AEMO Integrated System Plan consultation – December 2017

Stakeholder input by:

The Melbourne Energy Institute at the University of Melbourne
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Introduction

There is a need for significant modelling and study of scenarios to ensure the best possible outcomes for the ISP. The UoM has significant, relevant experience and capability in these areas drawn from UK studies and work in Australia with AEMO and AusNet Services and therefore feels qualified to comment.

Stakeholder input to modelling questions 1.1 and 1.2

In responding to the initial two questions, the UoM is using assumptions and conclusions reached during recent work with AEMO and AusNet services as well as expertise and experience from modelling and projects performed in the UK. Further research and modelling would be needed to answer the specifics in a fuller way.

1.1 *The material questions the ISP seeks to address are in Section 1.3.1.* ***Are there any other questions the ISP should address?***

Other questions that could be relevant (potentially to be merged with the existing questions) would be:

1. What technical, regulatory and commercial changes might be required for Distribution Network Services Providers to play new, more active roles?

This is particularly to provide local supply and demand balancing and provide demand management and ancillary services also supported by aggregated renewable energy generation (combined with storage) that could be orchestrated to interact with the transmission system[1,2] and potentially relieve the augmentation needs for the transmission network.

2. What needs to be done in order to incentivise potentially more efficient investment that could exploit the opportunity of using DER to provide system support services?

DER is currently underutilised in its ability to provide system services and to support local system balance within distribution networks[3]. With the appropriate control systems, these locally based resources, not necessarily small, could contribute to reduce upstream investments[4,5,6]. State planning aimed to increase the extent of "self-sufficiency" would need to be studied more closely as a viable alternative to transmission investment.

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[1] A. Saint-Pierre and P. Mancarella, "Active distribution system management: A dual horizon rolling scheduling framework for DSO/TSO interface under uncertainty", *IEEE Transactions on Smart Grid*, vol. 8, no. 5, pp. 2186-2197, September 2017.

[2] L. Zhang et al., "System-Level Operational and Adequacy Impact Assessment of Photovoltaic and Distributed Energy Storage, with Consideration of Inertial Constraints, Dynamic Reserve and Interconnection Flexibility", *Energies*, vol. 10, no. 7, p.898, July 2017.

[3] E.A. Martinez-Cesena, N. Good, A. Syrri, and P. Mancarella, "Techno-Economic and Business Case Assessment of Multi-Energy Microgrids with Co-Optimization of Energy, Reserve and Reliability Services", *Applied Energy* 210 (2018) 896–913.

[4] J. Schachter, P. Mancarella, J. Moriarty, and R. Shaw, Flexible investment under uncertainty in smart distribution networks with demand side response: Assessment framework and practical implementation, *Energy Policy*, Volume 97, October 2016, Pages 439–449.

[5] Y. Zhou, P. Mancarella and J. Mutale, A framework for capacity credit assessment of electrical energy storage and demand response, *IET Generation, Transmission and Distribution*, Vol. 10, Issue 9, Pages 2267-2276, June 2016.

[6] E.A. Martinez-Cesena, N. Good, and P. Mancarella, Electrical Network Capacity Support from Demand Response: Techno-Economic Assessment of Potential Business Cases for Commercial and Residential End-Users, *Energy Policy*, Volume 82, July 2015, Pages 222–232.

3. What is the role that new "smart grid" operational arrangements, services and technologies could play to improve investment efficiency in transmission asset?

The connection of large scale renewable generation in targeted zones (REZ facilities) remote from demand would further continue the centralised generation paradigm, which has a number of potential benefits. However, this might also result in relatively low transmission asset utilisation (due to intermittent generation) akin to peak demand management issues whereby a significant % of the network assets may be underutilised for large part of the year, namely, when the REZs are not producing and geographical diversity across the NEM could be insufficient or a costly exercise. To guarantee high levels of asset utilization, further considerations could then be given to; the potential role of storage of different types co-located in REZs; cost-effective transmission sizing and active network management (e.g., network investment co-optimised with renewable curtailment and active/reactive power control); utilization of power-electronics based devices for power flow control[7].

4. What regulatory changes are needed to promote new non-network solutions (e.g., demand response, storage, etc.) and provide a level playfield with conventional transmission investment[8]?

5. High-impact low-probability events are becoming of increasing importance worldwide and in Australia too; to what extent should planning be resilience-driven besides reliability-driven[9,10]?

1.2 The scenarios the modelling will use to inform the ISP are outlined in Section 1.4. Recognising the time limitations to produce the first ISP in mid-2018, ***are these suitable scenarios to address at a high level? Should these be expanded in more detailed analysis following the first high level ISP?***

In consideration of the suitable scenarios that have been selected, we suggest that it may be necessary, albeit challenging, to have economic forecasting of industrial, population and load growth modelled. Suitable scenarios, potentially to be considered after the first ISP stage, could depart from the focus on wind and solar coupled to electricity storage and include, for example, other renewables (e.g., tidal and waves) as well as major changes in industrial loads and other sectors (e.g., electrification of fuels).

Contributors

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[7] R. Moreno, A. Street, J. M. Arroyo, P. Mancarella, "Planning low-carbon electricity systems under uncertainty considering operational flexibility and smart grid technologies", *Philosophical Transactions of the Royal Society A*, Vol. 375, Issue 2100, Aug 2017, pp. 1-29.

[8] E. A. Martínez Ceseña, V. Turnham and P. Mancarella, "Regulation of trade-offs between economic and social costs for the planning of flexible distribution networks: Analysis of post-contingency demand response solutions," *Elec. Pow. Syst. Research*, vol. 141, pp. 63 –72, 2016.

[9] M. Panteli and P. Mancarella, "The Grid: Stronger, Bigger, Smarter? Presenting a conceptual framework of power system resilience", *IEEE Power and Energy Magazine*, vol. 13, no. 3, pp. 58-66, May-June 2015.

[10] M. Panteli, D. N. Trakas, P. Mancarella and N. D. Hatziargyriou, "Power Systems Resilience Assessment: Hardening and Smart Operational Enhancement Strategies," *Proceedings of the IEEE*, vol. 105, no. 7, pp. 1202-1213, July 2017.