Australian Energy Market Commission

RULE CHANGE

CONSULTATION PAPER

National Electricity Amendment (Generating System Model Guidelines) Rule 2017

Rule Proponent
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About the AEMC

The AEMC reports to the Council of Australian Governments (COAG) through the COAG Energy Council. We have two functions. We make and amend the national electricity, gas and energy retail rules and conduct independent reviews for the COAG Energy Council.

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1 Introduction

On 1 November 2016, the Australian Energy Market Operator (AEMO) submitted a rule change request to the Australian Energy Market Commission (AEMC or Commission) seeking to broaden the scope and increase the level of detail of model data AEMO may request from registered participants.

This consultation paper has been prepared to facilitate public consultation on the rule change request and to seek stakeholder submissions.

This paper:

- sets out a summary of, and background to the rule change request
- identifies a number of questions and issues to facilitate the consultation on this rule change request
- outlines the process for making submissions.

2 Background

AEMO has submitted a rule change rule request to the AEMC that seeks to broaden the scope and increase the level of detail of model data that AEMO may request from registered participants. This includes requiring the provision of:

- more detailed electromagnetic transient models (EMT-type models) from generators
- a broader scope of modelling data, potentially including models of network equipment, or generator protection and governor systems.

The rule change request was informed by a review of the Generating System Model Guidelines (the guidelines) that was conducted in July 2015 by the Plant Modelling Reference Group (PMRG).[1]

Following the PMRG's review in 2015, the rule change request was further informed by two rounds of consultation with stakeholders and consultants.

2.1 Modelling and data

Models are mathematical representations of how a generating unit or particular piece of network equipment works. These models may be used to represent generators and accompanying equipment, including governors, protection systems and transmission connection equipment. They may also be used to represent network equipment; including interconnector protection systems, static VAR compensators (SVCs) and synchronous condensers.

Model data is used for conducting power system simulations and studies that allow parties to examine how the power system will operate under different conditions.

For example, AEMO uses power system studies to understand the impact of generation systems on power system security. This can be used to inform the generator's performance standards, during the formulation of constraint equations, in ancillary services procurement, to inform planning processes such as AEMO's development of the national transmission network development plan (NTNDP), or during system investigations that follow major disruptions in the NEM.

Registered participants (including intending participants) may also use power system studies when planning their investments and when negotiating connection agreements. Transmission network service providers (TNSPs) may also use these studies to inform decisions about investment in the network and to examine the impacts of generators on the transmission network.

1 The PMRG is a forum of technical experts convened by AEMO that discusses power system modelling and model development. The data and models that generators must provide are described in the guidelines, which are developed by AEMO under the rules consultation procedures.

Generators are required to provide certain information when connecting. This is part of the connection process and is set out in S5.2.4 of the NER. Generators with a combined nameplate rating of 30 MW or more must provide to AEMO and the relevant NSP information about the control systems of their generator systems. This includes the following information:

- "a set of functional block diagrams, including all functions between feedback signals and generating system output;
- the parameters of each functional block, including all settings, gains, time; constants, delays, deadbands and limits; and
- the characteristics of non-linear elements,

with sufficient detail for AEMO and Network Service Providers to perform load flow and dynamic simulation studies."[2]

Generators are required to provide this modelling data to AEMO in both an encrypted and a non-encrypted format from intending participants.

Registered participants may also request encrypted modelling data previously submitted to AEMO by other generators, in order to undertake their own power system studies. NSPs may also receive encrypted model data for their studies.

The NER also set out requirements for ancillary service providers to provide AEMO with certain modelling data. Specifically, providers of SRAS are required to:

> "provide to AEMO data, models and parameters of relevant plant, sufficient to facilitate a thorough assessment of the network impacts and power station impacts of the use of the relevant system restart ancillary service."[3]

2.2 RMS and EMT models

For the purpose of power system studies, there are two types of models that can be used: RMS-type (root mean square) and EMT-type (electromagnetic transient) models:

- RMS-type models are easier to develop and are less complex, but may also be less accurate and not provide an adequate representation of power system outcomes in specific, extreme circumstances.
- EMT-type models are more complex and can be more detailed than RMS-type models. They can also provide a more realistic representation of power system operation under specific, extreme circumstances. However, EMT-type models may also be more costly and difficult to prepare than RMS-type models. They can also be potentially more commercially sensitive as they provide a very detailed "map" of exactly how a generating unit and related systems operate.

2 NER clause S5.2.4 (b) (5)

3 NER clause 3.11.9(g)

RMS-type models provide a more simplified representation of how certain elements within the power system operates. RMS-type models have traditionally been fit for purpose in assessing systems dominated by synchronous generation. However, RMS-type models are not in all cases capable of accurately modelling non-synchronous generating systems and how such equipment may interact with each other in a low system strength[4] power system environment. They may also not be fully effective for use in modelling the power system under more extreme conditions, such as during system restoration, where frequency and voltage may be well outside normal limits.

EMT-type models are able to provide more precise predictions of how the power system is likely to react in various situations. Unlike RMS-type models, EMT-type models provide the means to simultaneously and accurately assess all three phases in the power system. They are also better at representing the fast acting control and protection systems of non-synchronous generation that would not otherwise be captured by standard RMS-type simulation tools.

The National Electricity Rules (NER or rules) do not specify the type of models that must be submitted to AEMO and the TNSPs. The AEMC understands that, in practice, RMS-type models have typically been provided, although in some cases, generators have also provided EMT-type models on request.

2.3 Related work

The AEMC has previously considered three rule changes that are relevant to this rule change request.

These rule changes developed processes for the provision of detailed generator model information to AEMO and encrypted model information to market participants:

- the *Technical Standards for Wind Generation and Other Generator Connections Rule*[5] clarified the provision of information requirements on connection applicants. This rule was intended to allow the National Electricity Market Management Company (NEMMCO)[6] and NSPs to access to sufficient modelling information to maintain system security, while preserving the intellectual property of generator proponents and manufacturers.

- the *Confidentiality Arrangements in Respect of Information Required for Power System Studies Rule*.[7] This rule introduced mechanisms to allow registered participants to access model data for the purposes of undertaking their own power system studies. The rule:

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5 See AEMC, *Technical Standards for Wind Generation and Other Generator Connections*, Final Determination, 8 March 2007

6 NEMMCO was the former market operator of the NEM. From 1 July 2009 NEMMCO ceased operations and its role transitioned to AEMO.

7 See AEMC, *Confidentiality Arrangements in Respect of Information Required for Power System Studies*, Final Determination, 19 February 2009

- provided for protection of confidential information
- clarified what information may be disclosed by one NSP to another
- required generators to release information necessary to undertake power system studies, in the form of releasable user guides
- clarified in which format NEMMCO was allowed to disclose information.

- the *Release of Generator information by AEMO Rule*.[8] This rule brought forward the date on which AEMO may release modelling data and certain supporting information relating to connecting generators, to third parties.

A key issue that arose during assessment of these three rule changes was the commercial implications of the release of model data to third parties. Many original equipment manufacturers, particularly manufacturers of non-synchronous, power system electronically connected generators, considered that release of models of their generating systems could have significant commercial implications. The rule changes, therefore, carefully considered how best to protect this information, while allowing for participants to access the model data needed to undertake effective power system studies.

The AEMC is also currently progressing several projects relevant to this rule change. These include the non-scheduled generation and load in central dispatch and the demand side obligations rule changes[9], as these rule changes consider issues relevant to what additional information could be relevant for better demand forecasting.

Additionally, the rule change is relevant to the AEMC's System Security Market Frameworks Review.[10] One of the major work-streams in that review is consideration of the implications of increased penetration of non-synchronous generation, particularly how this may impact on overall system strength. AEMO stated that a key rationale for increasing the detail and scope of model data is to enable the more detailed modelling required to accurately reflect a power system with significantly reduced system strength.

8 See the AEMC, *Release of Generator information by AEMO*, Final Determination, 23 December 2010

9 For the consolidated rule change project page, see http://www.aemc.gov.au/Rule-Changes/Non-scheduled-generation-in-central-dispatch

10 See AEMC, *System Security Market Frameworks Review*, Interim Report, 15 December 2016

3 Details of the rule change request

This chapter provides a summary of the rule change request. The request is available on the AEMC's website.[11] AEMO has proposed in its rule change request to:

- broaden the scope and increase the level of detail of model data AEMO may request from prospective participants and registered participants, including generators and NSPs
- increase the detail of model data AEMO may request from parties tendering for the provision of ancillary services, such as system restart ancillary services (SRAS), network support and controls ancillary services (NSCAS) and frequency control ancillary services (FCAS).

AEMO's rule change request also set out the details of the issues and changes it proposes to make to its Generating System Model Guidelines. These issues and changes will be determined by AEMO through the rules consultation procedures. As such, consideration of the merits of these specific changes is largely outside of the scope of the AEMC's assessment of the rule change request.

However, as AEMO's proposed changes to the Generating System Model Guidelines provide an indication of the nature and extent of the potential information provision obligations and requirements that may be placed on participants, they are relevant to the AEMC's consideration of potential compliance costs for participants.

3.1 Rationale for the rule change request

In its rule change request, AEMO provided its rationale for the rule change. AEMO stated that changes in the power system, particularly a reduction in system strength in some areas, mean that more detailed studies are required to understand how the power system will function under certain conditions.

AEMO argued that current information provision obligations on participants do not provide it with the kind of modelling data needed to undertake these more detailed power system studies.

AEMO stated that the rules currently:

- require generators to submit data necessary for AEMO (and relevant NSPs) to conduct power system studies. However, as the type of models to be provided is not specified, generators may not provide the kind of models required by AEMO to undertake effective studies of a power system.

  To date, generators have submitted simpler RMS-type models. AEMO stated that these models may no longer provide levels of detail sufficient to undertake

11 For AEMO's rule change request see: http://www.aemc.gov.au/Rule-Changes/Generating-System-Model-Guidelines

effective power system studies, given changes to the power system such as reduced levels of system strength

- only require the provision of information related to generating units and do not require the provision of information about other equipment owned by generators, such as generator governors and protection equipment, as well as equipment owned by NSPs such as SVCs, synchronous condensers or interconnector protection systems. AEMO stated that these may have a significant impact on the performance of the transmission network

- require parties tendering for ancillary services (such as NSCAS, SRAS, and contingency FCAS) to provide data and models to AEMO for the purposes of assessing the effectiveness of tendered ancillary services. However, in the case of SRAS and NSCAS, AEMO argues that the type of data required by the NER may not be sufficient to allow for the most effective assessment of ancillary service tenders, which may result in inefficient under or over procurement, or the procurement of services that may not work effectively or as intended.

The rule change request includes a proposed rule.

A copy of the rule change request can be found on the AEMC website, www.aemc.gov.au.

3.2 Proposed solution

This section provides a summary of AEMO's proposed solution to the issues it has raised in its rule change request.

3.2.1 Extended detail and scope of data provision

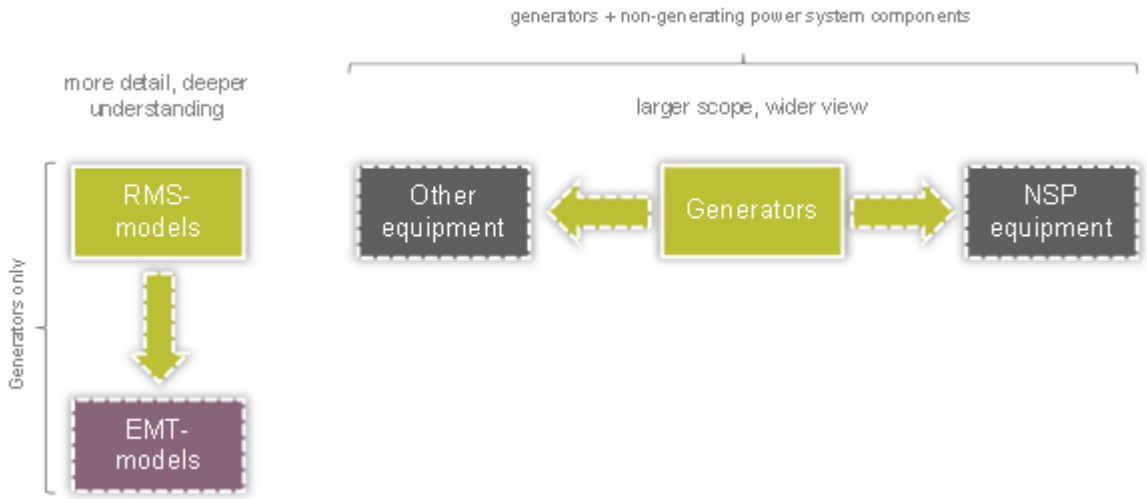
AEMO stated that allowing it to gather a broader scope of modelling information, as well as more detailed modelling information, will allow it and NSPs to undertake more effective power system modelling. This will allow for improved power system operation in the context of changing power system conditions, particularly reduced power system strength.

AEMO's request for access to additional modelling data can be described in terms of both a broader scope, and an increased level of detail, of modelling information required:

- broader scope in modelling means having access to modelling information for a larger set of generator and network equipment

- more detail in modelling means having access to more information about the technical operation of generators, typically through the provision of more detailed EMT type models.

Figure 3.1 Detail and scope of modelling data



Scope of information to be provided

AEMO recommended that modelling data requirements in the rules should be extended to include all critical network elements and other generation equipment. To achieve this, it proposed that the relevant NER references to "Generating System" should be changed to "Power System".

In effect, AEMO proposed to broaden the scope of information that it would be able to gather from a range of participants. This may include gathering model data that reflects other equipment owned by generators, such as governors and protection equipment or equipment necessary for the provision of ancillary services. It may also include model data that reflects equipment owned by NSPs, including interconnector protection systems, SVCs and synchronous condensers.

Detail of information to be provided

AEMO stated that in certain cases, generators should be required to provide more detailed EMT-type models of their generating systems.

These types of models would only be required where a generating system is connected to the network via power electronic interfaced technologies or if "in AEMO's reasonable opinion, there is a risk that the generating system will adversely affect other *Network Users* or *power system security* or quality or *reliability* of the *power system*".[12] In the former case, EMT-type models would only be required if the generating system is connected to the transmission system, or at the distribution system level if the installed capacity of the plant is greater than 10% of the available fault level at that point of connection.[13]

12 AEMO, rule change request, 31 October 2016, p. 7

13 Ibid., p. 7

These requirements would be assessed based on the risk that the equipment will "adversely affect *network capability*, *power system security*, quality or *reliability* of supply, inter-*regional* power transfers or the use of a *network* by another *Network User*".[14]

When deciding whether to require such modelling data, AEMO would consider, among other factors, "the size of the *plant*, *connection point* specifications, and the presence of adjacent *plant*".[15] The basis of assessment and the factors relate to both the extension of the scope and the detail of data provision.

Stated benefits of increased model detail and scope

AEMO stated that access to a more detailed and broader scope of modelling data will allow it to operate and plan the power system more effectively:

- **More effective connection processes:** AEMO considered that more detailed model data will assist in the assessment of new generators seeking to connect to the power system. For example, more detailed EMT-type models would allow AEMO (and potentially NSPs) to more effectively assess how non-synchronous, power electronic connected generators are likely to behave in a low power system strength environment, including how they may interact with other generators. This would allow for the negotiation of more effective access standards and/or generator performance standards.[16]

- **More effective power system operation:** AEMO considered that it could conduct better power system studies if it had access to more detailed modelling data. This would allow for the formulation of more accurate constraint equations to support more efficient operation of the power system. AEMO stated that these better power system studies would also allow for the efficient procurement of more effective ancillary services, supporting the secure operation of the power system.

- **More effective planning processes:** AEMO advised that building extra transmission network capacity that cannot be fully utilised in practice could be avoided through more detailed modelling information to enable more accurate power system studies. This is because the effective utilisation of network capacity may be impacted due to the characteristics of non-synchronous generation. More detailed EMT-type models to support better power system studies throughout the planning process may allow for these limitations to be identified before they arise. AEMO stated that more detailed model data would assist the evaluation of options presented during regulatory investment tests for transmission (RIT-T) by

14 Ibid., p. 7

15 Ibid., p. 7

16 Access standards are approved by the TNSP, however, according to 5.3.4A (a) of the rules, AEMO must advise on negotiated access standards. The generator performance standards proposed by the generator must be approved by AEMO and must be based on the access standards, regardless of being automatic or negotiated.

allowing for the higher integration of intermittent generation, while maintaining power system security.[17]

3.2.2 More efficient ancillary services procurement

AEMO has also stated that more detailed information and a broader scope of information will allow it to undertake more effective assessments of both market and non-market ancillary services.[18] This may have benefits in terms of improving the efficiency and effectiveness of service procurement, as well as allowing for more efficient operation of the power system.

In AEMO's view, a broader scope of model information and more detailed model information may be necessary from parties seeking to tender for certain types of ancillary services, including NSCAS, SRAS and FCAS. AEMO advised that this additional data may be necessary in order to accurately assess how an ancillary service will function in extreme power system conditions. For example, to adequately assess whether tendered SRAS is likely to work effectively, AEMO argued it is necessary to model the extreme voltage conditions that can exist during a system restoration. More detailed EMT-type models may be required to support this kind of power system modelling.

By allowing for more accurate modelling of tendered services, AEMO stated it may be better positioned to procure an efficient quantity of the relevant service, avoiding unnecessary purchases and therefore minimising ancillary services costs, which are ultimately borne by consumers through electricity prices.

AEMO also stated that system security may be supported by allowing it to more accurately model the ability of different tendered services to actually deliver their stated capability. In the case of a service like SRAS or FCAS, this may improve overall system security, by allowing AEMO to procure the services that have the greatest probability of actually being available when called on during a system security event.

3.2.3 Application to existing participants

AEMO's rule change request proposed that these new information provision requirements would mainly be applied to new connecting generators. However, in some instances, existing registered participants would also be required to provide modelling information.

For generators, this information would generally be required only at the time of negotiating a network connection or if changes are made to existing plant through the process under rule 5.3.9.

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17 AEMO, rule change request, 31 October 2016, p. 7

18 Market ancillary services include regulation and contingency FCAS and are sourced by the NEM dispatch engine through the 5 minute dispatch process. Non market ancillary services include SRAS and NSCAS. SRAS is procured by AEMO and NSCAS is procured by NSPs (and potentially AEMO). Both are typically procured on a bilateral contract basis.

Under AEMO's rule change request, existing generators, TNSPs or other registered participants, would be exempt from having to provide additional modelling information for existing plant, unless "in AEMO's reasonable opinion, there is a risk that the *plant* will adversely affect *network capability*, *power system security*, quality or *reliability* of supply, inter-*regional* power transfers or the use of a *network* by another *Network User*."[19] This would mean that, in some cases, AEMO would have discretion to require additional information, potentially including both a broader scope and more detailed modelling information, from existing registered participants.

19 AEMO, rule change request, 31 October 2016, p. 13

4 Assessment framework

The Commission's assessment of this Rule change request must consider whether the proposed rule promotes the National Electricity Objective (NEO).

4.1 Rule making test

4.1.1 Achieving the NEO

Under the NEL the Commission may only make a rule if it is satisfied that the rule will, or is likely to, contribute to the achievement of the national electricity objective (NEO).[20] This is the decision making framework that the Commission must apply.

The NEO is:[21]

> "To promote efficient investment in, and efficient operation and use of, electricity services for the longer term interests of consumers of electricity with respect to -
>
> (a) price, quality, safety, reliability and security of supply of electricity; and
>
> (b) the reliability, safety and security of the national electricity system."

Under the Northern Territory legislation adopting the NEL,[22] the Commission must regard the reference in the national electricity objective to the "national electricity system" as a reference to whichever of the following the Commission considers appropriate in the circumstances having regard to the nature, scope or operation of the proposed rule:

- the national electricity system;
- one or more, or all, of the local electricity systems;
- all the electricity systems referred to above.

but is not a jurisdictional derogation, participant derogation or rule that has effect with respect to an adoptive jurisdiction for the purpose of s. 91(8) of the NEL.

20 Section 88 of the NEL.

21 Section 7 of the NEL.

22 Section 32A of the National Electricity (Northern Territory) (National Uniform Legislation) Act 2015.

4.2 Proposed assessment framework

Assessment of this rule change request will consider whether the proposed changes in the rule change request are likely to deliver more efficient outcomes. In particular, assessment will include consideration of whether the proposed rule will facilitate more efficient investment and operation of the power system:

- **Efficient operation:** The rule change request will be assessed in terms of whether the provision of more detailed information for AEMO and NSPs is likely to facilitate more efficient operation of electricity services through more effective power system operation and use of ancillary services.

- **Efficient investment:** The assessment will also consider whether more detailed information is likely to support more efficient investment in network and generation assets, if the additional information supports more effective planning of those assets.

These potential operational and investment benefits are discussed in more detail below, particularly as they relate to the proportionality of the proposed solution to the identified issue, potential improvements in the security of power system operation, the efficiency of planning processes, and price impacts.

- **Proportionality:** When considering the introduction of new regulatory requirements for modelling data provision, it is first necessary to consider the materiality of current issues, whether they can be adequately addressed under existing frameworks or whether a change to the NER is required. This is necessary as the introduction of more regulatory obligations for the provision of wider scope and greater detail of modelling data may result in higher implementation and compliance costs, at least some of which may be passed on to consumers as higher prices. The complexity and extent of the regulatory obligation should be in proportion to the materiality of the issue it is designed to address.

- **Operation of the power system:** AEMO considered that a potential benefit of increased detail of modelling data may be enhancements to power system operation, with consequent improvements to system security. Security refers to the maintenance of the power system within certain technical operating limits. The provision of a broader scope and more detailed modelling data may allow for more effective power system studies. This may in turn enhance the quality of the system information available to AEMO and allow for more effective system operation, helping to improve the overall security of the power system.

  Access to more detailed and a broader scope of modelling information may also allow for a more effective assessment and procurement of ancillary services. This may in turn allow for more effective management of system security issues as they arise.

- **Planning outcomes:** Access to more detailed modelling data to develop more effective power system studies may support AEMO, NSPs and generators in undertaking their various planning processes. This may refer to planning in a more general sense, being the processes of planning where to connect a new generator to the system undertaken by AEMO, NSPs and generators. It may also refer to the formal processes undertaken by AEMO and NSPs when planning the transmission network, through the national transmission network development plan (NTNDP)/transmission annual planning report (T-APR) processes.

  In the NEM, the concept of planning is more commonly used to refer to the general planning of network infrastructure by AEMO and NSPs. As part of this process, access to better modelling information may support more effective power system studies, which may in turn be used when undertaking formal planning obligations through the NTNDP and NSPs' APR processes. A more efficient planning process can have a number of benefits for consumers, including lower network costs as well as improved security and reliability outcomes.

  This outcome can only be achieved if key system parameters can be accurately modelled and evaluated in the planning phase. The rule change request will therefore be assessed in terms of whether it is likely to support more accurate or effective modelling by AEMO and NSPs, and whether this is likely to enhance the transmission network planning process.

  Planning may also refer to the more general process of determining where a new generator should be connected to the NEM power system. This process involves the generator, the relevant NSP and AEMO. Where such a process can be better informed through more detailed modelling data and more accurate power system studies, this may result in AEMO, NSPs and generators being able to identify the optimal location of generation units in the network, in terms of increasing the likelihood the generator's ability to be dispatched (i.e., avoiding the risk of being constrained off) and reducing the possibility that the generator will locate in an area that will have a negative impact on the power system overall.

- **Price:** There may be a number of consequences for energy prices that flow from this rule change request. On the one hand, there are potential costs to generators and NSPs associated with the provision of additional modelling data. These may be passed through to consumers through increased energy costs or network charges.

  However, more efficient planning and operation of the power system may enhance the ability of generators to deliver energy to market, with positive consequences for competition in the wholesale market. Furthermore, more efficient and effective procurement of ancillary services may help to reduce the cost of these services, which are ultimately passed on to consumers. The AEMC's assessment of the rule change request will therefore consider the possible extent of these various price effects for consumers.

4.3 Making a more preferable rule

Under s. 91A of the NEL, the Commission may make a rule that is different (including materially different) to a proposed rule (a more preferable rule) if it is satisfied that, having regard to the issue or issues raised in the rule change request, the more preferable rule will or is likely to better contribute to the achievement of the NEO.

4.4 Making a differential rule

From 1 July 2016, the National Electricity Rules (NER), as amended from time to time, apply in the Northern Territory, subject to derogations set out in Regulations made under the NT legislation adopting the NEL.[23] Under those Regulations, only certain parts of the NER have been adopted in the NT.[24] As elements of the rule change requests relate to parts of the NER that will apply in the Northern Territory, the Commission will assess the rule change requests against additional elements required by the Northern Territory legislation.[25]

Under the Northern Territory legislation adopting the NEL, the Commission may make a differential rule if, having regard to any relevant ministerial council of energy statement of policy principles, a different rule will, or is likely to, better contribute to the achievement of the NEO than a uniform rule.[26] A differential rule is a rule that:

(a) varies in its term as between:

    (i) the national electricity system; and

    (ii) one or more, or all, of the local electricity systems; or

(b) does not have effect with respect to one or more of those systems,

but is not a jurisdictional derogation, participant derogation or rule that has effect with respect to an adoptive jurisdiction for the purpose of s. 91(8) of the NEL.

23 National Electricity (Northern Territory) (National Uniform Legislation) (Modifications) Regulations.

24 For the version of the NER that applies in the Northern Territory, refer to: http://www.aemc.gov.au/Energy-Rules/National-electricity-rules/National-Electricity-Rules-(Northern-Territory).

25 National Electricity (Northern Territory) (National Uniform Legislation) Act 2015.

26 The National Electricity Law as modified by the National Electricity (Northern Territory) (National Uniform Legislation) Act 2015.

5 Issues for Consultation

Taking into consideration the assessment framework, a number of issues have been identified for initial consultation. Stakeholders are encouraged to comment on these issues as well as any other aspect of the rule change request or this paper, including the proposed assessment framework.

5.1 Materiality of issue and potential benefits of implementation

The core issue raised by AEMO is that current information provision obligations are insufficient and therefore warrant a change to the NER.

- AEMO stated that changes to the NER are needed to require participants to provide it with more detailed modelling data. It argued this is necessary so it can continue to undertake accurate power system studies in a lower system strength environment.

- AEMO also stated that changes to the NER are needed to require ancillary service providers, particularly SRAS providers, to provide more detailed modelling data. It argued this is necessary so that it can undertake effective assessments of SRAS tenders.

However, as discussed in chapter 2, the NER already require generators and SRAS providers to provide AEMO with modelling data. AEMO also have various information gathering powers.

A key issue for consideration therefore is whether the NER require amendment to allow AEMO to gather this more detailed modelling data. In answering this question, it is necessary to consider the materiality of the issues raised by AEMO (addressed in this section) as well as the extent of AEMO's existing information gathering powers under the NEL and NER (addressed in section 5.2).

System strength and more detailed modelling data

As the number of non-synchronous generators in the NEM continues to increase, a number of changes are occurring in the power system. This includes lower fault levels or reduced system strength, which can result in a weaker system.[27]

AEMO has argued that inverter connected, non-synchronous generation systems may require more detailed and sensitive modelling, as these generators may react differently or unpredictably in power systems with reduced system strength. These kinds of generating systems may also interact with other systems in unpredictable ways in a low system strength environment.

However, AEMO argued that the NER do not currently require generators to provide it with the kind of detailed model data it needs to undertake the power system studies

27 See: AEMC, *System Security Market Frameworks Review - Interim Report*, 15 December 2016

to accurately capture these kinds of effects.[28] It argued that the NER should therefore be amended to require the provision of more detailed model data, as not being able to undertake effective power system studies could have operational and security implications.

AEMO also argued that in this new environment, other, previously not modelled equipment in the network (including reactive support plant, high-voltage direct current transmission links, large variable speed motor drives and protective functions) may be increasingly relevant to modelling the operation of the power system. Certain parts of the network, where local system strength is already at low levels and non-synchronous generators are in close electrical proximity to each other, may require more detailed modelling information to allow effective assessment of interactions between generators and other equipment. Access to model data for certain network equipment and more detailed data about generating systems may therefore allow for more accurate and effective power system modelling by AEMO.

A key question for consideration therefore is whether these changing power system conditions mean that current model data provision obligations are no longer sufficient to allow for effective assessment of the power system by AEMO.

Ancillary service procurement

As noted in chapter 2, the NER currently require ancillary service providers, specifically SRAS providers, to provide modelling data to AEMO.

AEMO also stated that the current modelling data requirements for SRAS and NSCAS are insufficient, which may reduce the efficiency of the procurement of these services. This is because assessing the effectiveness of SRAS and NSCAS involves modelling of a power system under more extreme conditions. However, AEMO argued that the current modelling data provision requirements do not support the kind of power system studies required to accurately reflect how SRAS units are likely to behave in these extreme power system conditions.

Finally, AEMO stated that the existing modelling data may not be sufficient for the optimal assessment of FCAS capabilities. It considered that this could result in involuntary or excessive load shedding due to the inadequate assessment of the capability of each contingency FCAS.

A key question for consideration therefore is whether current model data provision obligations on ancillary service providers remain sufficient to allow for the effective assessment and procurement of these services.

28 As discussed in section 2.1, NER clause S5.2.4(b)(5) currently describes the type of model data that generators must provide to AEMO. However, this clause does not specify whether this information should be provided as an RMS-type or EMT-type model.

Issue 1 Materiality of the issue

1. **Are changing power system conditions impacting on the ability of AEMO, and other parties, to accurately model the power system?**
2. **Given any such impacts, do existing NER requirements for the provision of model data remain sufficient for parties to undertake effective power system studies?**
3. **Is it necessary to amend the NER to place more explicitly defined obligations on participants to provide specific modelling data to AEMO?**

5.2 AEMO's information gathering powers

A key aspect of AEMO's rule change request is to expand the range of information that AEMO may request from market participants.

In assessing AEMO's proposal, it is necessary to consider what abilities AEMO already has for obtaining necessary information under the NEL and NER.

More generally, it is relevant to consider whether this information should be obtained by AEMO through a general, relatively open information gathering power, or through more specific means.

AEMO's information gathering powers

AEMO has information gathering powers under the NEL. A relevant issue to be considered in this rule change request is whether these information gathering powers are sufficient to address the issue raised by AEMO.

For example, the NEL allows AEMO, if it considers it reasonably necessary to do so for the exercise of a relevant function, to request information from a person or a class of persons (including registered participants) through a market information instrument.[29] Relevant functions are defined as AEMO's function as national transmission planner (NTP), an additional advisory function, a declared network function or any other statutory function for which the NEL authorises AEMO to gather information by means of a market information instrument.[30]

AEMO information gathering or generator information provision requirement

The rule change request proposed that AEMO would have reasonably wide discretion to seek EMT-type model data from generators, under certain conditions specified in the NER.

29 Part 5, Division 5, 53 (1) of the NEL.

30 Part 5, Division 5, 53 (2) of the NEL.

The AEMC seeks stakeholders' feedback on whether this kind of reasonably broad information gathering power would be the most appropriate solution for addressing the issues raised in the rule change request. As it has a reasonably broad scope, it would allow AEMO sufficient discretion to gather all information it needed for the purposes of more effective power system operation and planning.

However, it would also allow AEMO significant discretion to potentially require large volumes of highly detailed information from generators, with potentially significant compliance cost implications for generators. It may also create a degree of uncertainty in the market as to whether these additional costs will be imposed and their extent.

The AEMC asks stakeholders to consider whether the mechanism proposed is suitable, or whether an alternative solution is available. For example, would an information provision obligation on participants be a more appropriate mechanism to address AEMO's proposed requirement for more information.

Issue 2 Information gathering

4. **Does AEMO have scope to gather sufficient information under existing NEL/NER provisions?**

5. **Is the solution proposed appropriate?**

5.3 Costs and issues associated with the proposed rule

5.3.1 The costs of compliance

Both generators and NSPs may face compliance costs if they are required to provide more detailed model data to AEMO.

The Generating System Model Guidelines apply to "generators and persons intending to connect a generating system to the national grid".[31] Under the guidelines, generating system models must be provided to AEMO and to the relevant NSP. As discussed above, to date, generators have typically provided RMS-type models to AEMO and NSPs as part of the process of negotiating connection agreements and performance standards.

Under the rule change request, AEMO proposed to expand the application of this obligation by broadening its scope (i.e., requiring NSPs to provide model data of equipment such as transformers, SVCs and synchronous condensers, and generators to provide additional model data of equipment such as governors and protection systems), as well as requiring the provision of more detailed EMT-type models in certain situations.

31 Section 4 of the *Generating System Model Guidelines*

Meeting a requirement to provide more detailed EMT-type models may be difficult for generators that are already connected to the grid. If these generators were not required to provide an EMT-type model at the time of connection, they may not have requested such a model from the original equipment manufacturer of their generator.

In these cases, the procurement or development of these models may require the generator to engage with the original equipment manufacturer to source the necessary model, or to engage consultants to develop a new model. This has the potential to result in additional costs for the generator. In its submission, AEMO estimated the cost of this exercise to be approximately $75,000 per generating system. However, the AEMC understands that it is possible that in some cases, significantly higher costs could be incurred by generators in this situation.

However, the costs of sourcing more detailed EMT-models may be lower for connecting generators, if they are an upfront requirement that is part of the connection process. In this case, a generator may include a request to the original equipment manufacturer for an EMT-type model, as part of their negotiation process, as the inclusion of EMT-type models in the contract would be a regulatory requirement that must be met.

If NSPs are required to supply RMS-type models to AEMO about certain network equipment, there would be costs associated with developing those models and gathering the necessary information to comply with the guidelines. However, AEMO advised that it does not consider that these costs would be material for NSPs.

A related question is when any new obligation for the provision of a broader scope or more detailed modelling data should apply to a generator that is currently in the process of connection. If any such new obligation is introduced, it will be necessary to consider whether and how these new obligations should apply to a generator who is part way through the connection process.

Finally, it also needs to be considered how the costs of complying with new information provision requirements may be different for new entrant generators compared with incumbents. AEMO proposed that these obligations would typically only apply to new entrants, except in specific circumstances where they may apply to incumbent generators. A question therefore arises as to whether the costs of these obligations may form a barrier to entry for new generators.

The extent to which any such barriers may exist are likely to depend on:

- whether AEMO is able to apply the new requirements to incumbent generators, and the extent to which it elects to do so
- the costs of complying with this requirement.

Issue 3 Costs of compliance

6. **What are the likely costs for participants of providing a broader scope of modelling data, or more detailed EMT-type models, to AEMO?**
7. **Is there a difference in costs if an EMT-type model is requested before connection, or required retrospectively after the connection is completed?**
8. **What data provision requirements should apply to a generator that is halfway through the connection process, when new data provision requirements are introduced?**
9. **Could the cost of any new data provision requirements form a barrier to entry for new participants?**

5.3.2 The possibility of compliance

The NER do not apply to original equipment manufacturers, as they are not registered participants in the NEM. Therefore, there is a risk that, if the NER place an obligation on a generator to provide additional model information that it does not already possess and the original equipment manufacturer refuse to supply the models, the generator may be unable to comply with the rules.

Furthermore, even if generators already possess the EMT-type models from manufacturers, the release of those models to any third party, including AEMO, may be restricted under private confidentiality agreements. Therefore, the ability to comply is likely to be dependent on the particular circumstances of each party.

Issue 4 Possibility of compliance

10. **Are there any restrictions associated with providing data of the type contemplated in the rule change request?**

5.3.3 Application to existing generators

AEMO's rule change request proposed that already connected generators may be required to provide additional model data to AEMO in respect of their existing plant.

AEMO considered there may be system security and reliability benefits associated with requesting this model data from existing generators. Specifically, this data may allow AEMO to undertake more accurate assessments as to whether the generator will have an impact on reliability, the general security of the power system and inter-regional transfer capability.

To achieve this, the rule change request proposes that, in some specified cases, AEMO would have discretion to require additional model information from existing

registered participants, including generators that have already executed connection agreements with the relevant NSP.

However, under the NER, registered generators that have signed connection agreements and provided all required model data are not generally obliged to provide any additional model data to AEMO or NSPs, except in certain circumstances.

Specifically, under NER S5.2.4 (a) and (b), generators must provide modelling information while negotiating a connection agreement, or plan an alteration to their generating system. AEMO or the relevant NSP can only request an update to this information after the generator is connected if they consider "that the information is incomplete, inaccurate or out of date".[32]

As discussed in section 5.3.1, there may be significant costs for generators if they are required to provide EMT-type model data after they have finalised negotiations with an original equipment manufacturer and have executed a connection agreement with the relevant NSP. It will also be necessary to consider the extent of these potential costs when assessing whether AEMO should be able to require existing generators to comply with a requirement to provide additional modelling information.

Issue 5 Existing generators

11. Should AEMO be able to request additional modelling data from existing generators who are already registered and have executed connection agreements?

12. Does the rule change request and the proposed rule provide sufficient guidance or clarity regarding what circumstances AEMO may require additional model data from existing participants?

5.3.4 Third party disclosure of data

A key issue to be considered in the assessment of this rule change request is which parties should have access to EMT-type model data and in what form that data should be provided. This section considers two key issues, including whether:

- encrypted EMT-type models should be made available to other generators
- NSPs should have direct access to this model data, or whether they should request it through AEMO.

Disclosure of EMT-model data to other generators

As noted in section 2.3, the issue of third party disclosure of commercially sensitive information related to certain generation technologies has previously been addressed by the Commission.

32 S5.2.4 (d) (3) of the NER.

The model data that generators are required to provide under clause S5.2.4 may include information that is regarded as sensitive intellectual property by original equipment manufacturers of generating systems, particularly non-synchronous, power system electric connected generators.

Due to the extent of competition in the market for those technologies, original equipment manufacturers may have an interest in limiting the disclosure of intellectual property or other critical information that could compromise their competitive advantage.

However, access to this model data may allow connecting generators to undertake effective power system studies in order to understand how their generating unit is likely to perform once connected to the power system. Effective power system studies are central to enabling efficient connection of generators, while also supporting the reliable and secure performance of the power system.

The Commission has made a number of rules that have introduced measures to protect model data, while allowing third parties to access this data for the purposes of undertaking power system studies. This has been enabled by requiring generators to provide encrypted versions of their model data to AEMO for release to third parties.

This issue of third party disclosure may be relevant to the assessment of AEMO's rule change request.

AEMO's rule change request does not specify whether EMT-type models provided to it should be in a source code or encrypted format.

Furthermore, the rule change request does not specify whether any EMT-type models provided to it by generators would be made available to third parties.

However, as the rule change request does not propose any changes to the third party disclosure clauses of the NER,[33] it may be that the conditions for providing registered participants with EMT-type models would be the same as those that currently apply to RMS-type models.

In assessing this issue, it will be necessary to consider whether EMT-type models are likely to be significantly more commercially sensitive than an RMS-type model and whether current encryption requirements can provide adequate protection.

The Commission understands that the relative simplicity of RMS-type models means that to date, the encryption process has provided adequate protection for these kinds of

33 These requirements are set out in clause 3.13.3 of the NER. They firstly specify under what conditions AEMO may disclose information previously provided by generators to registered participants. Registered participants may request from AEMO "information that is reasonably required by the Registered Participant to carry out power system studies (including load flow and dynamic simulations) for planning and operational purposes". The NER then states that this information must be provided to registered participants in either compiled, encrypted or secured form, unless the original provider of the model has consented otherwise in writing. The NER then go on to say that such information must be treated as confidential information by the recipients.

generator model data. However, the more detailed nature of EMT-type models could mean that encryption does not provide sufficient protection.

NSP access to EMT-type models and NSP model data

The rule change request proposes to oblige generators to provide "all data required to perform specialised power system studies based on electromagnetic transient simulation analysis" only to AEMO.

However, NSPs may also require access to this data to undertake effective power system studies for the purposes of negotiating connection agreements and access standards with generators and for undertaking their own planning studies.

NSPs may request this information from AEMO in the same way as other registered participants. While this may be sufficient for NSPs, it may also introduce an additional step in the process.

A final issue to consider is whether model data provided by NSPs should be made available to third parties, in a similar way as generator model data.

Issue 6 Data disclosure

13. **Should third parties have access to EMT-type models?**
14. **What information should be made available to third parties? Would encryption of this data provide sufficient protection to address issues related to commercial sensitivity of the data?**
15. **Should EMT-type model data be provided only to AEMO, or should NSPs also have access?**
16. **Should information provided by NSPs be made available to third parties?**

6 Lodging a submission

The Commission has published a notice under s. 95 of the NEL for this rule change proposal inviting written submission. Submissions are to be lodged online or by mail by 12 April 2017 in accordance with the following requirements.

Where practicable, submissions should be prepared in accordance with the Commission's Guidelines for making written submissions on rule change requests.[34] The Commission publishes all submissions on its website subject to a claim of confidentiality.

All enquiries on this project should be addressed to Istvan Szabo on (02) 8296 7813.

6.1 Lodging a submission electronically

Electronic submissions must be lodged online via the Commission's website, www.aemc.gov.au, using the "lodge a submission" function and selecting the project reference code ERC0219. The submission must be on letterhead (if submitted on behalf of an organisation), signed and dated.

6.2 Lodging a submission by mail

The submission must be on letterhead (if submitted on behalf of an organisation), signed and dated. The submission should be sent by mail to:

Australian Energy Market Commission
PO Box A2449
Sydney South NSW 1235

The envelope must be clearly marked with the project reference code ERC0219.

34 This guideline is available on the Commission's website www.aemc.gov.au

Abbreviations

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
APR	annual planning report
Commission	See AEMC
EMT	electromagnetic transient
FCAS	Frequency Control Ancillary Services
MCE	Ministerial Council on Energy
NEL	National Electricity Law
NEM	national electricity market
NEMMCO	National Electricity Market Management Company
NEO	national electricity objective
NER	National Electricity Rules
NSC	Network Support and Control Ancillary Services
NSP	network service provider
NT	Northern Territory
NTNDP	national transmission network development plan
NTP	Network Transmission Planner
PMRG	Plant Modelling Reference Group
RMS	root mean square
SVC	static VAR compensator
SRAS	System Restart Ancillary Services
TNSP	transmission network service provider