

TECHNICAL INFORMATION REQUIREMENTS FOR GENERATOR CONNECTIONS

PREPARED BY: NETWORK DEVELOPMENT
VERSION: 2.0
DATE: 1 JULY 2012

FINAL

Version Release History

Version	Date	Approved
1.0	14/12/11	Transmission Services
2.0	01/07/12	Network Development

Important Notice

Purpose - This document is provided by AEMO as at July 2012 for general information purposes only.

No Reliance or warranty - This document or the information in it may be subsequently updated or amended. While AEMO has made every effort to ensure the quality of the information in this document, AEMO does not warrant or represent that it is accurate, complete or current or that it is suitable for particular purposes. You should not rely on this document as a substitute for obtaining detailed advice about the National Electricity Law, the National Electricity Rules, or any other applicable laws, procedures or policies.

Limitation of liability - To the maximum extent permitted by law, AEMO and its advisers, consultants and other contributors to this document (or their respective associated companies, businesses, partners, directors, officers or employees) are not liable (whether by reason of negligence or otherwise) for any errors, omissions, defects or misrepresentations in this document, or for any loss or damage suffered by persons who use or rely on the information in it.

© 2012 Australian Energy Market Operator Limited. The material in this publication may be used in accordance with the [copyright permissions](#) on AEMO's website.

Contents

1	Purpose.....	5
2	Overview	5
2.1	Data Provision Categories.....	8
2.2	Data Provision Risks	8
2.3	Confidentiality.....	8
2.4	Data Exchange.....	8
3	Technical Information Requirements – New generator connections	9
3.1	Pre-feasibility.....	9
3.2	Enquiry.....	9
3.3	Application	10
3.4	Contracts.....	12
3.5	Construction.....	12
3.6	Completion.....	12
3.6.1	Registration	12
3.6.2	Commissioning.....	13
3.6.3	Post-commissioning	14
4	Technical Information Requirements – Altered generating systems	14

1 Purpose

This document describes the technical information requirements for new generator connections and altered generating systems in the NEM (National Electricity Market).

Much of the required information is stipulated in the National Electricity Rules (Rules). This document provides applicants with supplementary information on the requirements at each stage of the connection process. It includes discussion of the level of detail required and the underlying intent behind the requirements, and refers to other AEMO documents that should be used in the provision of data.

Technical information is required at various stages of the connection process to enable AEMO to properly discharge its accountabilities under the Rules. The quality and timing of this information is critical for completion of a new connection or alteration to a connected generating system. Delays in provision of technical information of the required quality at any stage of the process will result in delays in establishing the connection or altering the generating system.

The technical information required for new generator connections is the same across the NEM; however, for connections to the Declared Shared Network (DSN) in Victoria, the timing for information provision is different. This is consistent with AEMO's obligations as the TNSP (transmission network service provider) in Victoria.

For alterations to generating systems across the NEM, the technical information requirements depend on the nature of the alteration.

2 Overview

For new connections to the DSN in Victoria, AEMO requires technical information at each stage of the connection process (from pre-feasibility to completion) to assess technical compliance with the Rules and to ensure that the connection is consistent with safe and efficient operation of the DSN.

For new connections in the NEM outside Victoria, AEMO only requires technical information once a connection application has been made to the relevant network service provider (NSP). The connecting NSP will require technical information at each stage of the connection process. These state differences are described in Section 3 of this document.

As applicants progress through the connection process, increasingly detailed and accurate descriptions of the project are required. Figure 2–1 shows the increasing level of detail and accuracy expected as the project proceeds.

Cooperation in sharing data makes the connection process more streamlined and reduces the likelihood of projects being delayed.

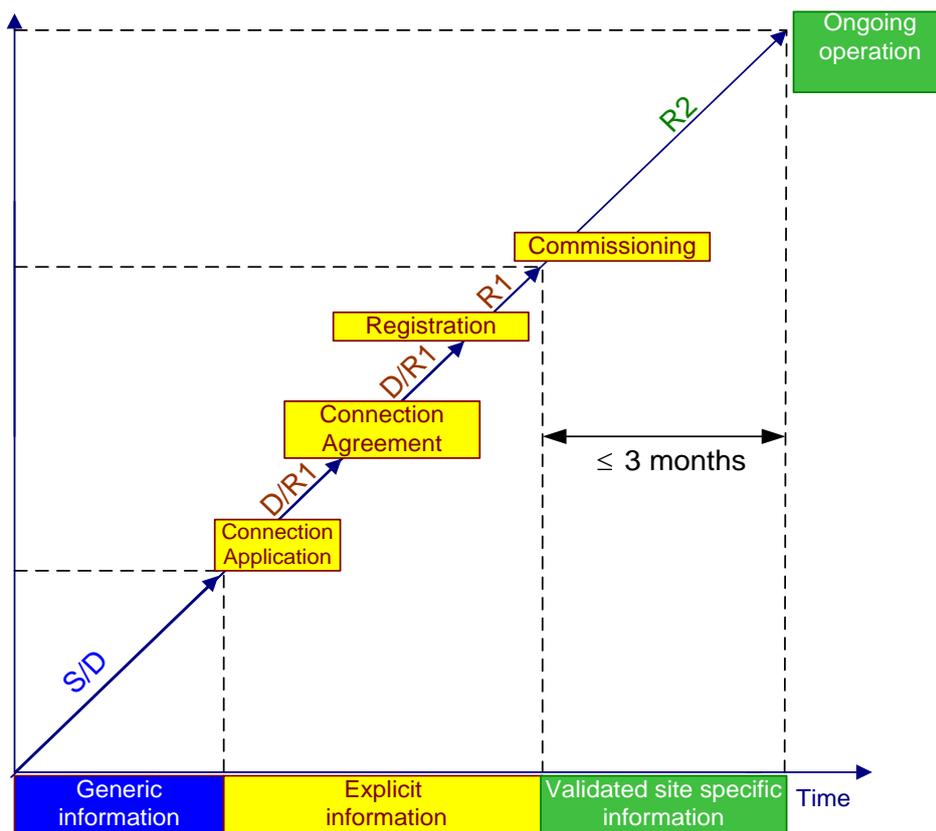


Figure 2–1: Illustration of detail of technical information requirements at each stage of the connection process

Table 2–1 summarises the technical information requirements for each stage of the connection process.

Connection Stage	Information	Information Quality
Pre-feasibility	General location, size and type of transmission and distribution connection and whether the project will be completed in stages	Informal
Connection Enquiry	Information as specified in Schedule 5.4 of the Rules	General, high-level
Connection Application	Generating system data including: <ul style="list-style-type: none"> • Standard Planning Data (S) • Detailed Planning Data (D) • Diagram of connecting plant configuration • Simulation and modelling data for generation connections 	Preliminary design data will be subject to review during detailed design

Connection Stage	Information	Information Quality
	(Clause S5.2.4 of the Rules) <ul style="list-style-type: none"> Proposed performance standards. 	
Contracts	Agreed performance standards Finalised data regarding connecting plant and its configuration	Detailed design data are subject to review prior to registration, based on finalised design tests and factory tests
Construction	Construction schedule information and coordination Factory acceptance test data Regular progress updates	Timely and up-to-date
Completion	<p>Registration:</p> Generating system and connecting plant data including: Registered Data: pre-connection (R1) Factory acceptance test data An acceptable model based on the finalised design data and in accordance with the modelling guidelines ¹ NEM registration documents Agreed performance standards	Finalised design data are verified from factory tests where applicable
	<p>Commissioning:</p> Commissioning program and coordination as per Clause 5.8.4 of the Rules. On-site test data Regular progress updates	Timely and up-to-date
	<p>Post Commissioning:</p> Registered data from post-connection tests (R2) Data and simulation model validation and performance verification	Finalised plant data and simulation model, verified from factory and on site commissioning tests

Table 2–1: Overview of technical information requirements

¹ http://norvbscore1/About-AEMO/Energy-Market-Registration/Registering-in-Energy-Markets/~/_media/Files/Other/registration/0110-0038%20pdf.ashx

2.1 Data Provision Categories

Clause S5.5.2 of the Rules categorises data into four stages:

S data: Preliminary system planning data (required for the connection application).

D data: Registered detailed system planning data (required for the connection application).

R1 data: Registered data (available prior to physical connection). These data are derived from the manufacturer's data, detailed design calculations and factory acceptance tests prior to network connection. This is the class of data that would be included in the connection agreement.

R2 data: Registered data (available after the physical connection has been made). These data are derived from online testing. AEMO's Generating System Design Data Sheets and Generating System Setting Data Sheets (available from AEMO's website) show the classification of the data required for connecting generating systems.

Applicants should note that changes in data values during the connection process may impact on the schedule for a new connection. The connection agreement and the physical connection of the system depends on the extent to which the generating system's modelled response predicts actual response. Large variations or errors in parameters submitted at the S or D stage, and identified at the R1 or R2 stage, will impact the ability of the connection to operate and will require investigation by either AEMO or the connecting NSP.

2.2 Data Provision Risks

At all times in the connection process, applicants are responsible for providing complete and correct data. AEMO will provide advice to applicants where data appears to be incorrect, inconsistent or contradictory to other information provided. This advice will not usually extend to suggested alternative data. AEMO will otherwise assume that information provided is correct. AEMO will not make assumptions about missing or incorrect information.

Applicants should pay particular attention to the simulation models they provide for generator connections. Standard or generic models and parameters are not acceptable for the purposes of approving proposed performance standards. All models and settings should: be specific to the generating unit/s proposed; accurately represent the behaviour of the generating system; and reflect the physical characteristics of any control systems. If it eventuates that incorrect data or models have been provided and used for the approval of proposed performance standards, AEMO will need to repeat its analysis. This will cause delays in the connection process and increased cost for the additional works. Any additional costs will be recovered from the applicant.

2.3 Confidentiality

AEMO is bound by the confidentiality requirements under the Rules, which contain provisions to address an applicant's rights to project confidentiality. However, the Rules also require the disclosure of power system and generating system modelling information that is reasonably required for power system studies by declared transmission system operators (DTSOs) and other registered participants or intending participants in the NEM. Confidentiality and the provision and use of information are addressed in Clauses 3.13.3, 5.3.8 and 8.6 of the Rules.

AEMO's publicly available planning documents contain information regarding new connections consistent with that which is already in the public domain and/or the applicant has agreed to being published.

2.4 Data Exchange

In matters associated with a connection, AEMO will only deal with the applicant or its nominated representative. This is to ensure consistency with the allocation of risk as discussed in Section 2.1 of this document. AEMO will only use data received as part of a formal connection application or

supplemental data that the applicant has authorised to be communicated to AEMO. If necessary, arrangements can be made to meet confidentiality or other specific requirements of equipment suppliers. For example, a manufacturer of a generating unit may not wish to give the applicant access to the dynamic model source code for its equipment. In this case, the applicant is unable to submit the data to AEMO; however, the applicant can provide a letter to AEMO that enables the manufacturer to provide the information directly to AEMO.

3 Technical Information Requirements: New generator connections

As described in Section 2 of this document, new generator connections to the DSN in Victoria require technical information to be provided to AEMO at each stage of the process. For connections to the NEM outside Victoria, the connecting NSP will require technical information at each stage, but AEMO only requires information at the application stage (Section 3.3) and completion stage (Section 3.6).

3.1 Pre-feasibility

Although there are no formal information requirements at the pre-feasibility stage, prospective applicants may approach AEMO for informal advice around possible locations for connection to the DSN in Victoria and special connection requirements. For AEMO to provide useful advice, applicants will need to advise the proposed connection location, and capacity and type of generating technology proposed. Additional information of the type listed in Schedule 5.4 of the Rules may be required from the applicant depending on the extent of the initial discussions with AEMO.

AEMO has no requirements under the Rules or mandated timeliness for provision of this informal advice, which is provided to assist the applicant in conducting pre-feasibility investigations. Generally any detailed involvement would be held over until a formal connection enquiry or connection application is received.

On request, AEMO can provide more specific advice at the pre-feasibility stage, including calculation of expected marginal loss factors and an assessment of the probable network constraints at the proposed connection point. These additional services may incur a fee.

3.2 Enquiry

The connection enquiry is the first formal approach by a connection applicant to AEMO. This initial approach should specify the type, magnitude, preferred location and timing of the proposed connection to the DSN in Victoria.

What information is required? Schedule 5.4 of the Rules specifies the information to be provided with a connection enquiry.

What will AEMO do with the information? AEMO will advise the applicant within five business days if additional information for the connection enquiry is required, and within 10 business days whether the connection enquiry should be referred to another more appropriate NSP (Clauses 5.3.2 (b) and (c) of the Rules).

Subject to the above, within a further 20 business days AEMO will prepare a response to the connection enquiry, which will include the following technical advice:

- Possible technical issues with the proposed connection, including probable significant transmission constraints; although, it should be noted that AEMO does not guarantee that all major issues will be identified at this stage.

- The access standards for each technical requirement (automatic, negotiated and minimum), which are detailed in the relevant schedules to the Rules². In Victoria, all proposed performance standards are AEMO 'advisory matters'. If the applicant proceeds with the connection, these proposed performance standards are to be considered in conjunction with other requirements of the Rules when making an application to connect.
- Details of technical information that must be provided with an application to connect (or referral to documents listing the required information).

In some cases, AEMO may advise that more than one NSP should be involved in the connection enquiry. For example, this could occur where a connection is proposed on an interconnector to an adjacent state. With agreement from the applicant, AEMO will provide the other NSPs with the technical information necessary to facilitate the connection process. There may be additional costs to the applicant if another NSP is affected.

3.3 Application

The application stage of the connection process is a formal requirement under Clause 5.3 of the Rules.

For connections to the DSN in Victoria, connection applications are submitted to AEMO. In Victoria, AEMO is responsible for the safe and efficient operation of the DSN, in addition to its responsibilities for power system security in the NEM. For connections to the NEM outside Victoria, applications are submitted to the relevant NSP. The NSP communicates with AEMO, which, under the Rules, is responsible for the development of those access standards defined as 'AEMO advisory matters'.

A connection application must include the technical information required by the connecting NSP and/or AEMO to conduct a detailed assessment of the connection, including the proposed performance standards and a proposed connection arrangement.

What information is required? For connections to the DSN in Victoria, the connection application must include the technical information identified in AEMO's response to the connection enquiry, including all standard and detailed planning data, simulation model information and proposed connection switching arrangements. For connections to the NEM outside Victoria, similar information is required as described below, although applicants should confirm with the connecting NSP.

Data provided by the applicant with the connection application is treated as confidential as required by the Rules. In general, technical information requirements will be as follows:

- **Preliminary detailed design data:** Design data as per Schedule 5.5 of the Rules and, for generators, models sufficient to represent the short and long-term dynamics of the proposed generation and control systems. The scope and accuracy of these data are defined in Schedule 5.5 of the Rules, and further elaborated upon in AEMO's Generating System Model Guidelines and Checklist of Model Data Requirements for New Connections and Planned Alterations (both available at AEMO's website). Data should generally be at the S and D levels. The data provision levels are summarised in Section 2.1 of this document and further explained in the Generating System Design Data Sheets and Generating System Setting Data Sheets (available at AEMO's website). In addition to the design data, the applicant must provide appropriate generating system modelling information as per AEMO's Generating System Model Guidelines (available at AEMO's website).

² The access standards differ for each of the technical requirements specified in the Rules, and may also depend on whether the generation is to be scheduled or semi-scheduled through AEMO's central dispatch. In some cases, the Rules specify the standard that must be met for new generating plant. In other cases, the standard can be negotiated between the minimum and automatic access standards.

- Proposed performance standards: Proposed performance standards are required together with documentation and analysis to support that these levels of performance are acceptable. A list of standards should be prepared using the proforma document available on AEMO's website. They are to be supported by technical information relating to the generating system. In addition, the dynamic response of the generating system to system events should be demonstrated to comply with the proposed performance standards. The supporting information relating to the proposed performance standards may be packaged in a connection studies report and provided to the connecting NSP and/or AEMO at the time of application.
- Construction Schedule and Proposed Commissioning Date: A construction schedule and proposed commissioning date are also to be provided; although, it would be expected that this would be a relatively high-level document at this stage of the connection process.

What will AEMO do with the information? For connections to the DSN in Victoria, AEMO will advise the applicant within five business days if additional information for the connection application is required. Once a complete set of technical data has been supplied, AEMO will use the information to assess the technical compliance of a proposed connection, within a further 30 business days,

For connections to the NEM outside Victoria, AEMO will advise the applicant within five business days if additional information for the connection is required to assess access standards termed AEMO advisory matters. Once a complete set of technical data has been supplied, AEMO will use the information in the connection application to assess the technical compliance of a proposed connection for those access standards termed AEMO advisory matters, within a further 20 business days.

Technical compliance is determined as follows:

- If the applicant has proposed performance standards at any of the negotiated or minimum access standard levels, AEMO will determine whether these standards are consistent with maintaining secure operation of the system within the system standards (Clause S5.1a.1 of the Rules).
- Assessment is made to ensure that the simulation model and other technical information provided are consistent with, and substantiate, the proposed performance standards. Studies are conducted in accordance with the Guidelines for Assessment of a Generator Performance Standards in the NEM³.
- AEMO will reject a proposed performance standard at the negotiated or minimum access level if AEMO considers that it will have a negative impact on system security or quality of supply to other network users. In carrying out this assessment, AEMO will consult with other NSPs and registered participants that have pre-existing connection agreements with AEMO or relevant projects already in the connection process that may be impacted by the proposed connection.

To make this technical assessment, AEMO uses the data and models provided by the applicant to conduct a comprehensive set of system studies. This often involves consideration of issues that the applicant's connection studies report may not have addressed, such as planned or likely upgrades, alternative system operating conditions and certain high-impact non-credible system events. It is for this reason that detailed modelling information is required with the connection application and that the accuracy of the information provided by the applicant must be the best available at the time. Subsequent variations in the values of the generating system data may impact performance standards and could lead to delays in accepting the connection to the grid during the commissioning process.

³ http://www.aemo.com.au/en/Electricity/Network-Connections/Vic_Generator_Transmission_New-Connection/~/_media/Files/Other/connections/network_connections/documents/0174-0024.pdf.ashx

During the course of AEMO's assessment and in consultation with the applicant, the proposed performance standards and connection arrangements may be modified to ensure that the technical performance of the connection is compliant with the Rules and consistent with plant specifications.

3.4 Contracts

For connections to the DSN in Victoria, AEMO will prepare an offer to connect, setting out all the agreed contracts. This will include a Use of System Agreement (UoSA), which forms the connection agreement, and any other contracts required to be executed by AEMO and the applicant.

For connections to the NEM outside Victoria, AEMO has no involvement in contractual arrangements, even though any connection agreement between the connecting NSP and applicant will include finalised performance standards for AEMO advisory matters that have been accepted by AEMO.

What information is required? The following technical information is required to prepare the offer to connect to the DSN in Victoria:

- S and D level planning data
- Detailed design data
- Agreed performance standards
- Arrangements and functional specifications, including details of civil, mechanical and electrical interfaces (primary and secondary) between the connection assets and, where applicable, new shared network assets and the DSN.
- Information on agreed performance standards and arrangements and functional specifications is finalised jointly by AEMO and the applicant during AEMO's technical analysis in response to the connection application.

What will AEMO do with the information? AEMO will use this technical information to prepare the contracts required to make the connection to the DSN. Final versions of these contracts will be included in the offer to connect.

3.5 Construction

Generally the coordination of construction activities is specified as part of the construction contracts. The technical information transfer during this stage will include reporting of progress and any issues likely to affect project timelines or costs.

3.6 Completion

3.6.1 Registration

For registration within the NEM, applicants are required to submit finalised technical design data, including agreed performance standards. These data are required to demonstrate compliance with the agreed performance standards and other applicable technical requirements specified in Chapter 5 of the Rules.

Data accuracy is critical for registration. If it is revealed at this stage that any of the data are incorrect or that the generating system does not meet the technical requirements (as specified in the Rules or the connection contracts), regardless of how minor the discrepancy, AEMO is not able to approve the application for registration until the issue has been addressed.

AEMO's experience indicates that a connection applicant may need up to three months to prepare the necessary documentation for registration. AEMO is allowed 15 working days to process a completed registration application once all required information has been provided.

Registration must be approved by AEMO's Participant Registration Committee before first synchronisation will be permitted. Generating more than 5 MW without being registered is a breach of the Rules, and synchronisation can be delayed if registration information is submitted late or has to be resubmitted.

What information is required? Technical data are required up to and including the R1 or pre-connection level. Applicants must provide finalised simulation models (including model source code) and an accepted Releasable User Guide.

AEMO's Generator and Customer Registration Guides (available at AEMO's website) provide detailed information on the registration process, including technical information requirements and the various classes of registration. They also detail any available exemptions.

What will AEMO do with the information? AEMO will use the technical information to ensure that a generating system meets the technical requirements for registration under the Rules.

3.6.2 Commissioning

Connection applicants must confirm technical compliance through commissioning and testing of the connection equipment and the generating system. During this stage, results are reported and any non-compliance defined and resolved. All non-compliance must be resolved before commercial operation can commence.

For connections to the NEM outside Victoria, applicants should confirm with the connecting NSP the additional information required to confirm technical compliance.

What information is required? A commissioning plan must be provided at least three months⁴ prior to the start of commissioning. The plan, which describes the proposed commissioning program of works, must include a list of commissioning tests to be undertaken, providing:

- a description of the purpose of the tests that outlines the equipment under test, the agreed performance standards being assessed, and the modelled performance comparisons being made;
- the proposed dates for tests;
- the proposed duration of tests;
- the specification of measurement equipment to be used; and
- any specific network conditions.

The plan must allow for hold points and include a proposal for evidence to be provided at each hold point. The commissioning plan may include other commissioning tests; however, it must show clearly which tests are intended to demonstrate the performance of the generating system against the agreed performance standards.

AEMO may request additional commissioning tests to gain further clarity regarding a particular test. The connection applicant must cooperate with AEMO to develop procedures to ensure that the commissioning of the generating system does not adversely affect other registered participants or the power system. AEMO will reply within a reasonable period of notification of commissioning tests advising whether AEMO agrees with the proposed commissioning times and if AEMO intends to witness the tests.

The results of the tests must be given to AEMO and must satisfy the requirements of the Rules and any connection contracts.

The connection applicant must supply to AEMO detailed design R1 data and a simulation model based on the finalised design, at least three months before commissioning commences.

⁴ For generator distribution connections, a commissioning plan must be provided at least one month prior to the start of commissioning.

What will AEMO do with the information? AEMO will use information in the commissioning plan to coordinate the applicant's commissioning activities with other activities across the power system.

AEMO will use the design data and simulation model to simulate the commissioning tests and determine any possible impacts on the power system. AEMO will also compare simulation and measured test results for the purpose of model validation.

3.6.3 Post-commissioning

Once commissioning has occurred, the applicant can finalise the technical data for the connection based on the commissioning test results.

What information is required? The applicant must submit a draft commissioning report to AEMO no more than three months after the completion of commissioning. This commissioning report should:

- outline the commissioning tests undertaken on site;
- compare expected performance with on-site performance; and
- outline the conclusions drawn regarding compliance with the Rules, compliance with the design and consistency with the model.

The applicant must supply detailed validated data, derived from on-system plant testing (R2), to AEMO within three months of the conclusion of the commissioning program. For generators, this data will include validated parameters and models based on generating system testing as per AEMO's Generating System Design Data Sheets And Generating System Setting Data Sheets and Generating System Model Guidelines (available at AEMO's website).

For connections to the NEM outside Victoria, applicants should confirm with the connecting NSP whether additional technical information is required to address post-commissioning obligations.

What will AEMO do with the information? AEMO will compare the R1 and R2 data. Where there is a variance between the R1 and R2 data, AEMO may repeat the connection studies to determine whether the agreed performance standards are still appropriate.

If the variance is shown to require renegotiation of agreed performance standards or has the potential to adversely affect system performance or other registered participants, operations may be curtailed and there could be significant delays to commercial operation.

4 Technical Information Requirements: Altered generating systems

Clause 5.3.9 of the Rules describes the procedure to be followed by a generator proposing to alter a generating system. The discussion in Section 2 of this document applies to alterations as well as new connections. The technical information requirements for each stage of the alteration process will be a subset of the requirements detailed in Section 3 of this document. These will be assessed on a case-by-case basis.