

1. Introduction

Generators seeking to connect new generating plant to the national electricity grid must negotiate a connection agreement with a Network Service Provider (NSP). The National Electricity Rules (Rules) provide the basis for negotiation.

The technical standards refer generally to provisions that specify the quality and nature of electricity that is supplied by the electrical network. They are broadly covered in Chapter 5 of the Rules, and more specifically the procedures of establishing or modifying a connection, inspection and testing requirements, and schedules specifying conditions for connection of new plant.

The technical standards comprise three sets of standards:

- *system standards*, which specify the quality and nature of electricity that is supplied by the national electricity system¹;
- *access standards*, which specify the upper and lower bounds (known as automatic and minimum access standards respectively) for certain technical requirements², and a basis for negotiation so as to contribute to the maintenance of system standards; and
- *performance standards*, which record the design performance of each plant, are registered with NEMMCO, and set the specific requirement upon which compliance should be enforced.

Generally, the basis for negotiating access to the network is that new generation should not adversely affect power system security or the quality of supply for other network users. Some of the technical requirements are not negotiable, but are mandated in the Rules.

Standards that are too high may constitute a barrier to entry, which increase new entrants' costs and jeopardise reliability if those barriers deter or delay new entrants. They could also exclude certain technologies if the Rules are not technology neutral. On the other hand, consumers and participants rely upon the power system meeting various standards for security, stability and power quality.

The Rules must strike a balance between ensuring sufficient new entry and the ongoing security of the power system and quality of supply. For this reason, the technical standards have been reviewed from time to time to ensure the provisions achieve that balance.

This request addresses deficiencies in the current technical and information requirements, for generating plant, and the processes for obtaining connection of that plant. These deficiencies create a legacy of compromises that will result in the gradual degradation of power system performance. As the extent of new technologies (such as wind farms) that have not been contemplated by the Rules increases, so does their detrimental effect on the power system unless the technical standards keep pace with the development of new technologies.

¹ The system standards are in Schedule 5.1a of the Rules.

² The technical requirements for each access standard are listed in Appendix A

2. Background

2.1 NECA review

Under the National Electricity Code (Code), the National Electricity Code Administrator (NECA) was required to undertake a review and report on the technical standards to which Generators³ must adhere. The NECA report was published in December 2001 and the Code changes applied from November 2003.

The 2001 review established the existing system/access/performance standards structure.

Since then, the number of connection applications for large wind farm developments has grown significantly. Some of the technical requirements of the Rules do not apply to wind farms because wind generation is classified under the Rules as *intermittent* and is permitted to be non-scheduled. Wind farms are also excluded in some instances because the technical requirements cannot be applied to the technology used.

2.2 MCE project

In August 2004, the MCE established a Renewable and Distributed Generation Working Group. This working group is responsible for wind energy policy, the development of a national Code of Practice for Embedded Generation, and the Improving Grid Accessibility initiative announced in the Australian Government's Energy White Paper in July 2004.

Under this working group, the MCE also established a Wind Energy Policy Working Group (WEPWG) to provide advice, information and recommendations to the MCE on issues related to the entry of intermittent renewable energy generation into the electricity market. The Wind Energy Technical Advisory Group (WETAG), with industry sector representation was formed to assist with and report on the analysis of technical matters associated with large-scale wind farm developments.

In March 2005, the WEPWG published WETAG's report⁴, which recommended a review of technical requirements for the connection of generating systems. WETAG identified the following matters arising from the increasing use of wind energy:

- an urgent review of the technical standards for connection of generating units, which is the subject of this request;
- managing the impact of intermittent generation on network flows, which is being considered by WEPWG;
- wind farm modelling in respect of power system operational implications, which is the subject of a separate investigation by NEMMCO;
- disclosure of appropriate information for non-scheduled generation, which has been incorporated into the Rules; and
- cost recovery of regulation frequency control ancillary services, which is being considered by WEPWG.

³ Under the Rules, a Generator is the person registered with NEMMCO who owns, controls or operates a generating system.

⁴ The report '[Integrating Wind Farms into the National Electricity Market, Discussion Paper, March 2005](http://mce.gov.au)' is available at the MCE website <http://mce.gov.au>.

2.3 NEMMCO review

As an out-working of the WETAG, NEMMCO wrote to the Standing Committee of Officials (SCO) proposing a review in line with the principles developed by the WETAG. The SCO agreed to NEMMCO commencing a review of the technical standards under the National Electricity Code. The review commenced in early 2005 using a set of guiding principles agreed by WETAG, the details of which are set out in the WETAG report and are reproduced in Appendix B of this report.

NEMMCO convened an industry-based Technical Standards Reference Group (TSRG) to assist NEMMCO with the review and the development of proposed Rules. The TSRG also considered comment from wind turbine manufacturers on the proposed technical requirements, and these have been taken into account in these proposals. Membership of the TSRG is in Appendix C.

In its consultations, WETAG also developed some proposals relating to confidential information. As there is some overlap between this work and the NEMMCO review, these proposals have been included in this request for a Rule.

2.4 South Australia

In late 2005, the Essential Services Commission of South Australia (ESCOSA) completed consultation on the impacts of increased wind generation capacity in South Australia and the means of dealing with those impacts. That process was triggered by an unprecedented number of electricity generation licence applications being lodged with ESCOSA by wind generation proponents during late 2004 and early 2005.

ESCOSA sought advice from the Electricity Supply Industry Planning Council (ESIPC) on the impacts that issuing licenses to all applicants might have on the long term interests of South Australian consumers with respect to the price, quality and reliability of electricity supply. ESIPC's advice was that the current national market design and rules do not adequately cater for the installation of significant amounts of wind generation capacity.

In September 2005, ESCOSA published a Statement of Licensing Principles for wind generation in South Australia⁵. These principles address four key matters relating to the need for wind Generators to:

- comply with higher technical operating standards for fault ride through⁶ and reactive power capability;
- provide real time data as specified by NEMMCO;
- participate in optimised dispatch processes;
- provide data for, and assist the development of, state of the art wind energy forecasting; and
- pay for ancillary service market impacts which they cause and earn revenues for those which they provide.

⁵ See <http://www.escosa.sa.gov.au/site/page.cfm?u=54&c=1580>

⁶ The ability for continuous uninterrupted operation during and after a fault on the transmission or distribution network.

These principles are intended to be of a transitional nature only until a national market-wide solution to the issues is developed. NEMMCO's request for Rules is directed at addressing the first of these matters.

2.5 Transitional arrangements

The WETAG report specified that the Rules should include transitional arrangements (see Section 2.3). Section 6 of this report describes how NEMMCO proposes to address this.

2.6 Managing the impact of intermittent generation on network flows

WEPWG also asked NEMMCO to develop a concept for operation of non-scheduled generation subject to network constraints (called 'semi-dispatch' in the WETAG report). This is being progressed through a separate process, although a technical requirement to support new market arrangements to manage network flows with non-scheduled generation has been included in this report.

WETAG also recommended that a review of the technical standards in accordance with principles developed by WETAG be carried out at intervals of 3 to 5 years.

3. Addressing the Issue

The main issues with the current framework are the:

- technical requirements are expressed in terms that cannot be applied to all generation technologies and, as a result, technologies such as wind generation are excluded from compliance with some technical requirements. This will result in overall network capability being reduced in order to maintain the system standards;
- requirements for provision and dissemination of information such as plant models are inadequate as they do not apply to all generation technologies. This will result in inefficient methods to manage uncertainty in the effect of new generation on network transfer capability, such as conservative limit calculations or investment in network plant that provides higher than needed network performance; and
- negotiation framework for access by generation to the network needs is inadequate in that it is unclear in some areas, does not cover all technical requirements and precludes use of alternative technologies to meet the requirements. This can result in longer and costlier negotiations, and inefficient investment in plant where a lower cost alternative is available but not permitted.

The remainder of this section considers each of the issues and Rules proposed to address them.

3.1 Technical requirements

3.1.1 Statement of issue concerning the existing Rules

Lack of certainty regarding how different technologies will be treated in the future leads to uncertainty in investment

Non-conventional generation technologies such as those used in wind farms are not subject to the same technical standards as conventional technologies because:

- wind generation is permitted to be classified as intermittent and must be classified as non-scheduled. A number of the technical requirements apply only to scheduled generating units;
- wind generation often uses asynchronous technology such as induction generators. A number of the technical requirements apply only to synchronous technology, which is used in conventional hydro, coal and gas powered generating units; and
- many wind farms are or are proposed to be connected to distribution networks. Some technical requirements only apply to transmission connected generating units.

While the proportion of generation using asynchronous technology remains a small proportion of the total generation in the NEM the failure to adequately cater for this technology does not have a material effect on secure operation of the power system. However, as the proportion of wind generation increases the impact of windfarms on the power system will need to be better managed. The uncertainty regarding how these issues will be managed in the future creates risks for NSPs and investors, as there is no clear guidance on how future proposed changes would affect their operations.

Standards do not permit flexible solutions

Wind Generators are subject to unnecessary restrictions on how they can meet the technical standards because:

- wind farms comprise a large collection of small generating units. Some standards must be met by each generating unit rather than by the wind farm (or generating system) as a whole;
- alternative methods for achieving a technical requirement such as auxiliary equipment or operation arrangements are excluded from being used to meet some of the technical requirements; and
- some standards do not allow scope for negotiation, even though experience has shown lower levels of performance could be accepted in some circumstances without adversely affecting power system security.

Management of network capability

The central dispatch process optimises the dispatch of scheduled generating units subject to a number of factors, including network capability. However, the central dispatch process does not control the output of non-scheduled generating units, which can result in potential risk of network overloads, or constraining off scheduled plant that may be a more cost-effective source of energy or ancillary services.

The technical standards do not provide any requirement for the control of active power, which would be necessary for any potential market arrangement that makes use of non-scheduled generation to manage network flows.

3.1.2 How the proposed Rules address the issue

Various options for addressing the issue have been considered by several groups, including WEPWG, jurisdictional regulators and NEMMCO. These options include:

- managing the impact on network capability through other means, for example by augmenting the transmission network or constraining scheduled generation when necessary;
- relying on NEMMCO to issue directions under s.116 of the NEL and clause 4.8.9 of the Rules (such as directing operation at a certain level, or the temporary disconnection of non-scheduled generation);
- imposing moratoriums on new wind farms beyond a certain threshold;
- requiring large wind farms and other renewable forms of generation to meet similar technical requirements to those of scheduled generation.

WETAG principles require that the solution provide for adequate power system security. Managing network capability through other means will not be effective at managing all the technical issues concerned (for example, the risk of cascade tripping of generation due to a fault on the network cannot be reduced by applying a constraint) and is not proposed. It may also transfer the risk of being constrained onto the scheduled component of the market, which would increase the long term cost of investment and operation of that part of the NEM.

NEMMCO's powers of direction are intended to be used as a last-resort power of NEMMCO's rather than a front-line power system management approach, and often have a lengthy and potentially expensive process to determine compensation to be paid to affected parties.

Moratoriums on the amount of wind generation could be applied centrally through the Rules or locally through jurisdictional licensing arrangements. NEMMCO has rejected this as it would place a potentially arbitrary and unnecessary limit on investment on a particular technology. The experience in South Australia suggests the "do nothing" option would very likely lead to a new tier of technical regulation on the NEM.

Extending and clarifying the existing framework of technical standards is the preferred solution. This maximises the potential for market-based negotiated access to the network, minimises the risk of both local and widespread disruption of the network due to inadequate management of power system security, and reduces the level of uncertainty for owners and investors in the NEM.

The proposed Rules have been developed by NEMMCO in consultation with WETAG, and industry participants and experts, through the TSRG.

3.1.3 Description of proposed rule

The proposal would amend the Rules, where appropriate, to:

- either cover non-scheduled generating units, remove technology specific terminology (such as references to synchronous generators), or add technology specific references where this is needed;
- generally improve the flexibility of the standards through references to generating systems, connection points and auxiliary plant;
- extend the negotiated access framework to those technical requirements that currently cannot be negotiated;
- remove the existing requirement for partial load rejection, which is not directly applicable to asynchronous generation and covered by other technical requirements (particularly S5.2.5.3 Generating unit response to disturbance in the power system); and
- add a new requirement dealing with active power control, to give effect to future market arrangements for management of network flows⁷.

3.1.4 How the proposed solution is likely to contribute to the achievement of the National Electricity Market objective

Efficient investment in generation of electricity

The proposed new technical standards to be imposed on asynchronous generation are expected to require additional control, monitoring and communication equipment that is likely to increase the cost of building wind farms. The most significant costs are expected to be in the areas of fault ride through capability, voltage control and reactive power capability, and communications facilities for the provision of real-time data to NSP and NEMMCO control centres.

Actual costs would vary between each project and NEMMCO is not in a position to provide a generic estimate of these costs. However, in discussions with industry representatives, NEMMCO has been advised that the cost of reactive power control for a wind farm varies between \$150k and \$500k per MVAR of reactive power capability, depending on the technology used. This compares with between \$2.1 and \$2.5 million per MW of installed capacity. Wind farms will normally require at least some reactive power control capability, whereas the proposed technical standards are expected to incrementally increase (or in some cases decrease) the required capability.

This is balanced by a number benefits to investors in the NEM including:

- more certainty in the process for managing the impact of their generating units on the national electricity system and therefore reducing risk of being constrained off or directed by the NSP or NEMMCO in day-to-day operation;
- lower risk of being constrained off as a result of later developments reducing the capability of the network, making more transparent the processes by which this is managed by bringing them into the negotiated access framework;
- removing the need for jurisdictionally-imposed requirements, moratoriums or limits on the amount of intermittent generation on the market;
- reduced costs of meeting those requirements that allow alternative solutions to those currently provided for; and

⁷ Providing this requirement in advance of the market arrangements avoids the potential for retrofitting control equipment in the future.

- greater certainty in the ongoing capability of the network over time.

For example, ESCOSA has indicated it will remove its licensing requirements on wind farms once new Rules are in place. NEMMCO is aware of one wind farm that is not currently proceeding as under the present arrangements the reactive power capability costs would make the project uneconomic.

Efficient use of the generation of electricity

Alternative technologies such as those contemplated by this request are generally non-scheduled and would displace scheduled generation while they are producing electricity. Precisely which scheduled generation is to be displaced will be determined by the NEM central dispatch process, taking into account factors that include offer prices and network constraints.

A benefit of the proposal would be that low cost scheduled generation is less likely to be constrained off, because network capability would not be adversely affected by new non-scheduled generation.

Efficient investment in transmission network services

Under the current NEM arrangements, a significant increase in the number of alternative energy sources would see network capability steadily degrade. At some point, it would be necessary to augment the network so that reliability and security of supply and the level of competition in the NEM could be maintained.

The proposed Rule would benefit network users by maintaining the capability of the existing network, deferring network augmentations that could otherwise be needed. Additionally, because responsibility for any impacts of new generation on network capability would be transferred to the owners of the generation rather than the NSP, there is also scope for more efficient pricing of those impacts that would have otherwise been borne by network users.

3.2 Provision and disclosure of information

NEMMCO and TNSPs use technical data and models of generation control systems to assess the power system's transfer capability under a range of conditions. Proponents of new generation must assess the affect of the new equipment on the transfer capability of the existing network when seeking connection to the network.

3.2.1 Statement of issue concerning the existing Rules

Provision of information by proponents

NEMMCO has been experiencing difficulty obtaining adequate models for some new generation proposals, particularly wind farms, because:

- some wind farm technologies are relatively new and accurate models have not yet been fully determined, which requires NEMMCO and TNSP to incorporate large operating margins into their analysis of network limits;
- equipment manufacturers are reluctant to provide this information because it is commercially sensitive. If this information were provided on the basis of

confidentiality agreements it would conflict with NEMMCO's obligation to provide information to other participants⁸;

- the Rules do not currently permit NEMMCO to require testing to confirm or correct model parameters, which again must be managed by incorporating operating margins into network limits;
- the Rules prescribe in detail the information to be provided for synchronous and scheduled generating units but do not cover other technologies, which means incorporating new technologies requires ongoing requests for Rules.

Disclosure of information by NEMMCO or NSPs

Disclosure of generating plant technical information to prospective connection applicants would allow those new applicants to assess the likely performance and effect of their plant on the power system. Disclosure of this information also enhances the transparency and accountability of NSPs. Consultants and academics also use the information, thereby developing the base of expert opinion available. The current Rules limit the disclosure of information by:

- failing to specify how the information is to be used, and to whom and when the information may be released;
- providing conflicting requirements for disclosure and non-disclosure of information disclosed as part of the connection process (especially model information);
- not requiring the disclosure of sufficient information to complete a connection application; and
- restricting the ability of applicants to obtain information on concurrent projects that may, for example, be competing for access to the same network or adversely impact each project's ability to "ride through" a disturbance.

3.2.2 How the proposed Rules address the issue

The WETAG investigated the following options relating to the provision and disclosure of information:

1. maintaining the status quo;
2. requiring similar information for each generating unit (e.g. each wind turbine) in significant installations (e.g. wind farms larger than 30 MW) to scheduled generation;
3. option 2, but permitting each generating system (e.g. a wind farm) to be aggregated.

If the status quo was maintained, NEMMCO would need to manage the uncertainty of the accuracy of the models by applying larger safety margins to network limits so that power system security can be maintained. At the same time, network planners and proponents of new plant would need to adopt more stringent design requirements to compensate for this uncertainty, increasing the cost of investing in generation of electricity and the transmission network. NEMMCO considers this option to be inappropriate.

⁸ Clause 3.13.3(k) requires NEMMCO to provide certain technical information to Registered Participants on request.

It is necessary to model significant generation of any technology type connected to the power system to assess power system security. Any unit or system less than 30 MW is unlikely to have possible impacts on power system security, and is also the size that generally determines whether a unit is to be scheduled or non-scheduled. However, it is proposed to allow aggregated models that would reduce the computational burden to manageable levels and allow manufacturers to develop accurate wind farm models with lower risk to intellectual property.

It is further proposed to require concurrent connection applications to be accounted for in the assessment of any individual project.

3.2.3 Description of proposed rule

The proposed Rules:

- clarify power and obligations for provision and disclosure of models for all significant generation installations (larger than 30 MW);
- remove technical details from the Rules and require guidelines and procedures to be developed by NEMMCO and NSPs on information to be included in plant models and the form in which it is to be provided;
- require the staged disclosure of information commencing at the time of submitting a connection enquiry, which balances the commercial needs of potentially competing projects against the potential for over investment to mitigate against uncertainty;
- give NEMMCO and NSPs the authority to require models to be verified through testing, and extend NEMMCO's power to restrict operation of plant if it believes there is a risk to power system security due to inadequate modelling;
- permit provision of models for significant generation installations (comprised of multiple small units) in an aggregated form, which would preserve confidentiality of models at the generating unit level⁹; and
- define a 'considered project' as a concurrent generation or network project, which must be assessed in the negotiation of performance standards.

3.2.4 How the proposed solution is likely to contribute to the achievement of the National Electricity Market objective

Efficient investment in generation of electricity

The proposals on provision of information will require manufacturers of all types of generating technology to develop and provide aggregate dynamic models of their plant. The cost of doing this is not expected to be significant and will reduce as experience is gained with the development of the models. Additionally, the new requirements for testing will impose costs on new developments.

Investors in wind farms will benefit from the changes by being able to optimise the cost of meeting the technical requirements, through having access to current and accurate models of plant connected to the power system. Similarly, by making information available on the proposed considered projects, investors will

⁹ For example, wind farms can consist of hundreds of individual generating units. NEMMCO is proposing to disclose models of wind farms rather than individual units.

not need to make onerous assumptions about the interaction of their projects with other concurrently proposed projects.

Efficient use of the generation of electricity

The benefits of the proposed Rules concerning provision and disclosure of information arise from maintaining the capability of the existing network by reducing the reliance on operating margins on the network to ensure power system security. These benefits are similar in nature to those discussed in section 3.1.4 dealing with the proposed technical standards.

Efficient investment in transmission network services

Again, the benefits from a reduced reliance on operating margins are similar in nature to those discussed in section 3.1.4.

3.3 Access negotiation and compliance

The Rules provide boundaries for negotiating the technical terms and conditions in connection agreements in the form of minimum and automatic access standards, and bases for negotiating access within these bounds. Ongoing compliance with the agreement is managed through performance standards that are registered with NEMMCO and are used to benchmark the observed performance at any time in the future. The proposed process for negotiating access is shown in Appendix D.

3.3.1 Statement of issue concerning the existing Rules

Insufficient guidance for negotiations

Currently, the only requirement is that negotiation must result in an access standard set at a level that will not adversely affect power system security or quality of supply for other network users¹⁰. This provides insufficient guidance specific to each technical requirement and therefore results in a lack of consistency when wind farm proponents are negotiating with different NSPs and NEMMCO.

Negotiated access standards do not consider reliability of supply impacts

The current Rules do not provide for consideration of new generation that reduces the reliability of supply to consumers when negotiating access. In this context, reliability of supply refers to the ability to maintain a *reliable operating state* as defined in clause 4.2.7 of the Rules. It is analogous to the supply-demand balance reported in the Statement of Opportunities, and the short and medium term projected assessments of system adequacy (STPASA and MT PASA).

Specifically, the current Rules:

- only explicitly allow consideration of adverse impacts on power system security in negotiations;
- restrict consideration of power system transfer capability to stability limits, whereas under some circumstances, it is possible for a new generating plant to reduce network transfer capabilities because of thermal network limitations.

¹⁰ See clauses 5.3.4A(a)(2) and (3) of the Rules.

This can happen, for example, where the new plant changes the sharing of power flow between high and low capacity transmission lines; and

- for the minimum standard, restrict consideration of transfer limits to the region in which the plant is installed.

The implication of this is that new generation can obtain access to the network provided power system security can be managed, even though that generation could materially reduce the overall reliability of supply to consumers.

Compliance with performance standards

The current Rules limit the effectiveness and efficiency of compliance monitoring and enforcement by:

- exempting some owners of older plant from complying with performance standards that have been registered with NEMMCO. In some instances, derogations, connections agreements or plant design take precedence over the registered performance standards, which complicates and confuses the compliance process;
- restricting NEMMCO's input into the assessment and wording of performance standards¹¹. NEMMCO is in a position to provide advice on whether the performance standard is suitable for compliance assessment or the plant can comply with the standard. However, NEMMCO receives final wording or performance standards only after the execution of the connection agreement, and is required to assess whether the plant can comply with its performance standards at the time of registration, which NEMMCO believes is too late;
- restricting the ability to revise performance standards, except where plant has been modified. Updating performance standards for any other reason, including due to temporary plant restrictions, is not allowed even if all parties agree;
- requiring a review of all performance standards where plant has been modified, rather than just those that are affected by the modification. Potentially, this could require additional modifications to the plant to cater for changed power system conditions or Rule changes that occurred since the plant was originally built. NEMMCO believes this places an unreasonable risk on owners of plant and could discourage ongoing plant improvements; and
- allowing some generating plant to avoid registering performance standards, through apparent errors in some transitional provisions.

3.3.2 How the proposed Rules address the issue

The issues of inappropriate levels of guidance for negotiation and reliability of supply impacts had been identified by WETAG. The proposed Rules are consistent with the WETAG principles (see Appendix B).

The proposed Rules would streamline the compliance process by recording performance agreements outside connection agreements, relaxing some restrictions on how performance standards can be modified and requiring NEMMCO input to the wording of performance agreements before the execution of connection agreements.

¹¹ For example, NEMMCO is not involved where the automatic access standard for a technical requirement has been adopted.

3.3.3 Description of proposed rule

The proposed Rules would:

- provide guidance on the basis for negotiation of technical requirements, monitoring and control requirements, power station auxiliary transformers and fault levels;
- introduce reliability of supply as a basis for negotiated access standards;
- broaden the factors to be considered when assessing impacts of new generation on power transfer capabilities;
- simplify and clarify the process, and narrow the scope of performance standard reassessment for plant that is altered;
- permit alteration of performance standards for registered generating plant when parties to the connection agreement and NEMMCO agree;
- correct references to ‘technical requirements’ where ‘performance standards’ would be more appropriate; and
- consolidate all clauses dealing with performance standards – which are currently spread through Chapters 4 and 5 – into on place, Chapter 5.

3.3.4 How the proposed solution is likely to contribute to the achievement of the National Electricity Market objective

Efficient investment in and use of generation of electricity

Including reliability of supply considerations in access negotiation can be expected to increase the cost of a proportion of new generation projects that might be required modify a proposed connection or accept the prospect of being constrained off¹². However, when this is balanced against the benefit in reliability of supply to electricity consumers there are overall benefits to the proposed solution.

The clarifications and improvements to the process of negotiating access will result in more consistent and less costly negotiations ultimately leading to reduced costs being passed through to consumers. The new Rules also remove the potential to discourage investment in upgrades of existing plant that come about from enforced changes to performance standards.

Long term security of supply to consumers

The changes proposed to performance standards will improve the security of the power system by providing a compliance regime that:

- better reflects the most up-to-date information on the performance of plant;
- is technically feasible and consistently applied across the NEM; and
- can be efficiently and effectively managed by the bodies responsible for monitoring compliance, namely NEMMCO and the NSPS.

¹² Existing technical requirements include some clauses that deal with reliability impacts (such as transfer limits in the generating system’s region) – the proposed changes would clarify the basis for registering a proposed performance standard on the basis of an adverse impact on reliability of supply to customers. The situation in which adding generation reduces reliability of supply is rare, but can occasionally occur. The proposed changes would minimise these impacts.

3.4 Transitional arrangements and general omissions and corrections

3.4.1 Transitional arrangements

Transitional arrangements must achieve a balance between regulatory risk to investors and the long-term cost to the market in terms of reliability of supply from maintaining legacy systems at performance levels lower than current standards. They must apply to plant in all possible phases of development, and be consistent in approach.

For Registered Participants and those with signed connection agreements the proposed Rules do not require upgrading of performance standards to current levels, but allow performance to be registered based on relevant derogations, connection agreements or if these are silent on a particular technical requirement, the capability of the plant. Connection applicants however are required to meet the technical requirements that apply at the time they sign a connection agreement. When plant is altered, only the performance standards relevant to the particular alteration are required to be upgraded to current standards.

3.4.2 Items that could be outside the scope of rules

The Rules provide schedules that list the range of data that may be required to be submitted by Generators to the NSP. These schedules:

- only cover synchronous plant and need to be updated for alternative technologies; and
- could be outside the scope of the Rules, because they are indicative only may need to be varied depending on the nature and impact of the plant on the power system.

NEMMCO proposes to remove these lists from the Rules. They would be replaced by data lists established and maintained by NEMMCO through the Rules consultation process.

3.4.3 General omissions and corrections

The proposal would correct existing Rules that:

- omit a number of common power system disturbances from the technical requirements;
- have some terms that are poorly or not defined; and
- do not cover people intending to be registered who are not already registered as Generators, Registered Participants or Network Users.

4. Other Considerations

4.1 Power to make the Rule

NEMMCO believes the AEMC has the power to make the requested rule under s.34(1)(c) of the NEL. It also falls within the head of power in clause 13 of Schedule 1 of the NEL relating to access to electricity services provided by means of transmission systems and distribution systems, which is given effect by s.34(2) of the NEL.

4.2 Non-controversial or urgent Rules

NEMMCO does not believe the request can be considered non-controversial or urgent under s.96 of the NEL because the proposed Rules would change the allocation of costs and risks with the NEM.

4.3 MCE directed review on the enforcement of, and compliance with, the technical standards under the National Electricity Rules

This Rule request covers some of the issues raised by the AEMC in the issues paper published as part of its MCE directed review on the enforcement of, and compliance with, the technical standards under the NER.

APPENDIX A – TECHNICAL REQUIREMENTS

Technical Requirement	Performance Standard	Determination	Comment
Reactive power capability	Negotiated capability for supply or absorption of reactive power	Negotiated	Automatic standard applies to synchronous generators only. Non-synchronous generators must comply with minimum or negotiated standard.
Quality of electricity generated	AS/NZS 61000	Plant standard	Proponent may use either the plant standard or the access standard. Minimum and automatic access standards are the same.
	Specified level of voltage fluctuation, harmonic voltage distortion and voltage unbalance	NSP (automatic) or NEMMCO (negotiated)	
Response to disturbances in the power system	Continuous operation during:		To be converted to negotiated access.
	Power frequency & voltage variations	Minimum (must be provided)	
	Voltage dip due to transmission fault, with severity negotiable	Negotiated	
Partial load rejection	Continuous operation during and following system-imposed load reductions, with severity negotiated	Negotiated	To be removed.
Protection of generator from power system disturbances	Automatic disconnection from power system in response to negotiated abnormal conditions	Negotiated	Minimum standard only specified (output reduction only for scheduled generators).
	Automatic, rapid reduction in output for high frequencies nominated by NEMMCO		
Protection systems that impact on power system security	Primary and breaker-fail protections as negotiated	Negotiated	Protection solely for generator risks is at proponent's discretion
Asynchronous operation	Pole-slipping protection as negotiated	Negotiated	Synchronous generators only
Frequency control	Negotiated response to a range for frequency events.	Negotiated	Scheduled generators only.
Stability	Negotiated effect on inter or intra-regional power transfer capabilities for transient, oscillatory or voltage stability.	Negotiated	IEC 60034-3 may optionally be applied as a plant standard for transient stability.
Excitation control system	Voltage regulation, stability control, ceiling excitation voltage, reactive power compensation, excitation limiters	Minimum (must be provided)	Synchronous generators only. To be converted to negotiated access.
	Damping of generator power oscillations.	Negotiated	Voltage and reactive power control requirements to be added.
Remote monitoring	Negotiated level of information to be transmitted in real-time to NEMMCO's control centres as per Appendix 2A.	Negotiated	Extra data requirements from wind farms to be added.
Communications equipment	Primary speech facility is mandatory, NSP or NEMMCO may also require a back-up speech facility as per Appendix 2B.	Minimum (must be provided)	
Auxiliary transformers	Performance standards for connection of Customers apply	Various	
Fault levels	Fault level contribution limited to level specified by NSP, under negotiated network configurations.	Negotiated	

APPENDIX B – WIND ENERGY TECHNICAL ADVISORY GROUP PRINCIPLES

Description of Principle	How principle has been applied
<p>Principle 1: The technical standard must provide for adequate security, quality of supply and reliability.</p> <p>The technical standards are proposed to specify performance of plant such that:</p> <ul style="list-style-type: none"> • Power system security; • Quality of supply; and • Reliability of supply¹³ <p>would be maintained at satisfactory levels into the future.</p> <p>The Rules specifically require that NEMMCO and the NSP to take into account security and quality of supply in their negotiations. Consideration of impacts on reliability of supply would extend only to generating units or systems, and not impacts from customers.</p>	<p>A test for reliability of supply impacts from generating systems has been incorporated in the process for assessing proposed performance standards.</p> <p>Clauses in Schedule 5.2 have been carefully examined to ensure that they cover all areas of performance impacting security. In S5.2.5.3 equipment is now required to remain in operation for all credible contingencies, and not only faults.</p> <p>The minimum access requirements in S5.2.5.12 have been extended to cover the situation where a generating system reduces the reliability of supply into another region.</p>
<p>Principle 2: Minimum, automatic and mandatory standards should be defined so that performance requirements are consistent with the potential impact of generating plant on the power system.</p> <p>This principle provides for the negotiated standard to be no more onerous on the generator seeking connection than is necessary. The technical standards cover two sets of standards – “system standards” and “access standards”. System standards are defined to set a target performance level for the power system overall¹⁴.</p> <p>Consistent with achieving the required system standards, the Code allows for developers, NSPs and NEMMCO to negotiate a suitable level of technical performance for new connecting plant. In NECA’s Review of Technical Standards (Dec 2001), NECA stated:</p> <p style="padding-left: 40px;">“The range for those parts of the standards that can be negotiated should be defined between the automatic access standards and the lowest capability that is acceptable, called the minimum access standard. The lowest acceptable standard should normally be related to the level at which a risk to system security or of harm to other connected parties may arise.”</p> <p>In a few instances, mandatory requirements have been placed on connecting parties, without scope for negotiation</p> <p>The technical standards should be formulated in terms that provide for an automatic access standard and a minimum access standard. A review of the technical standards should determine whether:</p> <ul style="list-style-type: none"> • the minimum access standards are reasonable minima, considering the location and potential impact of the generating system within the network; and • the mandatory requirements can be re-cast in terms of minimum and automatic standards; • automatic access standards are set at appropriate levels. 	<p>The minimum and automatic access standards for each clause in S5.2.5 have been reviewed to assess whether they are set at appropriate levels.</p> <p>All mandatory requirements have been redrafted as minimum and automatic access standards.</p>

¹³ Chapter 5 refers specifically to security and quality of supply, but at least one technical standard addresses reliability of supply (see clause S5.2.5.12).

¹⁴ Ref. ACCC final determination on technical standards – February 2003.

Description of Principle	How principle has been applied
<p>Principle 3: Terminology used in the technical standards should support their appropriate application. Where technically appropriate, performance of generating plant should be measured at the connection point.</p> <p>Most of the technical standards are applied to generating units, but for distributed generating systems, such as wind farms, which are comprised of numerous small units, it is appropriate to consider performance requirements in terms of “generating systems”, or the performance of the plant on the power system as measured at its connection point.</p> <p>Depending on the way the plant is controlled and the configuration of its connection, performance can be considered in some cases a function of the generating system¹⁵, and in others a characteristic of the generating unit. The terminology used in the technical standards should therefore be specific, and appropriately support the standard’s application, allowing flexibility to define combined performance in terms of generating systems, and take effect at the connection point where appropriate.</p> <p>The impact of a generating system on the power system security or quality of supply is generally governed by the laws of physics and not influenced by whether it is scheduled or non-scheduled, except through application of certain market rules (such as dispatch rules). Inappropriate use of the term “scheduled” in technical standards can have the consequence of excluding significant intermittent generation projects from the requirement to comply with some technical standards. When the technical standards are reviewed inappropriate use of the term “scheduled” should be avoided.</p>	<p>Use of the term “scheduled” has been reduced to those instances where the category of registration is intended.</p> <p>The technical requirements have been redrafted to allow for performance related to a generating system, where appropriate and to refer performance to the connection point or other agreed location.</p>
<p>Principle 4: Where reasonable, the technical standards should be written so that they are applicable to all technologies. Technology-specific terms should be used only where necessary to clarify requirements for particular technologies.</p> <p>The technical standards must adequately cover all types of generation technologies. To the extent reasonably possible the technical standards should not treat one technology more favourably than another. While the technical standards might recognise the differences between technologies, the standards should aim to achieve an equivalent performance outcome.</p> <p>As new technologies may emerge over time, technical standards should be written, where possible, in a form that can be applied to all technologies. It is recognised that there may be some exceptions to this principle, for example, where a technology has established methods of specifying technical capability that simplify performance assessment or where the technical parameters for a technology are significantly different from those of other technologies.</p>	<p>All clauses in S5.2 have been reviewed to eliminate technology specific wording where possible or to write equivalent clauses for different types of technologies.</p> <p>In S5.2.5.10 and S5.2.5.13 equivalent clauses for synchronous and asynchronous plant have been written.</p>
<p>Principle 5: Where possible, the technical standards should provide clear guidance on the basis for negotiating access standards for each requirement.</p> <p>To provide a fair and consistent basis for negotiation on a particular technical standard requirement, there should be no ambiguity in the intent of the clause or the factors that impact the level of acceptable performance. This can be achieved by the provision of clear guidance.</p>	<p>A basis for negotiation has been added to clauses in S5.2.5 to clarify the conditions that must be considered in the negotiation of access standards.</p> <p>The concept of “considered project” has been introduced to ensure that impacts between projects are properly considered in the assessments.</p>

¹⁵ The Rules define a generating system to be “a system comprising one or more generating units”.

Description of Principle	How principle has been applied
<p>Greater clarity on the purpose of clauses and the basis for negotiation between automatic and minimum access standards will assist both NSPs and Generators in their negotiations, and will enhance the consistency of negotiated outcomes for technical standards.</p> <p>Principle 6: Changes to the technical standards must include appropriate transitional arrangements.</p> <p>Consideration must be given to how the changes will apply to</p> <ul style="list-style-type: none"> (i) Registered generators (as at the date of commencement of the amendments); (ii) Plant not registered, but with connection agreements pre-dating the commencement date of amendments; (iii) Plant registered prior to the amendments coming into effect, but modified after this date (including whether the plant must comply with all new requirements or only those related to the modifications made). (iv) Non-committed projects that are in the process of negotiating connection agreements. <p>In developing these transitional arrangements consideration must be given to the possible economic impact on all parties affected by the transitional arrangements, and in any case, the requirements of Principle 1 must not be compromised.</p>	<p>Transitional arrangements have been drafted to account for registering of performance standards when technical requirements change for</p> <ul style="list-style-type: none"> • existing Registered Generators; • plant for which a connection application has been signed (which may or may not contain performance standards), and which has not been registered; and • plant for which (because of an anomaly in previous drafting) technically has no registered performance standards. <p>Under the proposed arrangements, performance standards of existing registered plant and plant with signed connection agreements are not required to meet new standards, but new plant is required to meet the new standards.</p> <p>When plant is altered, the owner will only be required to upgrade performance standards related to the modification (for example, if an excitation system is modified then the Generator will be required to upgrade plant performance for S5.2.5.13 to current requirements).</p>
<p>Principle 7: Changes to technical standards are to be technically justified</p> <p>To provide adequate certainty to generators and intending generators the technical standards should only be changed if an appropriate industry body can demonstrate an adequate technical requirement for the change. The justification for this could include the need to correct an error or omission or to incorporate a new technology.</p> <p>In general, when changes are required to incorporate a new technology into the technical standards, contributions to the technical standards review should be sought from both power system experts and specialists from the new technology.</p>	<p>The technical changes have been reviewed and refined with the assistance of a group of highly experienced industry representatives. Input to the review process has also been sought from equipment manufacturers (including wind turbine manufacturers.) Comment from manufacturers was reviewed by the industry reference group.</p>

APPENDIX C – MEMBERSHIP OF THE TECHNICAL STANDARDS REFERENCE GROUP

Industry sector	Company	Name
Transmission Network Service Provider	ElectraNet SA	John Thompson
	Transend	Chandra Kumble
	ESIPC	Craig Oakeshott
	TransGrid	Michael Bradbery
Distribution Network Service Provider	Country Energy	Col Hackney *
	ETSA Utilities	Paul Driver *
Generators (synchronous plant)	Hydro Tasmania	John Arneaud
	Loy Yang MMCo	Jonathon Dyson
Retailers	AGL	Alex Cruickshank
Wind Generation Developers	Tarong Energy	Nic Buckley
	Pacific Hydro	Kate Summers
Renewable Energy Developers	Southern Hydro	Rob Jackson
System Operator	NEMMCO	Paul Ravalli
		Jennifer Crisp (Chair)
		Ian Arnott

* Alternate meetings.

APPENDIX D – PROPOSED CONNECTION AGREEMENT PROCESS

