2016 NATIONAL TRANSMISSION NETWORK DEVELOPMENT PLAN

RESPONSE TO 2016 CONSULTATION PAPER SUBMISSIONS

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AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

IMPORTANT NOTICE

Purpose

AEMO has prepared this document to provide information about AEMO's response to submissions received on the January 2016 NTNDP Consultation Paper, as at the date of publication.

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CHAPTER 1. INTRODUCTION

This document provides AEMO's responses to stakeholder submissions on the 2016 Consultation Paper[1] for the *National Transmission Network Development Plan* (NTNDP), and highlights the material discussion points from an open-invite consultation workshop held on 25 February 2016.

AEMO publishes the annual NTNDP as part of its role as national transmission planner under the National Electricity Law, in accordance with clause 5.20.2 of the National Electricity Rules (the Rules).

The NTNDP is an independent, strategic view of the efficient development of the national transmission grid in the National Electricity Market (NEM) over the next 20 years.[2]

1.1 2016 Consultation Paper

The Consultation for the 2016 NTNDP accorded with clause 5.20.1 of the Rules. It provides stakeholders with the opportunity to comment on relevant scenarios and sensitivities, methodology and inputs, and material issues involved in preparing the 2016 NTNDP.

In the 2016 Consultation Paper, AEMO sought specific feedback from stakeholders on the following questions:

1. What do you think are the material issues facing the electricity industry that the 2016 NTNDP should address?
2. What scenarios/sensitivities would you like to see examined in the 2016 NTNDP?
3. Is the proposed approach to modelling the impact of the COP 21 Commitment[3] reasonable?
4. What do you think are the key challenges/opportunities for network development in the future, particularly highlighting any that were not identified in the 2015 NTNDP?
5. Do you have any suggestions on how to improve the generation outlook or transmission outlook methodologies for the 2016 NTNDP?
6. Are the proposed 2016 NTNDP input assumptions appropriate, and would you recommend any additions/changes to these assumptions?

These questions were discussed at a stakeholder consultation workshop held on 25 February 2016, and stakeholders were also invited to provide formal written submissions.

Four formal submissions to the 2016 Consultation Paper were received from:

- GDF Suez Australian Energy (GDFSAE).
- Hydro Tasmania.
- TransGrid.
- Sligar and Associates (Sligar).

AEMO would like to thank these stakeholders for taking the time to provide written feedback. This feedback, together with feedback obtained in the stakeholder workshop, has been an important contribution to developing the objectives, scope and assumptions to be used in the 2016 NTNDP.

This paper outlines how AEMO will take into account the points raised in those submissions and the February workshop when preparing the 2016 NTNDP.

[1] AEMO. 2016 Consultation Paper for the National Transmission Network Development Plan. Available: http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/National-Transmission-Network-Development-Plan.
[2] National Electricity Rules – subparagraph 5.20.2 (c) (1).
[3] Australia's 2015 Paris 21st Conference of Parties (COP21) emission abatement commitment to reduce greenhouse gas emissions by 26 to 28% by 2030 from 2005 levels.

CHAPTER 2. RESPONSE TO WRITTEN SUBMISSIONS

The format of this response to written submissions will first cover the specific questions raised in the 2016 Consultation Paper, and will then address any other points raised in the submissions or stakeholder workshop.

2.1 Question 1: What material issues should the 2016 NTNDP seek to address?

The submissions broadly agreed with the four material issues facing the electricity industry that AEMO highlighted in the Consultation Paper, namely:

- Uncertainty about the electricity industry's contribution towards emissions reduction targets, which can change the generation mix and network development in the National Electricity Market (NEM).
- A changing generation mix from large-scale synchronous generation to inverter-connected generation (both large-scale and distributed), which is leading to emerging operational challenges.
- The increasing range of both network and non-network solutions to be considered in long term planning processes to meet these emerging operational challenges.
- Changing consumer behaviour, influenced by network tariff reform and adoption of energy management technologies, changing both the amount and timing of grid electricity consumption.

Submission topic 1

GDFSAE added that more emphasis should be placed on identifying the role of network support services required to integrate intermittent generation. Hydro Tasmania also highlighted that there may be shortcomings in the way that network support services provided by synchronous generators are currently valued.

Hydro Tasmania stated that they currently provide NSCAS-type services to the market which are essentially provided free in the absence of any formal arrangements, and that the provision of these services masks network impacts to voltage, fault level provision, frequency, and inertia. As a result, Hydro Tasmania said, NSCAS gaps are not identified and reported. This topic was also raised at the consultation workshop.

AEMO response

AEMO recognises that detailed studies of the outlook for inertia and fault level provision have not been included in previous NTNDPs, which have traditionally focused on voltage studies. AEMO intends to include all these studies in the scope for the Network Support and Control Ancillary Services section of the 2016 NTNDP.

The content of the NTNDP and the obligations in relation to NSCAS that are triggered as a result are prescribed under the National Electricity Rules (Rules).[4]

Under that framework the NTNDP must only address NSCAS gaps, which are defined as a need for further NSCAS arising within the next five years. The intent of the NSCAS rule as it was determined in 2011, and AEMO's obligations under this rule, were made clear at that time and the rules implementing NSCAS are prescriptive.[5]

Based on the current framework and current market operation, as Hydro Tasmania correctly points out, no gap would be identified. It follows that no obligation would be triggered for either the relevant

[4] National Electricity Rules. Clause 5.20.2.
[5] AEMC, 2011. Network Support and Control Ancillary Services. Available: http://www.aemc.gov.au/Rule-Changes/Network-Support-and-Control-Ancillary-Services#.

transmission network service provider (TNSP) to procure services, or for AEMO to consider safety-net options through the NSCAS framework. The NSCAS framework may therefore not be the appropriate mechanism to address the specific issues raised by Hydro Tasmania.

On the broader question of valuing network support services, AEMO and the Australian Energy Market Commission (AEMC) have formalised a collaboration[6] to address challenges in the National Electricity Market as a result of the changing generation mix. Through its System Security Market Frameworks Review[7], the AEMC will address the related regulatory and market framework challenges that will arise, with technical input from AEMO's Future Power System Security (FPSS) program.[8] The next update to the FPSS program will be published in August 2016.

An objective of this collaboration is to publish recommendations on changes required to the regulatory framework to meet power system security challenges, with an initial focus on issues related to frequency control, lowering levels of system inertia, and areas of the power system that are becoming weaker.

Submission topic 2

TransGrid identified that the interaction between new generation sources connecting to potentially 'sub-optimal' locations in the NEM and the potential withdrawal of existing generation and transmission assets is likely to drive different network topologies to what the least cost modelled outcome would project. TransGrid suggested that AEMO should examine this interaction further with stakeholders as it develops the 2016 NTNDP.

In the consultation workshop Powerlink also identified that analysis on the outlook for transmission asset utilisation could assist their decision-making on replacement or withdrawal of transmission assets.

AEMO response

AEMO intends to apply two methodology improvements relating to this topic in the 2016 NTNDP:

- New generation built in the first five years of the generation outlook modelling will be prioritised according to the location of new generation connection applications received by TNSPs and AEMO. This will guide the planting of modelled new generation capacity in locations that proponents believe are most attractive or efficient in the NEM at present, rather than relying solely on generic fuel and technology costs, fuel availability, and network connection costs (which has been the approach in previous NTNDPs) to determine location of new generation.
- AEMO intends to examine national flow path utilisation rates over the outlook period for the scenarios assessed. This information should help TNSPs to understand whether opportunities exist to downgrade or retire transmission assets that are due for replacement or refurbishment.

2.2 Question 2: What scenarios/sensitivities would you like to see examined?

The Consultation Paper discussed how scenario development for the NTNDP adopts the demand sensitivities in the *National Electricity Forecasting Report*[9] (NEFR) as a starting point, but may adjust them according to the focus of the planning analysis. This consultation question sought stakeholder feedback on relevant scenario variations to consider. The 2016 NTNDP scope and scenarios are described further in Chapter 4.

[6] AEMC-AEMO Collaboration on Framework for System Security in the National Electricity Market. Available: http://www.aemc.gov.au/getattachment/47f82c2a-92a1-4c3e-bb2c-5a02f431bced/AEMC-AEMO-scope-of-work.aspx.
[7] AEMC. System Security Market Frameworks Review. Available: http://www.aemc.gov.au/Markets-Reviews-Advice/System-Security-Market-Frameworks-Review#.
[8] AEMO. Future Power System Security program. Available: http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Security-and-reliability.
[9] AEMO. *2016 National Electricity Forecasting Report*. Available: http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/National-Electricity-Forecasting-Report.

Submission topic 3

GDFSAE proposed that using a small number of "stretching but believable" scenarios to examine a range of uncertainty is an appropriate approach. The objective in this approach is to identify an envelope of scenarios within which the future scenario will be captured.

TransGrid added that a wide range of generator planting possibilities should be assessed in order to ensure the transmission network has the flexibility to cater for a range of futures.

Discussion on scenarios was also held at the consultation workshop. Powerlink stated an interest in whether the NTNDP scenarios could examine the one million solar rooftops by 2020 and 50% renewables aspirations in Queensland. There was also general interest in AEMO considering the need for further interconnection across the NEM, but particularly between South Australia and other regions.

AEMO response

The 2016 NTNDP scenarios for demand will examine a most probable path together with a stretching low grid demand scenario. As network development expenditure is driven less by maximum demand levels, and more by the need to integrate new renewable generation into the NEM, examining a low grid demand scenario will stress test how minimum demand levels could impact network development and power system security as the generation mix continues to evolve.

The 2016 NTNDP will examine the impact of the COP21 Commitment (discussed further below) and relevant legislated policies such as the Renewable Energy Target. It will not consider stated aspirational targets such as the 50% renewables target in Queensland and South Australia, or the announced renewable energy target in Victoria, since these targets are not yet legislated.

AEMO does intend to examine the impact of a higher emission abatement target, which could take into account regional targets, in an *Insights* paper to be published after the 2016 NTNDP.

Further transmission interconnection between regions will be considered in the 2016 NTNDP, and this is outlined further in Chapter 4 below.

Submission topic 4

TransGrid supported the NTNDP exploring a range of potential solutions to address identified network security and operating limitations. TransGrid is, however, concerned by any attempt to put dollar values in the NTNDP against these potential solutions, as the analysis will necessarily be of a high level with various simplifying assumptions. Publishing dollar values in this way may result in erroneous price signalling to the market and distorting the efficient procurement of solutions.

AEMO response

AEMO will compare different network development plans using high level costs estimates for each solution, indicating the likely least cost network development plan for consumers. All indicative costs (including tolerances) associated with each development plan will be presented, so the analysis is as transparent as possible. AEMO will emphasise that the NTNDP represents a high level strategic analysis, and more detailed studies, such as the Regulatory Investment Test for Transmission, should be undertaken to inform investment decision-making.

2.3 Question 3: Is the proposed approach to modelling the COP21 Commitment reasonable?

The Council of Australian Governments (COAG) Energy Council has agreed that the contribution of the electricity sector should be consistent with national emission reduction targets. For energy sector modelling, COAG has stated that a 28% reduction from 2005 levels by 2030 is an appropriate constraint for AEMO to use in its ongoing forecasting and planning processes.

The general feedback from stakeholders was that it is reasonable to assume the NEM achieves a proportionate share of emissions reduction to 2030, although acknowledging that, in reality, the electricity sector's share could be more or less than this.

Submission topic 5

GDFSAE emphasised the impact of the emissions reduction target will differ depending on the policies applied to reach the target. GDFSAE proposed that a range of policies should be examined. GDFSAE also recommended that the impact of different policies on wholesale prices be incorporated, together with the resulting impact on electricity demand.

AEMO response

AEMO agrees that the emissions reduction target could be met through a range of different policy measures. In the absence of detailed policy mechanisms to achieve the COP21 Commitment, AEMO believes it is prudent to explicitly assume a 28% reduction of emissions in the electricity industry is achieved. AEMO will adopt a least cost modelling approach, subject to achieving the emissions constraint, without making any assumption on the type of policy that will be implemented to facilitate this.

2.4 Question 4: What are the key challenges/opportunities for network development in future?

Only one key challenge/opportunity identified in the submissions has not already been covered in other sections of this response.

Submission topic 6

GDFSAE highlighted that there are often differences in the interconnector capacities applied in previous studies and actual operational outcomes, mainly driven by intra-regional constraints. An example is interconnector capacity between regions being constrained in light of congestion on the South Morang F2 transformer in Victoria.

AEMO response

In AEMO's long-term market simulations, the nominal capacity of the interconnectors is applied, although reduced ratings are assumed for inter-regional reserve sharing during peak demand conditions, to reflect likely constraints invoked at those times. In its short-term (hourly) market simulations, AEMO applies both inter-regional and intra-regional constraint equations to identify the appropriate transmission development strategy. These constraint equations simulate the limitations observed in practice rather than the nominal capacity of the interconnectors. Where appropriate, a feedback loop is provided to adjust the inputs applied in the long-term studies. This approach was taken in the 2015 NTNDP and will continue in 2016.

2.5 Question 5: How to improve the generation and transmission outlook methodologies?

Submission topic 7

After considering the merits of the least cost modelling approach versus a true market modelling approach in the generation outlooks, GDFSAE strongly suggested that the least cost approach should continue to be used for NTNDP studies. GDFSAE also recommended that some sensitivities based on market dispatch behaviours should also be considered from completeness.

GDFSAE did raise the point that generation plant introduced by the least cost model may not be sustainable in a market arrangement since the revenue is not based on costs but market outcomes.

The merits of the least cost modelling approach were also deliberated at the consultation workshop, with participants discussing both for and against utilising the approach for the NTNDP modelling.

AEMO response

AEMO believes that the least cost modelling approach is most appropriate for the purpose of the NTNDP, which is to identify an appropriate course for the efficient development of the national transmission grid.

The NTNDP modelling is based upon the current market design and regulatory frameworks. Discussion on the merits of the current market design is out of scope for the NTNDP.

AEMO acknowledges that a short run marginal cost (SRMC) bidding approach, ignoring unit commitment, tends to underestimate the amount of synchronous generation dispatched, and therefore the level of inertia in the power system. AEMO intends to run a sensitivity on the base case using a competitive bidding strategy with unit commitment decisions included, to provide insights on the outlook for inertia over the next 20 years.

2.6 Question 6: Are the proposed 2016 NTNDP input assumptions appropriate?

Only GDFSAE recommended specific considerations for the 2016 NTNDP input assumptions, highlighting that AEMO should consider carefully how the Basslink outage may impact future interconnector studies, and how hydro storage levels may be managed differently in future. GDFSAE also suggested that AEMO should apply a similar methodology of regionalised fuel and technology prices to previous NTNDPs.

AEMO response

AEMO will reassess the failure rates that should be applied to any interconnector between Victoria and Tasmania.

The assumptions applied for annual hydro yield are based on historical average inflow data from recent years, and use of the water across the year is optimised within the market model. AEMO intends to continue this practice for the 2016 NTNDP. It is not considered appropriate for AEMO to comment more generally on water storage management practices.

AEMO will use the Australian Power Generation Technology (APGT) report as the basis for the 2016 fuel and technology cost assumptions.[10] These figures have been adjusted to maintain the regionalised fuel prices, consistent with previous NTNDPs, and AEMO has sought further information from other sources to ensure the most up to date costs are incorporated in the NTNDP:

- Large-scale PV and concentrated solar thermal costs have been reduced, based on publicly available information, to reflect further cost reductions since the APGT report was published in 2015.
- AEMO engaged Wood Mackenzie to provide updated coal fuel costs.
- AEMO engaged Core Energy Group to provide updated gas fuel costs.
- Large-scale battery storage costs have been aligned to those in the Energy Storage for Commercial Renewable Integration project.[11]

All fuel and technology costs will be published in full in the NTNDP Database later this year.

[10] CO2CRC, 2015. *Australian Power Generation Technology Report*. Available: http://www.co2crc.com.au/publication-category/reports/.
[11] ARENA. *Energy Storage for Commercial Renewable Integration*. Available: http://arena.gov.au/project/energy-storage-for-commercial-renewable-integration/.

2.7 Transparency

Almost all submissions highlighted how important it is for AEMO to be totally transparent on the assumptions applied in the NTNDP modelling.

AEMO response

AEMO agrees with the requirement for total transparency on the inputs, assumptions, and methodologies applied in the NTNDP studies. All relevant inputs will be published in the 2016 NTNDP Database to enable stakeholders to replicate the modelling using their own inputs and assumptions.

CHAPTER 3. 2016 NTNDP OBJECTIVES

Subparagraph 5.20.2(c) of the Rules states some of the requirements the NTNDP must address. The most pertinent of these state that the NTNDP must:

1. Consider and assess an appropriate course for the efficient development of the national transmission grid for a planning horizon of at least 20 years.
2. Identify a range of credible scenarios for the geographic pattern of the demand for, and supply of, electricity for the planning horizon of the NTNDP.
3. Specify a development strategy for each current and potential national transmission flow path in accordance with clause 5.20.3.
4. Include an assessment that identifies any NSCAS gap, the relevant NSCAS trigger date and the relevant NSCAS tender date.

In addition to meeting the requirements of clause 5.20.2, the NTNDP process is also guided by some key objectives that AEMO sets through consultation with AEMO's internal and external stakeholders.

1. **How has AEMO's long-term view on transmission development evolved following changes in the National Electricity Market (NEM), and why?**

   This is important for providing stakeholders with context on what factors influence transmission development and how these factors have changed in recent years.

2. **For each scenario examined, what is the appropriate course for the efficient development of the national transmission grid over the next 20 years?**

   This is the core purpose of the NTNDP. In performing this analysis it is possible that more than one efficient solution will emerge, particularly given rapidly evolving technology improvements.

3. **What are the possible network and non-network development solutions to efficiently manage challenges to power system security and reliability presented by the changing generation mix?**

   Having highlighted a range of emerging challenges associated with the changing generation mix in the 2015 NTNDP, the next progression for the 2016 report is to identify a range of opportunities to resolve those challenges.

4. **Are there opportunities to optimise transmission reinvestment expenditure to better match the transmission network topology to future generation and demand outlooks?**

   As the focus of network development is changing from augmentation to replacement expenditure it is important to understand how the utilisation of major flow paths is likely to change over the next 20 years.

5. **Are there any requirements for further provision of Network Support and Control Ancillary Services (NSCAS) in the NEM over the next five years?**

   This is a core element of the NTNDP and for the 2016 report it will incorporate studies into voltage support, inertia levels, and fault level provision.

CHAPTER 4. 2016 NTNDP SCOPE

This chapter provides an overview of the 2016 NTNDP scenarios and scope that have been developed following detailed consultation with NTNDP stakeholders.

4.1 2016 NEFR demand sensitivities

In 2016, AEMO has developed weak, neutral, and strong demand sensitivities for its major forecasting and planning publications. These were first presented in the 2016 NEFR and the neutral sensitivity is considered the most likely pathway for consumer demand.

The weak and strong sensitivities are based on dynamics affecting total energy consumption, such as differences in the population, the performance of the economy, and consumer confidence/engagement.

These sensitivities are not low and high boundaries for the consumption of grid-supplied energy. Indeed, a strong economy is assumed to have higher uptake of rooftop PV and a stronger embrace of energy efficiency, outcomes that offset the consumption of grid-supplied energy.

All sensitivities assume the successful achievement of the COP21 Commitment.

4.2 2016 NTNDP scenarios

The 2016 NTNDP will consider future development under two scenarios for grid demand:

- “Neutral grid demand” scenario adopts the 2016 NEFR “Neutral” sensitivity.
- “Low grid demand” scenario adopts the 2016 NEFR “Weak” sensitivity, but with adjustments. The NTNDP scenario will adopt higher uptake of energy efficiency and embedded technologies. The result is a scenario that reflects a credible low boundary for grid demand.

4.3 2016 NTNDP scope

For each demand scenario, the high level scope of work is to:

- Co-optimise generation and transmission outlooks to establish the most appropriate course for efficient transmission development, assuming the COP21 emissions reduction target is met.
- Test outlooks in market and network models to identify challenges to system security and reliability resulting from the changing generation mix, at times of both maximum and minimum demand.
- Identify credible network and non-network development solutions to efficiently maintain system security and reliability. AEMO intends to include high level cost benefit analysis of:
  - A new South Australia–Victoria/New South Wales interconnector.
  - A new Victoria – Tasmania interconnector (specific locations to be determined).
  - Updating the functionality of Murraylink interconnection between Victoria and South Australia
  - A combination of new interconnectors between regions.

  The investigation of non-network development will focus on whether regionally located solutions such as demand management, distributed generation, storage, synchronous condensers, and dynamic reactive power sources could efficiently maintain system security and reliability.
- Examine national flow path utilisation rates over the outlook period. This information should help TNSPs to understand whether opportunities exist to downgrade or retire transmission assets.
- Perform Network Support and Control Ancillary Services (NSCAS) studies that include examination of whether additional network support services (such as voltage, inertia, and fault level provision) are required at times of maximum and minimum demand in the next five years.