SOLARRESERVE
Australia Pty Ltd

South Australian Energy Transformation PADR Feedback

ElectraNet
South Australian Energy Transformation PADR Feedback
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Re: Feedback to SAET PADR Final

Thank you for the opportunity for SolarReserve Australia Pty Ltd (SolarReserve) to provide a submission to ElectraNet regarding the SAET PADR. Please find a summary of:

- Who is SolarReserve;
- How our technology works; and a
- Response to some of the questions raised by the SA Energy Transformation PADR feedback.

1. Who is SolarReserve

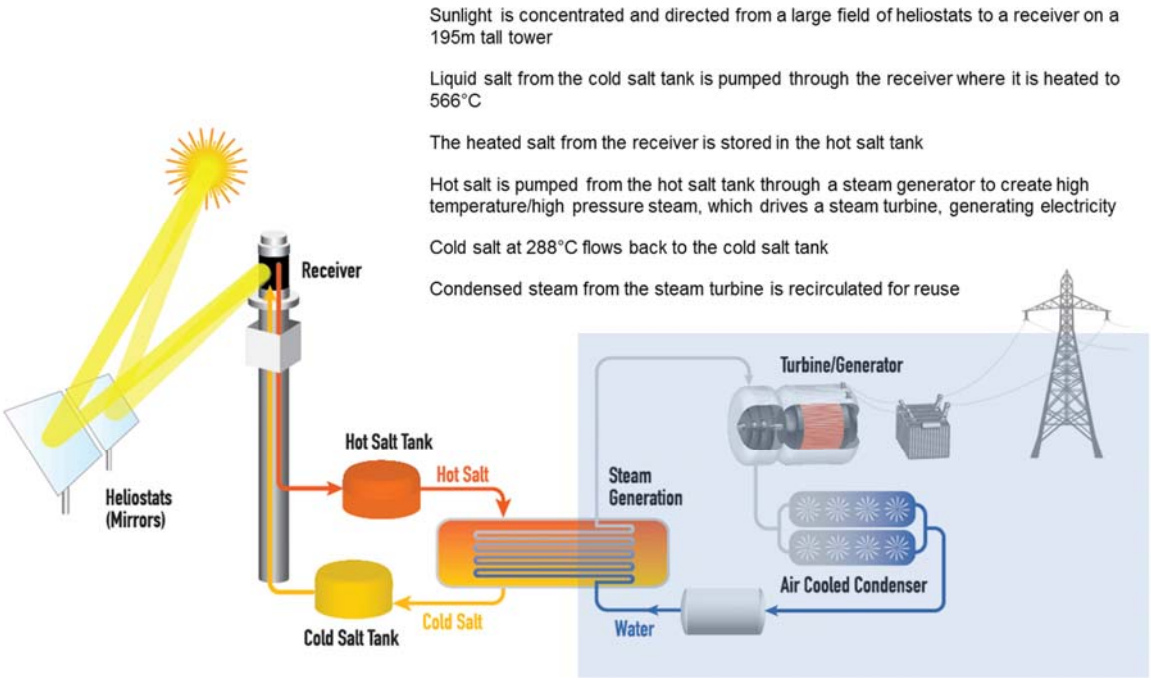
SolarReserve is a leading global developer of Concentrating Solar Power (CSP) and photovoltaic (PV) solutions, that combine our proprietary molten salt power tower storage technology with project development, financing, and operating expertise. Our technology can provide firm, fully dispatchable, non-intermittent renewable energy, day and night. Its power generation capabilities are nearly identical to that which is found in a coal or natural gas-fired power station.

SolarReserve has successfully financed and constructed more than US$1.8 billion of large scale solar projects worldwide. These include the 110 MW Crescent Dunes CSP project in Nevada; the 150 MW_{DC} combined Letsatsi and Lesedi Solar PV Projects; and the 96 MW_{DC} Jasper Solar PV Project in South Africa, all fully operational. Construction is due to commence shortly on the 100 MW Redstone CSP project in South Africa, and a 150 MW Aurora CSP project in South Australia.

Crescent Dunes Solar Energy Project, Nevada, USA. 110MW with 10 hours of full load storage (1,100MWh)

2. How our Technology Works

SolarReserve's CSP with storage technology utilises molten salt to collect and store heat from sunlight during the day and then power a conventional steam turbine whenever electricity is needed. Low-cost thermal storage allows the facility to deliver clean energy at full output 24 hours a day, or whenever it is needed by the grid, rather than being subject to the moment-by-moment variability of sunshine or wind. CSP with molten salt storage can be configured to a variety of load profiles, including peak or baseload operations.



Schematic of SolarReserve's CSP with storage technology

The power block within the facility, as presented in the blue shaded area above, is nearly identical to that found in a coal-fired power station. The key difference with SolarReserve's CSP technology is the absence of fossil fuel. Our technology relies instead on energy collected from the sun, stored in molten salt and converted to steam through a heat exchanger.

Transition from Coal to Renewables

CSP with molten salt energy storage enables the transition from fossil fuel to renewable energy based generation. The storage element of the technology enables CSP to provide nearly identical dispatchability, energy security, network strengthening and wholesale price stability to that which traditional coal-fired power stations provide, but wholly from a renewable energy resource.

The Value of CSP with Storage

Our technology delivers multiple value streams which are increasingly important in the changing energy landscape. CSP with storage provides an alternative to traditional network augmentation solutions, enhancing energy security by providing energy locally from an indigenous generation solution. The benefits that are provided by CSP can be divided into the following four categories:

- Energy and Capacity Value: Molten salt storage allows a CSP facility to shift energy generation to match the highest-value times on the grid. With enough storage, this shift includes covering both the typical "peak" period, and also the unexpected event of a price spike at another time, whether morning, evening, or overnight. This shifting ability allows CSP to replace conventional infrastructure not only for energy supply but for reliable capacity supply, meaning it can fully replace baseload generators like coal power plants. Storage enables CSP to operate at a high capacity factor which leads to a higher utilisation of transmission infrastructure, reducing the capital and environmental cost of building new transmission lines and interconnectors. Because CSP can operate reliably and stably, it reduces the fuel use and Operations and Maintenance (O&M) impact of flexing the conventional generation fleet in response to intermittent solar and wind conditions.

- Ancillary Services: The dispatchability afforded by molten salt storage allows a CSP plant to deliver ancillary services to the grid. "Ancillary services" include the various functions a plant can provide a wholesale market which enhance the market operator's ability to maintain stability. For instance, the practice by which a plant operates at partial capacity but turns up to full capacity rapidly in response to variations in load and generation is often called "spinning reserve." SolarReserve's CSP with storage is capable of providing frequency regulation, spinning reserve, non-spinning reserve, load following services, and black start capability. Each of these is important to the reliable functioning of the grid.

- Intrinsic Stability: A steam turbine, a massive piece of machinery spinning at thousands of RPM, provides significant inertia to the grid. It resists short-term fluctuations which would otherwise cascade into a brownout or blackout. CSP with storage offers fault ride-through capability, frequency response, and voltage / VAR support. These attributes are of enormous value to the grid, particularly in grids like South Australia's that is already experiencing high penetrations of intermittent renewables such as wind, and where even a momentary disruption could have severe economic consequences.

- Risk Management: Renewable energy technology is a hedge against future electricity price increases (as it has no fuel cost), but CSP with storage is also a hedge against other risks. Because it provides ancillary services rather than requiring them from the grid, it is a hedge against future ancillary service costs. Because it enhances the stability of the grid rather than degrading it, CSP is a hedge against the future cost of integrating a high penetration of renewables into the grid – a cost which today is typically socialised in the cost of expensive transmission upgrades and interconnectors and the implementation of higher reserve margins. The output of an individual CSP plant is also lower-risk than PV's due to the nature of *integrated* storage; because all of the collected energy is stored before being dispatched, a CSP plant's output is far less sensitive to momentary fluctuations in sunlight. Weather conditions will only affect the number of operating hours – the MWh amount delivered per day – and will not affect the MW level that the system produces. Importantly, CSP with storage can also change its behaviour mid-life, 10 or 20 years after commencing operations, to adapt to new market realities. This allows CSP to maintain its value over the long term, even while the wholesale market value of additional PV or wind declines precipitously as more and more of those technologies are added to the grid.

Wholesale Market Value

The energy landscape in Australia is rapidly changing as coal fired generation is phased out and solar and wind power gain traction. SolarReserve's CSP facility can adapt to the changing profile of the market, both now and into the future. SolarReserve's CSP technology is designed with price risk management in mind, featuring two key elements:

- High capacity factor: SolarReserve's CSP technology can run for up to 24 hours per day throughout the summer months, smoothing intermittency generated by wind and solar PV and adding stability to the network. This guarantees that the facility will meet all high demand periods on the grid.

- High storage capacity: When not running baseload, 8-12 hours of storage capacity (typical for plants of this scale) allows for unprecedented discretion in dispatch patterns. The facility could run principally at night during the winter, if it were advantageous to avoid hours when intermittent generation is generating. The dispatch pattern can adapt as markets change, allowing the CSP facility to adjust its behaviour following contingency events and as the States load profile changes over the next 20 years.

Independent studies have shown that CSP with a significant amount of storage is capable of consistently supplying electricity into the peak demand periods.[1] Additional studies have shown that intermittent renewables (PV and wind) without storage *lose their value* as additional intermittent renewables come on line, while CSP with storage maintains its value.[2,3]

COMMENT ON ELECTRANET INTERCONNECTOR PROPOSAL 2018

1. *South Australia is a national leader in renewable energy and we have an opportunity to further build on this reputation. Interconnection with NSW would enable South Australia to increase renewable energy production and export it into the national market.*

   An interconnector with NSW was found to provide the largest net benefits to customers of all the options considered.

   COMMENT:
   AEMO suggested (in section 4.3.2 of the draft SAET PADR), that the system resilience benefits should be described and matched with the components that deliver those benefits.

   The Riverlink (Option C.3i) Interconnector crosses three of the REZs identified by AEMO (19, 18, 13). These three REZs all support the same intermittent types of renewable energy (wind and photovoltaic) and are not attractive for renewable energy projects such as CSP, that can bring system resilience benefits, such as inertia and dispatchability.

   The Option C.3i interconnector may have benefits in supplying cheap electricity from interstate and access to existing sources of inertia for a period. Some of these existing sources of inertia are scheduled to retire soon and this will result in an area of low system strength connected to another area of low system strength.

   Furthermore Option C.3i is unlikely to attract renewable energy that can provide inertia or grid support services. The REZs as identified by AEMO do not recognise the different resource requirements between PV and CSP or the benefits of CSP.

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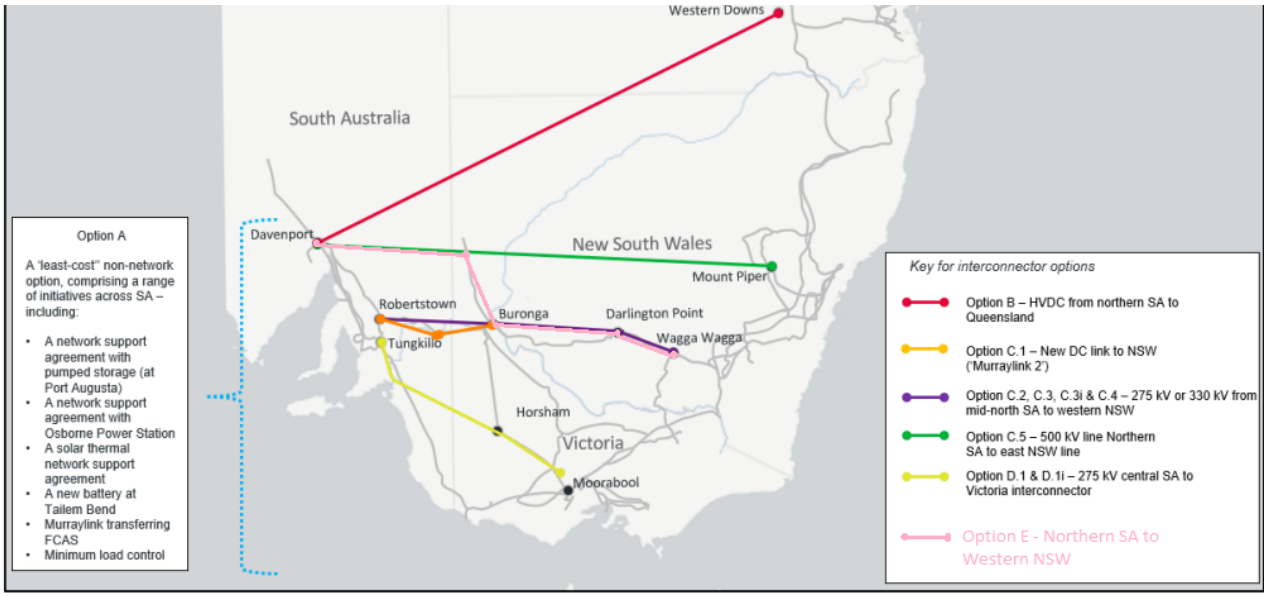
[1] *Madaeni, S.H., R. Sioshansi, and P. Denholm, "Estimating the Capacity Value of Concentrating Solar Power Plants: A Case Study of the Southwestern United States," IEEE Transactions on Power Systems, Vol 27, No 2, pp 1116-1124, May, 2012a.*
[2] *Mills, A., and R. Wiser, "Changes in the Economic Value of Variable Generation at High Penetration Levels: Pilot Case Study of California", Environmental Energy Technologies Division, Lawrence Berkeley National Laboratory, LBNL-5445E, June 2012b. See http://eetd.lbl.gov/ea/ emp/reports/lbnl-5445e.pdf.*
[3] *Jorgenson, J., P. Denholm, and M. Mehos, "Estimating the Value of Utility-Scale Solar Technologies in California Under a 40% Renewable Portfolio Standard," National Renewable Energy Laboratory, Technical Report, TP-6A20-61685, May 2014.*

It would provide more opportunity if the interconnector were one that targeted the widest range of renewable energy technologies in the REZ as this would allow a better mix of technology that could provide a more resilient solution.

SolarReserve suggests that a combination of the Options B and C would incentivise more renewable energy developments that will bring with them the suite of resilience benefits. Please see the attached image in Figure 1.

Figure 1 - Alternative Interconnector



2. *Construction of a new 330 kV line between South Australia's mid-north and Wagga Wagga in New South Wales, via Buronga, is expected to deliver the highest net market benefits by helping to lower electricity prices, improve system security and support our energy transformation towards a lower carbon emissions future and the adoption of new technologies, through improving access to high quality renewable resources across regions.*

COMMENT:

The interconnector could be relocated northwards Broken Hill to increase the potential for a greater diversity of renewables including CSP with storage.

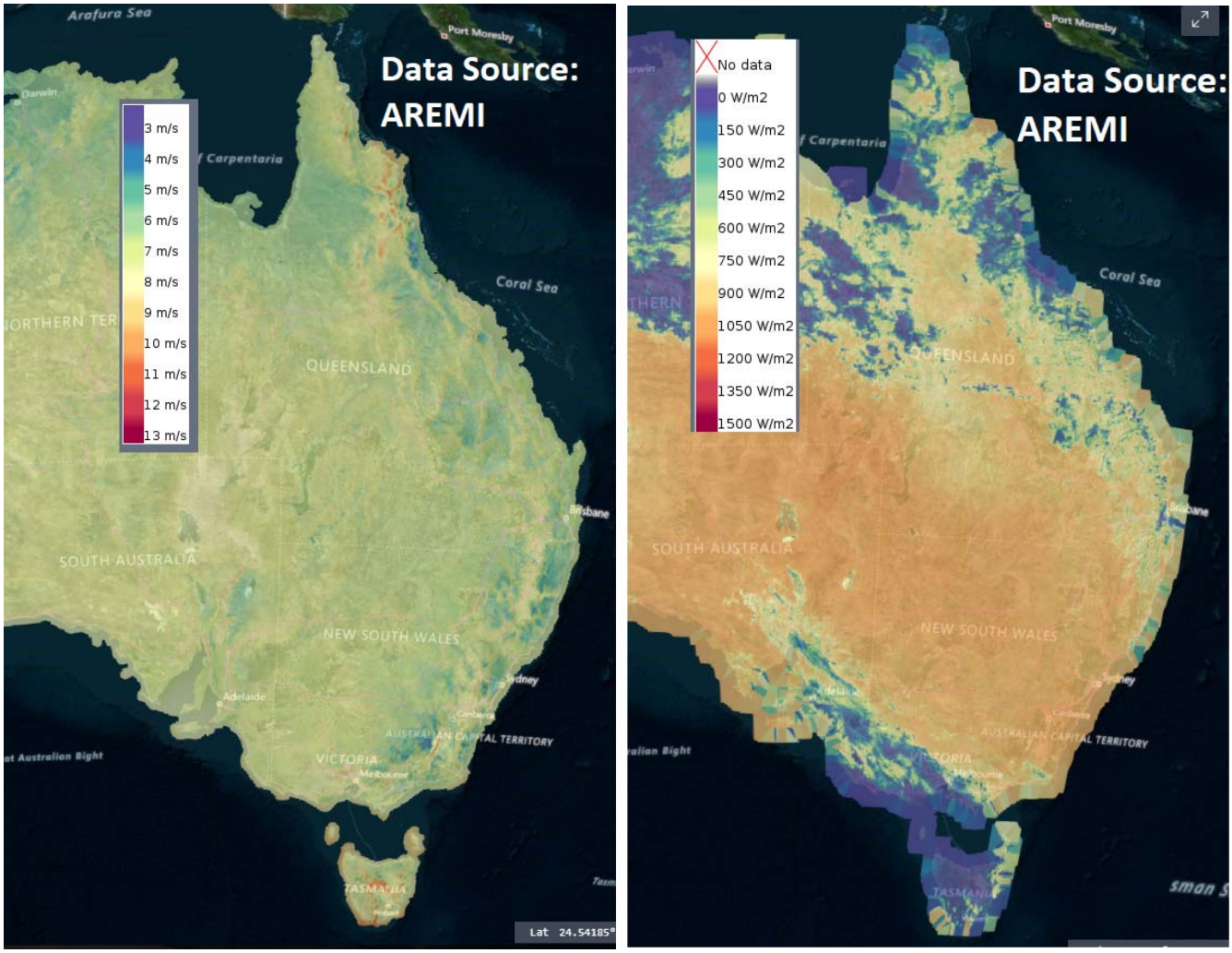
While there are no established REZs on the SA to QLD interconnector Option B, this factor is driven by the lack of existing transmission lines, rather than lack of resource. The DNV GL study to determine the REZs cross referenced energy resources to areas close to existing transmission lines.

This makes it very difficult to compare avoided REZ transmission capex when the interconnector would form the transmission to the new REZ. ElectraNet should consider reviewing the value of a new REZ(s) along the line route of Option B and the overall market benefit that this would provide.

The proposed alignment of Option B passes close by REZ 12 and crosses some of the best solar resources in SA, QLD and NSW that without the Option B interconnector have not previously been considered as possible REZ(s). See Figure 2 for reference on the quality of the resources traversed by the Option B interconnector.

These high-quality resource areas are particularly valuable to CSP and would provide the opportunity to develop low cost, high efficiency, non-intermittent base load renewables across SA, NSW and QLD.

Figure 2 – Resource maps (Wind on left, Solar DNI on right) from AREMI



As demonstrated by the Aurora project in South Australia, transitioning from coal fired power stations to CSP could be a practical solution for SA, NSW and QLD. CSP and coal fired power stations both have the same technology base: they both use steam turbines. The difference is the fuel source, with coal fired stations using fossil fuels and CSP the sun. Both technologies are also dispatchable during the day and night, and operate in similar ways on the electricity network, unlike solar PV and wind, which operate very differently and only provide intermittent electricity when the sun is shining or the wind blowing.

Overall, CSP has significant development potential in SA, NSW and QLD. SolarReserve is already working with the SA government, the NSW government, the QLD government and ElectraNet, TransGrid and Powerlink to plan for future projects.

3. Next Steps

We thank you for the opportunity to contribute to the feedback process for the SAET PADR. Please feel free to contact me on 0428 928 894 or at Daniel.Thompson@SolarReserve.com should you wish to discuss any of the above further.

Yours sincerely,

Daniel Thompson
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SolarReserve Australia Pty Ltd