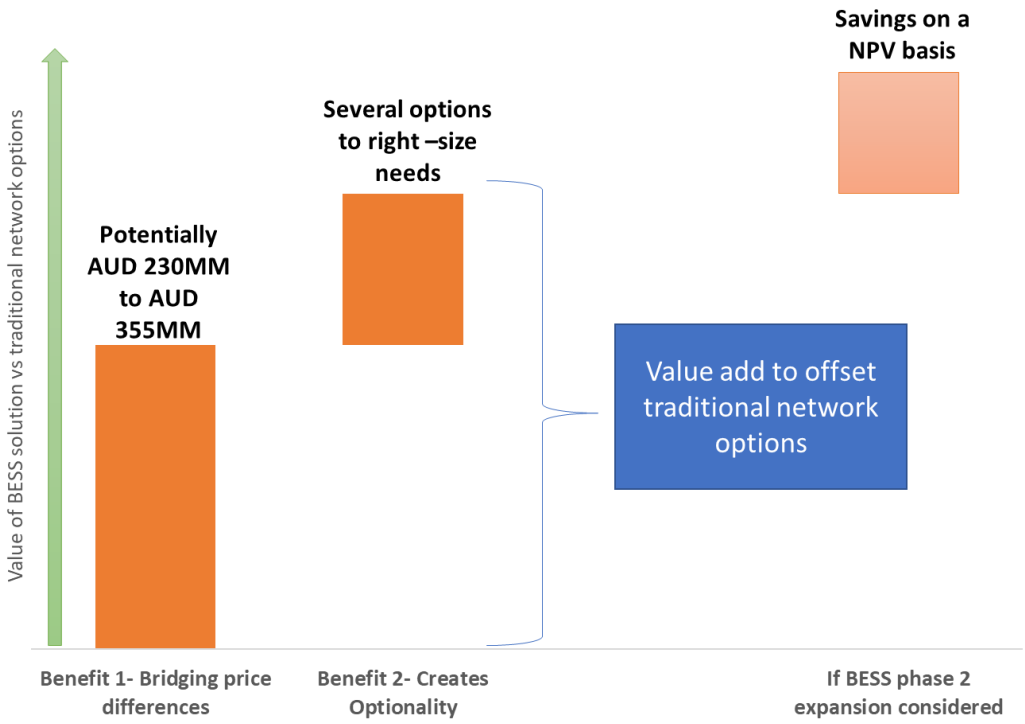




The graphs above illustrated how investing in BESS in a two-phased approach, in similar fashion to the capacity capabilities being considered via traditional network options, is a cheaper on a NPV basis than alternative than the traditional network upgrades identified in the PSCR.

Fluence wants to encourage the modelling of including a Virtual Transmission line as proposed -- including Benefit 1 as highlighted above plus the added value optionality can bring -- as a model may have perfect foresight when optimizing a solution, but the network requirements may change significantly between 2021/22 and 2028. Fluence offers to support any further analysis to determine different sizes or locations of the proposed BESS solution.

Figure 9. BESS value-add vs traditional network options considered[7]



The PSCR specifically provides guidance that benefits related to: (i) ancillary services and (ii) competition are not considered material in this assessment. As a result, Fluence has not included any description of these benefits (which can be provided by a BESS) in our proposal. However, the capability to bring on a BESS solution far quicker ahead of another competing solution could provide a significant technical, commercial and operational advantage.

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3.8 Victoria SIPS 2020 EOI

The EOI being run by AEMO and the Victorian Government may result in a large amount of reserve capacity on one side of the interconnector. Recognizing this, the resulting solution in

[7] Indicative values used to determine these benefits

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the near term could be as minimal as a BESS system at Wagga Wagga only. Then accordingly the same phased approach can be taken there after, depending on further network developments.