

Mallee Regional Innovation Centre

SUBMISSION

to

Australian Energy Market Operator (AEMO) & TransGrid

in response to the

**Victoria to New South Wales Interconnector West (VNI
West) Regulatory Investment Test for Transmission
(RIT-T) Project Specification Consultation Report
(PSCR)**

March 2020

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Executive Summary

The Mallee Regional Innovation Center submits this submission which will address questions as proposed by the Australian Energy Market Operator and TransGrid in the report Victoria to New South Wales Interconnector West (VNI West) Regulatory Investment Test for Transmission (RIT-T) Project Specification Consultation Report (PSCR).

The Centre supports the view of the preferred option - VNI 7 with (REZs) Expansion A.

The Augmentation on new corridors (Via Kerang), VNI 7 - New 500 kV transmission lines from North Ballarat – Bendigo – Kerang – Darlington Point – Wagga, with potential expansions to accommodate renewable energy zones (REZs) Expansion A, new transmission lines to unlock generation capacity from Kerang – Red Cliffs.

This submission will highlight the opportunities in the Mallee (North West Victoria) in regard to the following:

- Renewables as an energy source
- Capacity of solar farm generation
- Potential of the Mallee as a hydrogen hub
- Emissions reduction
- Credible options
- Loddon Mallee Renewable Energy Roadmap
- North Western Victoria Energy Group

The MRIC would like to acknowledge the contribution of Lower Murray Water in providing the Case Study to supplement to the submission. The Case Study can be found in Appendix 1.

The [Mallee Regional Innovation Centre](#) (MRIC) is an unincorporated joint venture between the parties of the University of Melbourne, La Trobe University and the Sunraysia Institute of TAFE (SuniTAFE).

Led by Centre Director, Professor Michael Stewardson (The University of Melbourne) and Co-Directors, Professor Ashley Franks (La Trobe University) and David Harris, General Manager Operations (SuniTAFE), the MRIC pairs in-depth knowledge from the Mallee region with the world-leading research capabilities of the University of Melbourne and La Trobe University and through the Australia's Large Training Provider of the Year 2019, SuniTAFE, the capabilities of applied research and delivery of training to address emerging skill requirements.

The MRIC has staffed offices in Mildura, in the North West of Victoria. The Centre opened on the 6 May 2019 and concentrates on the focal areas of energy, water, horticulture and the environment in irrigated production and natural resource management. The Centre's footprint of operations is along the Murray River in the Swan Hill Rural City Council local government area, through the Mildura Rural City Council local government area to the South Australian border. The Centre coordinates research and development projects and delivers contracts on a fee for service basis.

The purpose of the Centre is to:

Drive collaboration to promote innovation in practical research, development and adoption to address the key challenges in the Mildura and Swan Hill regions in horticulture and natural resource management.

To ensure a successful and sustainable Mallee region through innovation and collaboration, the Centre is focused on:

- Prioritising and fast-tracking R&D projects which will strategically address the key challenges of the region in the four focal areas of horticulture, environment, energy and water;
- Seeking opportunities to foster new areas of development;
- Facilitating the commercialisation of research and development outcomes; and
- Seeking outcomes that are practical, implementable and value add to the region.

To do this we need to:

- Have strong collaborate partnerships;
- Source funding to support projects;
- Compliment established activities;
- Bring in new capabilities where required; and
- Build capability and encourage the adoption of Research & Development (R&D).

Terms of Reference

Scope

AEMO’s 2018 Integrated System Plan1 (ISP) set out an optimised national pathway for development of the power system that would maximise the value from new and existing resources across the National Electricity Market, while delivering reliable energy at the lowest cost to consumers. It identified that both short-term and longer-term investments were required to increase interconnection capacity between Victoria and New South Wales to enable more efficient sharing of generation between the states and deliver energy at the lowest cost to consumers.

AEMO and TransGrid are already jointly progressing a Victoria – New South Wales Interconnector (VNI) Upgrade Regulatory Investment Test for Transmission (RIT-T) 2 to address the immediate need for increased transfer capacity from Victoria to New South Wales. In addition, the ISP also recommended that a longer-term investment would be required to strengthen bidirectional interconnection between Victoria and New South Wales to deliver fuel cost savings, facilitate efficient connection of new renewable generation, and provide greater access to hydro energy storage plant in the Snowy Mountains

Key Questions for consideration

In particular, AEMO and TransGrid are seeking feedback on the following questions:

- Have AEMO and TransGrid properly described the identified need for this project? If not, how can the description of the need be improved?
- Have AEMO and TransGrid considered the most appropriate development options in this PSCR? If not, what other credible options should be considered for the PADR?
- Are there any non-network options that AEMO and TransGrid should consider to meet or partially meet the identified need, for example non-network options with the capability to alleviate constraints and unlock REZ capacity?
- What, if any, additional factors should AEMO and TransGrid consider to determine the preferred option for VNI West?

Submissions are not limited to these specific consultation questions, and not all questions are expected to be answered in each submission. Submissions should be emailed to VNIWestRITT@aemo.com.au

Map of credible options as presented by the Australian Energy Market Operator and TransGrid in the report - *Victoria to New South Wales Interconnector West (VNI West)*, December 2019.



Provide benefits as reported in the *Victoria to New South Wales Interconnector West (VNI West)* report:

To satisfy the RIT-T, there must be net market benefits associated with implementing the preferred option. The classes of market benefits considered for this project are:

- *Changes in fuel consumption arising through different patterns of generation dispatch*
- *Changes in voluntary load curtailment and involuntary load shedding*
- *Changes in costs to other parties due to differences in the timing of new plant, differences in capital costs and differences in operational and maintenance costs*
- *Differences in the timing of transmission investment*
- *Changes in network losses*
- *Option value benefit. In addition, these credible options may provide market benefit beyond the identified need, such as increased strength, voltages support, or the ability to optimize fuel costs over time with storage devices, which will be considered in the RIT-T.*

Credible options that result in increased interconnection may also improve the power system's resilience to non-credible contingencies, changing operating patterns, and other possible market changes (such as early withdrawal of existing generating units). Such as high-impact, low probability events can carry significant cost implications, and related market benefits will also be considered.

Introduction

The Mallee Regional Innovation Centre's research and development projects are focusing on tangible, value add outcomes for the region that encompasses Mildura Rural City council and Swan Hill Rural City Council government areas.

What we do

Our role is to:

- collaborate to address the priorities and challenges of the region;
- coordinate research and development (R&D), and facilitate the dissemination, adoption and commercialisation of the results;
- investigates data insights to allow them to capture commercial opportunities;
- engage in R&D that builds excellence, improves resource management and sustainability; and
- builds capability and encourages the adoption of R&D.

We are actively encouraging and supporting innovation, extension and adoption of R&D and engage with industry, business, government and other stakeholders in the region on the issues that matter to them.

Our Vision

Our ambition for the Mallee Regional Innovation Centre is to contribute to a successful and sustainable Mallee region through innovation and collaboration. Our MRIC *Strategic Plan 2019–2024* outlines our priorities and activities to achieve this.

Our Funders

Funding Agreement

Core funding of \$1.7 million for the Centre was announced by the Victorian State Government in the 2018/19 budget. The University of Melbourne has entered into a funding agreement for a grant that is administered through the Department of Jobs, Precincts and Regions.

Centre Agreement

The Centre partners, namely the University of Melbourne, La Trobe University and SuniTAFE provide cash and in-kind contributions as per the Centre Agreement.

Scholarships

The Centre is also supported through the Invergowrie Foundation. They have committed to five Invergowrie and McPherson Family Women in STEM PhD scholarships over 5 years.

Fee for Service

The Centre is also engaged in *Fee for Service* activities. These activities are defined with contractual agreements between one university partner or both, and a proponent wanting research undertaken.

As an enabler, the governance structure of the Centre was designed with a view of how best to support such outcomes.

Steering Board

On the Centre's Steering Board comprises the representatives of all parties of the Centre.

Mallee Regional Innovation Centre Steering Board members	
Professor Mark Hargraves - Pro Vice Chancellor (Research Partnerships and External Relations)	Professor Susan Dobbs Deputy Vice-Chancellor (Research and Industry Engagement)
Peter Forbes (Manager Regional Planning and Coordinated, Regional Development Victoria)	Geoff Dea (Chief Executive Officer, SuniTAFE)
Professor Mike Stewardson, Leader Water Environment and Agriculture Program (MRIC Director, University of Melbourne)	Professor Ashley Franks Pro Vice-Chancellor Research Capability (Co-Director La Trobe University)
David Harris General Manager Operations (Co-Director SuniTAFE)	

Strategic Advisory Panel

Sitting underneath the Steering Board, the Centre is supported by the Strategic Advisory Panel (SAP) who assist in setting the direction for research and development projects that address the challenges and priorities of the region.

The panel is comprised of key regional leaders from a cross section of industry, who individually and as a group bring a depth of expertise and collective knowledge to the Centre for the betterment of the region.

Mallee Regional Innovation Centre Strategic Advisory Panel Members	
Leonie Burrows - SAP Chair (Chair of Sunraysia Community Health Services, Deputy Chair Murray PHN and member of the Loddon Mallee Regional Development Australia Board.	Ross Lake (Chair Integrated Water Management)
Ferdi Bergamin (Development Manager, Mildura Fruit Company)	Anne Mansell (CEO Dried Fruits Australia)
Anthony Couroupis (Managing Director, Lower Murray Water)	Peter O'Donnell (Executive Director, Southern Cross Farms)
Jenny Collins (CEO, Mallee Catchment Management Authority)	Stefano de Pieri (Board Member of Mildura Regional Development)
Paul Dillon (CEO, Mallee Rising)	Patrick Timmons (Executive Officer, Rural Financial Counselling Service, Victoria North West)

Academic Panel

A key feature of the Centre is the prominence of the two universities. The Centre has an Academic Panel which comprised of academics from both the University of Melbourne and La Trobe University. MRIC is a relationship broker between those requiring research and the universities. In an innovation

system context, this is described as a capacity to co-innovate and requires:

- Skills and competencies that cover science, technology and innovation management practice
- Linkages between producers and users of knowledge
- Relationships and the institutional setting conducive to knowledge sharing and interactive
- Learning
- Flexibility in working habits and institutions that allows dynamic and rapid responses to changing circumstances
negotiation of place-based rural innovation
- Governance arrangements that support emergent practice and collaboration
- Presence of brokerage/intermediation roles and stimulating networks of factors
- Supporting new ways of working

Partnership and collaboration for innovation

The Mallee Regional Innovation Centre has worked closely with a range of stakeholders to form collaborative partnerships that facilitate the pursuit of R&D projects. This includes Regional Development Victoria, through which a grant to the establish of the Centre is administered.

The Centre also engages with local governments (Mildura Rural City Council, Swan Hill Rural City Council, Wentworth Shire Council and the Murray River Group of Councils), statutory authorities (Lower Murray Water, the Victorian Mallee Catchment Management Authority), industry peak bodies (Almond Board of Australia, Australian Table Grape Association, Citrus Australia, Dried Fruits Australia, Murray Valley Winegrowers Association) and other regional recognized organisations such as Mildura Regional Development and First People of the Millewa-Mallee Aboriginal Cooperation.

Critical Mass of Agencies

Mildura houses a hub of federal and state government agencies and departments and other key stakeholder organisations, with staffed offices open for the Inspector-General Murray- Darling Basin Water Resources and the Murray Darling Basin Authority. Hort Innovation have also indicated they will have a presence in the region through an Extension Officer.

Complementary to that, the region is already home to staffed offices for the Victorian Department of Land, Water and Planning, Victorian Department of Jobs and Precincts and Regions, Mallee Catchment Management Authority, Commonwealth Environmental Water Office, Agriculture Victoria, Parks Victoria, Lower Murray Water, Western Murray Irrigation, Regional Development Victoria, New South Wales Department of Primary Industry, ALTA (Analytical Laboratories and Technical Services Australia), Sunrise21 Mapping and Research, and the office of the First People of the Millewa-Mallee.

The region is also home to the SuniTAFE SMART Farm and the CSIRO have a presence through the Koorlong Field Station.

Industry knowledge and expertise is further enriched in the region by the presence of these organisations. The relationship the Centre has built and will continue to build with these stakeholders, will enhance the ability to undertake key R&D in the region.

Response to key questions

Have AEMO and TransGrid properly described the identified need for this project? If not, how can the description of the need be improved?

Renewables as an energy source

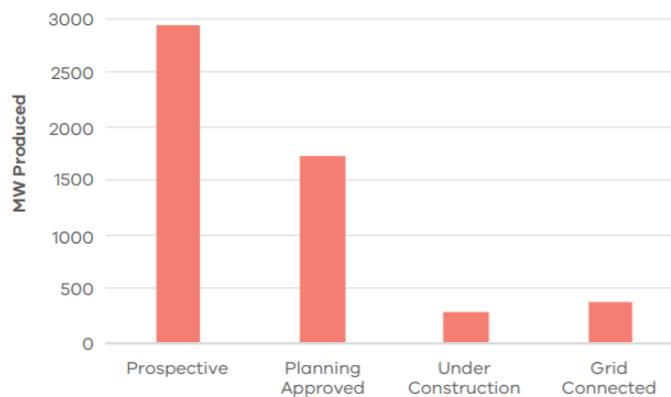
The North West of Victoria has become a key location for solar farms in the state of Victoria. As reported in the *Mallee Economic Growth Strategy 2018/2019* (1) and can be seen by the information provided below, there has been significant development in large scale solar projects. As the Lower Murray Water case study reports, solar farms in the region are operating at 50% capacity. This unused capacity could be used in the development of a hydrogen for use in the local industry.

Nineteen large-scale solar projects, valued over \$2.8 billion, have either received planning permission, are under construction or are operational in the four municipalities across the Mallee. These projects have a combined energy capacity of 2380 MW (Figure 3-11), which exceeds the capacity of Victoria's largest coal fired power station Loy Yang A.

Planning departments within the four Mallee LGAs are aware of a further thirteen prospective solar farm developments, which have a regional energy capacity of 2,950 MW. Combined, they have a total potential energy capacity of 5,280 MW.

The region is also seeing investment in battery storage and this is expected to accelerate. Battery storage has the capacity of providing solar electricity at times of peak demand.

Figure 3-11 Mallee Region Large Scale Solar Power Projects



Source: RDV (2019) Loddon Mallee Renewable Energy Projects.

Capacity of solar farm generation

The solar generation capacity in the region is now clearly in excess of the customer demand in the region and any additional solar generation will continue to compound this situation. In addition, the existing transmission network does not have the capacity to deliver the excess solar generation to customers outside of the region. The recently announced interconnector between SA, NSW and Victoria will assist but there will still be excess solar generation even after this transmission line is commissioned.

As detailed in the graph above, there remains a strong interest in further developing the solar industry in the North West of Victoria. However, interested parties can easily become perturbed from investment if there is not wider infrastructure to support the investment in solar.

Further to this, solar development has the potential to support a new industry in the region. Hydrogen production(2) for a hydrogen re-fueling station would be benefit from being able to access excess solar generation capacity.

Recently the Australian Energy Market Operator (AEMO) reported that growth and speed in the establishment of solar (and wind) in some regions is causing 'unprecedented technical issues'⁽³⁾. These issues have the potential to affect the stability and performance of the national electricity grid. For instance, within the region there have been significant periods of loss of power. A hydrogen industry in the region could assist with storage to flatten the peaks of production to provide better stability from renewables. Please see Lower Murray Water case study provided in Appendix 1.

Are there any non-network options that AEMO and TransGrid should consider to meet or partially meet the identified need, for example non-network options with the capability to alleviate constraints and unlock REZ capacity?

Potential of the Mallee as a hydrogen hub

Initial investigations driven by the MRIC and supported with assistance from the Melbourne Energy Institute and Regional Development Victoria, have determined that the Mallee has the suitable elements to support a hydrogen hub. Next step evaluation requires a pre-scoping feasibility study into the region to formally document the competitive advantage of such an industry and build on the acknowledged evidence base. This study will set out to evaluate how a hydrogen facility can complement the regional economy, specifically the resources, infrastructure and local industry.

Essential elements of a hydrogen hub that are found in the Mallee include:

- a rich solar resource for renewable energy and hydrogen production and seasonal storage
- a concentrated agricultural and industrial infrastructure which could benefit from heavy duty hydrogen powered transport as well as back-up generation
- a large biomass resource which can complement hydrogen use for power generation
- access to transport infrastructure for a hydrogen export market.

What, if any, additional factors should AEMO and TransGrid consider to determine the preferred option for VNI West?

Region Specific

Energy is a key strategic consideration for any business or industry in the Mallee region. Decisions relating to risk and financial considerations are key to ensuring sustainability and success. This covers the consumption of, supply, demand, costing and in the case of solar farms, the grid and grid capacity. An investment in transmission capacity that has the potential to link through Red Cliffs to the Interconnector with Extension A with provide better grid capacity.

Climate Adaption

Climate adaption and preparation is a necessity for irrigated production and resource management in the region. Energy is an interictal component of adaption. See the Lower Murray Water case study provided. As the climate changes in the region, all businesses will have to consider what will impact on their ability to service their customers. In the case of Lower Murray Water, energy is core to their ability to deliver services to urban and rural customers.

The Mallee Climate Projections

The CSIRO has released the Mallee Climate Projections 2019⁽⁴⁾ and they state that:

- by the 2050s, the climate of Mildura could be more like the current climate of Menindee, New South Wales, and Swan Hill more like Balranald, New South Wales.
- by the 2030s, increases in daily maximum temperature of 0.8 to 1.6°C (since the 1990s) are expected.

Rainfall will continue to be very variable over time, but over the long term it is expected to continue to decline in winter and spring (medium to high confidence), and autumn (low to medium confidence), but with some chance of little change.

Maximum and minimum daily temperatures will continue to increase over this century (very high confidence).

Emissions reduction

For the Federal and State governments to meet their emissions targets, further investment will be required in green energy options. This includes solar and hydrogen. Accompanying infrastructure will be required to support the growth of these industries.

The recently released 2020 Climate Policy Toolkit Summary produced by the Climate Change Authority reports that ‘More ambitious targets will be required in Australia and around the world over time to meet the goals of the Paris Agreement.’⁽⁵⁾

Further to this the [Victorian State Government](#)⁽⁶⁾ has legislation that requires statutory authorities like water corporations to have a proactively work towards 42% reduction in emissions by 2050. For these targets be achieved, there will need to be innovation, new technology’s and access to new energies and supporting infrastructure. See the Lower Murray Water case study in Appendix 1.

Have AEMO and TransGrid considered the most appropriate development options in this PSCR? If not, what other credible options should be considered for the PADR?

Credible Options

The preferred urgent option is VNI 7 with (REZs) Expansion A. This option would support the growth of large-scale solar farm development in the region. The North West of Victoria has suitable topography for such infrastructure and the social license of the region would provide pathways for support. Many businesses and industry of the region have concerns in regard to security of supply, access to supply. Separate to this is the North West regions inability to capitalize on development of the solar industry.

In supporting other points of view from the region and reiterating the urgency of this required infrastructure, the MRIC supports required upgrades include a new 500 kV transmission line from Ballarat – Bendigo – Kerang with double-circuit 220 kV transmission lines from Kerang – Wemen – Red Cliffs and a minimum double-circuit 220kV transmission line from Bendigo – Shepparton – Glenrowan.

Table 1 below categorizes the options proposed to meet the identified need as detailed below.

Augmentation to existing VNI corridor	
VIC-NSW Option 5A ('VNI 5A')	New 330 kV transmission lines from South Morang – Dederang – Murray
Augmentation on new corridors (Via Bendigo or Shepparton)	
VNI 6	New 500 kV transmission lines from North Ballarat – Bendigo* – Shepparton – Wagga
Augmentation on new corridors (Via Kerang)	
VNI 7	New 500 kV transmission lines from North Ballarat – Bendigo – Kerang – Darlington Point – Wagga
VNI 8	New 330 kV transmission lines from North Ballarat – Kerang – Darlington Point - Wagga
Potential expansions to accommodate renewable energy zones (REZs)	
Expansion A	New transmission lines to unlock generation capacity from Kerang – Red Cliffs
Expansion B	New transmission lines to unlock generation capacity from Shepparton – Glenrowan

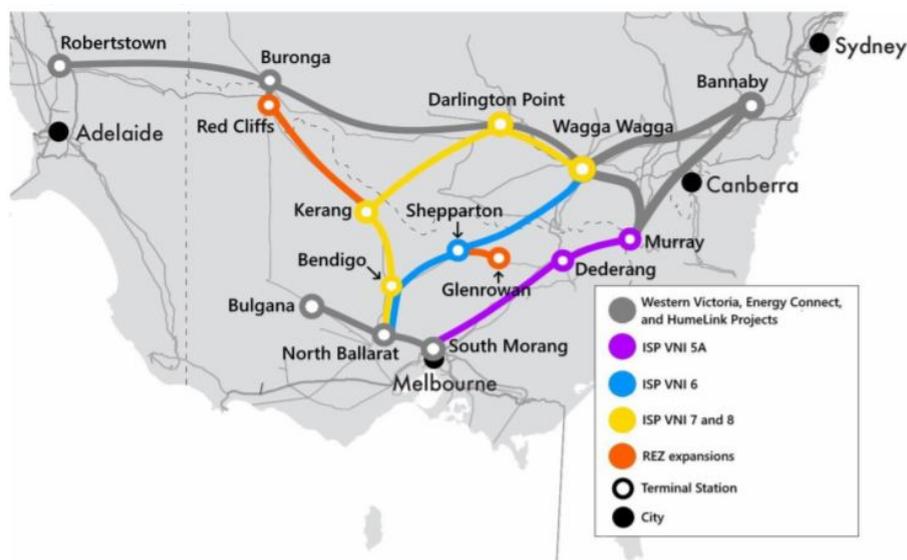
*VNI 6 also includes option variations which bypass Bendigo and/or Shepparton (see Section 6).

Table 1 - Executive Summary, Victoria to New South Wales Interconnector West (VNI West) December 2019. Regulatory Investment Test for Transmission Project Specification Consultation Report (PSCR). (7)

As reported by Regional Development Australia in the *Mallee Economic Growth Strategy 2018/2019* in August 2019, the Loddon Mallee Energy Renewables Projects table (refer to p.10 of submission) and accompanying text details at the time of publishing, document that the Mildura Rural City Council, Swan Hill Rural City Council, Buloke Shire Council and Gannawarra Shire Council reported that nineteen projects valued at \$2.8 billion that had received planning permission, were under construction or operational in the their local government areas. These projects have a combined energy capacity of these was reported as 2380MG

Further to this, the four local government areas acknowledged awareness of thirteen prospective developments with a combined energy capacity of 2950MW. Combined this gives a potential of 5280MW.

Map – From Executive Summary, Victoria to New South Wales Interconnector West (VNI West) December 2019. Regulatory Investment Test for Transmission Project Specification Consultation Report (PSCR). (7)



Loddon Mallee Renewable Energy Roadmap

The MRIC is seeking out and assisting in facilitating energy conversations in and for the region. In 2019 upon request, the Centre contributed insights for consideration into the Victorian State Government's Loddon Mallee Energy Renewable Roadmap.

The Loddon Mallee Renewable Energy Roadmap project worked with individuals, businesses, communities, and government, with a goal to build a vision for the region in the renewable energy transition and to capitalise on the transformation of regions electricity system. As acknowledged on the Victorian Government's website (7), the process will deliver a regional renewable energy strategy for the purpose of providing intelligence to business, industry and communities seeking to establish or expand new energy technology development, manufacturing or renewable energy generation in Victoria.

Our energy system is changing. We are witnessing a shift to decentralised electricity generation from renewable energy resources coupled with an increase in energy storage, with generation plants ranging from small-scale behind the meter installations through to front of meter large-scale solar and wind.

There are opportunities for the implementation of new models and for the investment in clean generation projects. This presents opportunities for communities to determine where their energy comes from, how it's generated, how its shared, and the community benefits that may be derived from large infrastructure developments in their region. (8)

Consultations like these have provided opportunities our region to raise concerns over the transmission network, security of supply and a network that is fit for purpose in regard to the businesses and industry operating within the region.

North Western Victoria Energy Group

The MRIC is in the early stages of assisting to facilitate an Energy Group for the North Western Victoria. In conjunction with Lower Murray Water and Mildura Regional Development (currently on hold due to COVID-19), the initiative is proposed with the intent to bring business, industry and government of the region together, to further insights and knowledge pertaining to energy challenges and solutions. Such a group would give the region a stronger voice in the energy arena and allow for regional scale projects, further advocacy regarding energy matters and through the Centre, a mechanism through which research could be undertaken to support the economic benefit of the region.

Closing Statement

The Mallee Regional Innovation Centre supports the preferred option of VNI 7 with (REZs) Expansion A.

New infrastructure will support new energy options, that will in turn support development and growth of new industries such as large scale solar and hydrogen but will also assist horticulture and resource management and their service industries in remaining successful and sustainable.

Firstly and foremost, the investment in creditable options like VNI 7 with (REZs) Expansion A, with further complemented by secondary options VIN 7 (REZs) Expansion B, will complement the next wave of innovation that will for the regions, help secure the stability of the network grid and enhance economic growth and support reductions in emissions.

Key contact for submission:

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Chief Executive

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0417 728 114

References

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2. COAG Energy Council, 22 November 2019, <http://www.coagenergycouncil.gov.au/publications/reports-support-national-hydrogen-strategy>
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4. *Mallee Climate Projections 2019*, Clarke JM, Grose M, Thatcher M, Round V & Heady C. CSIRO, Melbourne Australia.
5. *2020 Climate Policy Toolkit Summary*, Climate Change Authority, 2020, p.3 <http://climatechangeauthority.gov.au/sites/prod.climatechangeauthority.gov.au/files/Updated%20Toolkit%202020/2020%20Toolkit%20summary.pdf>
6. *New deal to reduce emissions and keep water affordable*, Victorian State Government, 3 April 2019, <https://www.premier.vic.gov.au/new-deal-to-reduce-emissions-and-keep-water-affordable/>
7. *Victoria to New South Wales Interconnector West (VNI West) December 2019*. Regulatory Investment Test for Transmission Project Specification Consultation Report (PSCR), Australian Energy Market Operator Limited and NSW Electricity Networks Operations Pty, 2019.
8. *Regional Renewable Energy Roadmaps*, Department of Environment, Land, Water and Planning, Victorian State Government, <https://engage.vic.gov.au/regional-renewable-energy-roadmaps>
9. Australian Energy Market Operator's Integrated Systems Plan, July 2018 <https://aemo.com.au/en/energy-systems/major-publications/integrated-system-plan-isp/2020-integrated-system-plan-isp>

Lower Murray Water - Case Study

Background

Lower Murray Water's (LMW) rural business comprises about 2,800 small to large agricultural businesses that compete mainly in global markets. Table grapes, dried fruit, citrus, avocados and wine grapes supply markets in Asia and Europe. Growers are acutely aware of the need for both quality and cost competitiveness of their products. The reliability of LMW's infrastructure to deliver water is crucial to maintaining quality. Because horticulture requires long term investment, customers value price stability as well as price competitiveness.

LMW pumps water from the Murray River and delivers water through a network of channels and pressurised pipes. The continued sustainability of the water delivery infrastructure depends upon LMW securing stable cashflows from its customers to fund the 20-year asset renewal and replacement master plan.

The electricity consumption of the LMW irrigation pumps peaks at around 14MW during summer with a total electricity consumption of about 32GWh per annum. The peak pumping period coincides with the highest and most volatile electricity spot prices and the coincidence of peak load and price volatility has the effect of amplifying electricity price volatility risk.

In 2016, LMW made a pledge to the Victorian state government to reduce emissions from its operations to 24,708 tCO₂ (total carbon dioxide) 1 July 2025, a reduction of 39% from the baseline of 40,243 tCO₂. LMW's irrigation pumps contribute 70% of LMW's total emissions.

LMW Objectives

LMW has three strategic objectives:

- Maintain the supply of water deliveries to our customers when they need it.
- Optimise the cost/risk of electricity and renewables.
- Meet our emissions Pledge obligations.

Situation and context

Electricity Grid

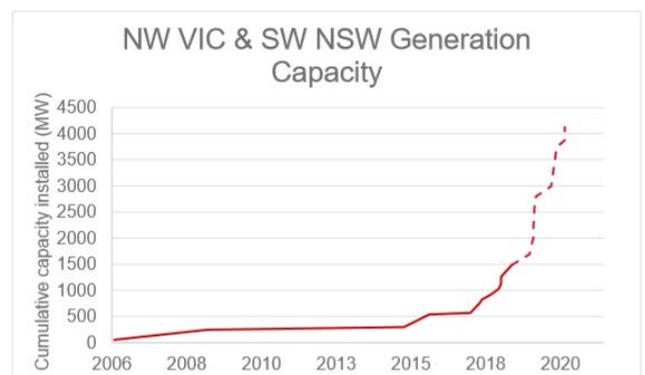
The LMW service area is supplied by three transmission lines, two from Ballarat and the other from the NSW transmission line to Broken Hill.

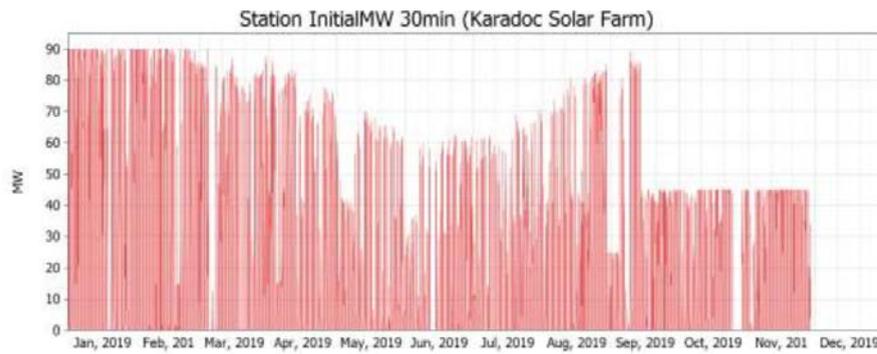
There have been a significant number of new solar and wind generation projects connected to this transmission network over the past few years and AEMO expects this trend to continue as shown in the figure.

In September 2019, the Australian Energy market Operator (AEMO) advised that these developments have increased the potential for widespread thermal and stability constraints on generation in our region.

Existing solar generators in our region are being constrained back to 50% of capacity to protect the grid against contingency events. An example of this is the shown in the figure below. The AEMO constraint on output

was applied from September (note there is no data for December). Fluctuations prior to that date are due to variations in solar output related to solar intensity. Typically, there is lower production during winter months than during summer months.





In late December 2019, AEMO issued a notice of a fault level shortfall at Red Cliffs of 312MVA (current fault level 638MVA) and that it will use reasonable endeavours to address the shortfall by 1 January 2021. This will include the need for new generators to provide system support and add to the cost of new renewable projects.

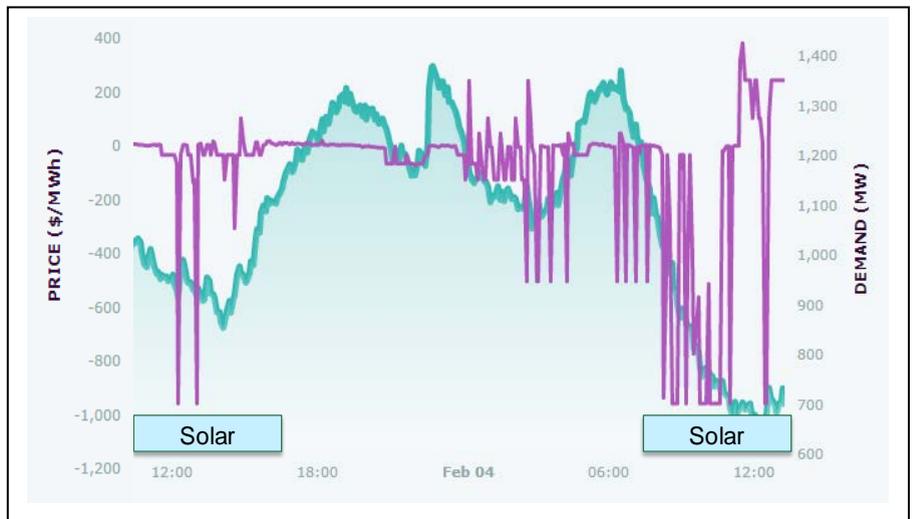
While it is not possible to quantify the probability of outages, the current situation has clearly increased the risk of loss of supply due to transmission outages. The recent loss of supply to the Robinvale district is an example of how this risk may affect LMW's operations.

The rapid development of solar projects in our region has created an oversupply of solar generation compared to demand and network capacity. This situation is anticipated to continue as new solar generation projects are developed.

Electricity and Renewable Markets

AEMO forecast a 560MW shortfall in generation in Victoria in peak periods during the 2019/20 summer. AEMO contracted with a number of market participants for demand response capability to offset the shortfall through its Reliability and Emergency Reserve Trader (RERT) scheme.

The rapid development of solar and other renewables has had a transformational impact on time-of-day electricity prices and price volatility. The volume of solar now connected to the grid has meant that the minimum daily net demand occurs during daylight hours. In South Australia, negative prices are common (see Figure) and this outcome and trend will also become common in Victoria.



Regulatory developments

Several regulatory changes are being considered by the Australian Energy Regulator (AER) for the region which may have a significant impact on reliability and electricity price:

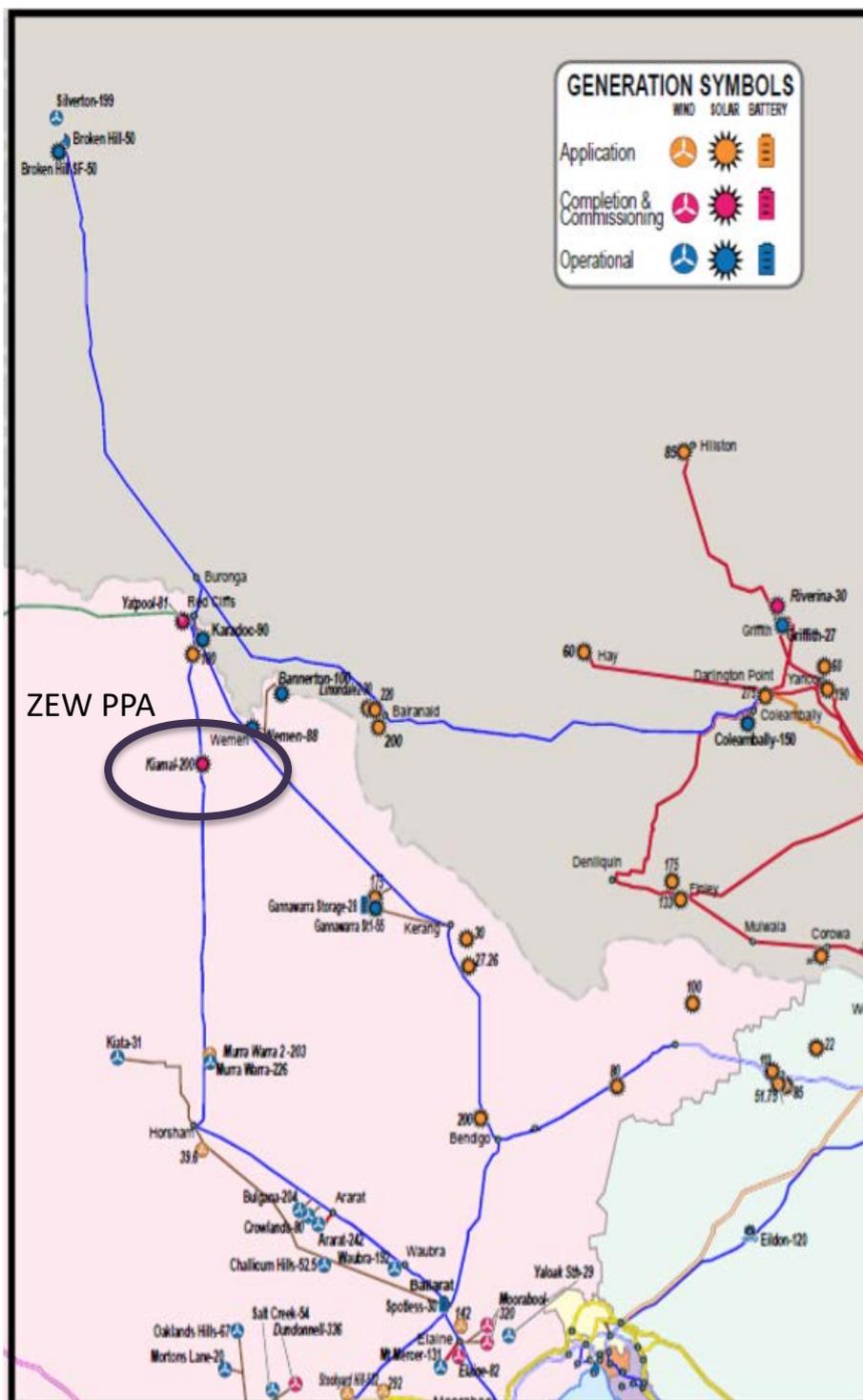
- New transmission infrastructure. An 800MW transmission line connecting NSW, SA and Victoria through Buronga has recently been approved and will be constructed by 2022. This interconnector will enable existing solar plants access to market only and will be fully utilised on completion. Another interconnector between NSW and Victoria via Kerang is also likely to proceed by 2025. These will improve the reliability of the power network.
- An Intra-regional spot market is being considered for the region. This would mean the LMW service region would have separate spot price from the rest of Victoria.

- Marginal loss factors (MLF's) change favourably for LMW the more generation that is developed in our region. However, there are submissions being considered by the AER to change the way MLF's are calculated.

Emergence of green Hydrogen as a potential fuel source

There is evidence that the cost hydrogen produced by electrolysis is similar to diesel now and that the cost is expected to halve over the next 5 years¹.

Attachment 1. Electrical network and location of generation.



¹ Green Hydrogen Investment Program; November 2019. Victorian State Government, p 11.