

Connection Process Summary

NT NER S5.10

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Introduction

Background

Power and Water Corporation (**Power and Water**) operates the electricity transmission network in the Northern Territory. Power and Water publishes this document as a guide to connection enquiry and application to connect fees, pursuant to Schedule 5.10 of the National Electricity Rules (Northern Territory) (**NT NER**).

Version history

Version	Date	Comments
V1.0	09 October 2024	Initial version for publishing

Table 1: Version history

Disclaimer

This document may be regularly updated. Persons not on a Power and Water distribution list should not assume that this document is the latest version.

The only up-to-date version is that located on Power and Water's web site.

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<h3>Pre-feasibility</h3>  <p>Time: 2-12 months Cost: Quoted services</p>	<h3>Enquiry</h3>  <p>Time: 2 months Cost: Estimated at \$50-\$80k</p>	<h3>Connection application</h3>  <p>Time: 12-18 months Cost: Estimated at \$700k+</p>	<h3>Connection offer and agreement</h3>  <p>Time: Subject to negotiation and complexity, estimated 6 months+ Cost: \$50k +</p>	<h3>Capital construction</h3>  <p>Time: 8-12 months Cost: Quoted services</p>	<h3>Commissioning and compliance</h3>  <p>Time: Life of the connection Cost: \$250k</p>
<p>Power and Water supports applicants during their capital investment planning by:</p> <ul style="list-style-type: none"> advising on relevant technical codes, standards, and guidelines for major connections to the electrical network supporting preliminary assessment of connection locations and concept designs providing a preliminary summary of the connection application process and estimated time and costs. 	<p>Power and Water reviews each enquiry for completeness and complexity. A preliminary response is issued to summarise the enquiry and advise the enquiry fee.</p> <p>Power and Water will issue a detailed enquiry response that includes:</p> <ul style="list-style-type: none"> a preliminary system strength impact assessment (PIA), which identifies networks constraints that the applicant will need to consider during their connection application information to support the applicant's investment decision in the connection location and preliminary concept designs. 	<p>To submit a connection application, the applicant must propose network access standards for their plant, based on a R1 connection package that is supported by:</p> <ul style="list-style-type: none"> connection assumptions root square mean (RMS) model electromagnetic transients (EMT) model connection studies. <p>Power and Water performs a compliance review of the connection package and the connection's network access standards are assessed. The R1 connection package also informs the detailed design and specifications for the plant and electrical connection, which are developed concurrently.</p> <p>The connection application should also confirm if Power and Water is to construct the electrical connection or inspect the applicant's constructed electrical connection, for compliance against the Network Technical Code and Power and Water standards.</p>	<p>Power and Water will issue a connection offer based on the connection application which includes:</p> <ul style="list-style-type: none"> electrical connection construction and commissioning cost agreed access standards operating protocol compliance test plan. <p>When the connection agreement has been executed the joint market registration with NT Electricity System Market Operator (NTESMO) is completed.</p>	<p>The construction of the applicant's plant, electrical connection and eventual commissioning of the integrated connection commences, and the pre-commissioning works is completed.</p>	<ul style="list-style-type: none"> The plants performance is bench marked against the model submitted in the application and agreed access standards registered in the connection agreement. Once compliance is achieved at the agreed hold points, the applicant is issued a commencement of service (COS) notice to start a 30-day reliability run. From the date the COS is issued, the applicant has 90 days to submit the R2 validation package. When the R2 validation package compliance has been achieved, the applicant is approved for market dispatch. Dispatch of generation connections are managed through the System Operator and the NTESMO. During the life of the connection the applicant has an on-going obligation to provide performance data to validate ongoing compliance.

Table 2: Connection process summary

1. Pre-feasibility

Applicant input

The applicant submits a pre-feasibility request which provides Power and Water with a high-level summary of their connection, including:

- connection type
- capacity
- locations.

Power and Water output

Power and Water is able to support with pre-feasibility engagement and connection engagement packages at nil cost:

- Pre-feasibility engagement meeting to advise the applicant on:
 - connection process requirements and deliverables
 - connection process timeframes
 - high level processing cost estimates.
- A connection engagement package which includes key documents for submitting a connection application.
 - Network Technical Code and Network Planning Criteria
 - Generator and Load Model Guidelines and Change Management Requirements
 - Generator Forecasting Compliance Procedure
 - Large Connection Enquiry Form.

Estimated delivery time

2 to 12 months.

Estimated costs – Quoted service

Power and Water can provide a quoted service for supporting applicants in assessing potential connection locations through assessment of system strength and network assets including:

- concept design review
- responses to request for information (RFI)
- preliminary connection location(s) scoping assessments.

2. Enquiry

Applicant input

The enquiry application must provide all relevant information (including but not limited to the below items) prior to Power and Water accepting the enquiry and preparing a preliminary response:

- the full address of proposed installation including national meter identifier (NMI) and current meter number/s
- a description of the entry point and transfer point at the Power and Water substation, pillar or pole number of which the installation is/will be connected
- a description of the premises and connected plant suitable to determine load profile, power consumption and expected operation
- a single line diagram outlining the existing connection arrangements and the integration of the proposed system
- generating system details – Inverter size, number and size of photovoltaic (PV) panel arrays
- maximum export requested in kVA
- maximum annual demand of the site in kVA, including any proposed growth or guaranteed reduction
- estimated annual energy consumption and production in kWh (net and gross figures)
- any disturbing load and step change details, and proposed ramp rates for generation
- any additional information as requested by Power and Water.

Power and Water outputs

Power and Water will provide a preliminary response that will summarise the connection enquiry and complexity of the enquiry application, which determines the processing fee for the enquiry application.

Once financial commitment is provided, and all information has been received, Power and Water will undertake a detailed assessment being:

- a summary of the enquiry application
- preliminary system strength impact assessment (PIA)
- network model request form
- details of the studies undertaken
- assumptions used for future generation patterns, dispatch during contingency events, network configurations, augmentations, and retirement of network plant
- an indication of the network that is intended to be modelled in the final impact assessment (FIA) and how the remainder of the network will be addressed:
 - information of the level of modelling required for an FIA (surrounding network and nearby generating systems)
 - scope of power systems studies required for an FIA, including any further data required by Power and Water.
- a connection processing agreement that includes an estimate for Power and Water services in supporting your connection application.

- connection application and checklist
- network access standard template.

Estimated delivery time

Power and Water will:

- acknowledge receipt for your enquiry within 5 business days
- advise of any additional information required to be submitted with 10 business days
- issue a preliminary response within 15 business days
- issue a detailed response within 30 business days, from the date financial commitment and all requested information is received from the applicant.

Estimated costs

Processing fee for the detailed response is generally from \$50,000 to \$80,000 (excluding GST) depending on the complexity of the connection enquiry.

3. Connection application

Applicant input

The applicant is required to prepare a compliant connection application to enable Power and Water to issue a connection offer.

A compliant application (in accordance with the Northern Territory National Electricity Rules) requires:

Technical information:

- applicant and facility details:
 - source of supply
 - plant control
 - protection systems
 - SCADA and metering.
- Information to support compliance to the Network Technical Code Part D, Schedules:
 - 3.1 Generating unit design data
 - 3.2 Generating unit setting data
 - 3.5 Network and plant technical data
 - 3.6 Network plant and apparatus setting data
 - 3.7 Load characteristics at connection point.
- Location maps showing:
 - project location
 - boundaries
 - collector substation site.
- Single line diagrams (SLD):
 - connection arrangement and generating system clearly showing the connection point including primary electrical SLD (all collector circuits showing switching arrangements for each generating unit)
 - demonstrate alignment with the model representation of the generating system if applicable
 - revenue meters and power quality meters
 - protection systems and protection settings report
 - auxiliary supply arrangement
 - SCADA and communications.
- generation and/or load profile (storage projects may require load from the network and this should be considered)
- generating system capability curve during steady state conditions and transients (if applicable)
- detailed design for identified user shared assets, only for connections at 66kV and above that will not be provided by Power and Water (and any other associated requirements as outlined in chapter 5 of the NT NER).
- proposed generator performance standards (GPS) in the current Power and Water template.
- connection power system studies report(s) detailing and demonstrating how the applicant intends to meet each of the GPS

- confirmation that protection settings report does not over-rule any other requirement in the GPS (i.e. quality check to ensure that protection settings design (which may be undertaken at detailed design stage) does not impede any otherwise agreed generator performance standard items or stated capability.
- voltage control strategy document including an explanation of how the generating system meets NTC 3.3.5.1 – Reactive power capability and NTC 3.3.5.13 – Voltage and reactive power control. This needs to include primary, secondary, and tertiary control and equipment responses (transformer tap change positions and switching logic used)
- address the PIA/FIA report from Power and Water as per [Power and Water System Strength Impact Assessment Guidelines](#).

Generator and load modelling:

- submit models that are compliant with the Generator and Load Model Guidelines and Change Management Requirements
- root square mean (RMS) model
- electromagnetic (EMT) model
- final models will need to comply with the Generator and Load Model Guidelines and Change Management Requirements, particularly section 2, including:
 - general requirements
 - software requirements
 - dynamic model requirements
 - small signal requirements
 - power quality data requirements.
- model documentation:
 - RMS model block diagrams
 - Releasable User Guide (RUG)
 - model development report.

Power and Water output

- model tuning
- model acceptance
- electrical connection concept design
- connection agreement:
 - cost estimates
 - accepted access standards
- full impact assessment (if required)
- operating protocol.

Estimated delivery time

12-18 months.

This is dependent on the applicant's ability to submit all required information and documents including Power and Water's technical compliance review of the model package.

Estimated costs

Power and Water can assist with development of a compliant connection application based on hourly rates. Total fees may range from \$450,000 to \$700,000 (excluding GST) based on the complexity of the connection application.

Services include:

- project management
- technical design review and compliance
- compliance reviews of models, engineering studies, proposed registered data and technical standards
- risk and option analysis including system strength impact assessment (i.e. PIA and/or FIA as applicable) and any resulting negotiations
- scoping and pricing for capital works
- compliance review of agreed access standards and negotiation of the access standards.
- drafting and negotiation of a connection agreement to enable a connection offer to be issued.
- liaising with the System Controller and NTESMO for all functions required to process the connection.

4. Connection offer and agreement

Applicant input

Nil. Information from the connection application will be considered.

Power and Water output

Based on the connection application and Power and Water's technical compliance review of the model package, a connection offer and connection agreement will be issued to the applicant.

The connection agreement will confirm the costs and delivery timeframes for establishing an electrical connection and compliance validation testing.

Estimated delivery time

Included in the estimated delivery time for the connection application as the connection offer and connection agreement will be progressed concurrently with preparation of the model package. Estimated to require 6 months to develop the connection offer, negotiate the conditions of the connection agreement and negotiate the access standards.

Estimated costs

The estimated costs for drafting and negotiating the connection agreement is \$50,000.

5. Capital construction - Delivery of plant and electrical connection construction

Applicant input

During the capital delivery the applicant will construct their plant. The electrical connection is constructed. Should the applicant construct the electrical connection Power and Water will perform a compliance review.

Should Power and Water construct the electrical connection, the applicant will be required to provide the:

- bank guarantee to reflect the capital delivery cost. This is released once integrated connection performance is validated.
- “as constructed” drawings and specifications
- as-built single line diagram
- certificate of compliance (COC) and a statement to certify that the equipment to be connected has been designed and installed in accordance with the Network Technical Code, all relevant standards, all statutory requirements, and good electricity industry practices.

Power and Water output

- construct and commission the electrical connection to the transmission network in accordance with the agreed connection agreement
- capital delivery project management plan
- final detailed design (electrical connection)
- connection commissioning
- once electrical commissioning has occurred, and the applicant has demonstrated compliance at 50% capacity, Power and Water will release the bank guarantee.

Estimated delivery time

As per the executed connection agreement.

Estimated costs

As per the executed connection agreement.

6. Commissioning and compliance

The compliance and commissioning test plan is used to validate that the applicant's plant performance meets the agreed access standard and validate the applicant's model with actual performance data. It will also detail when hold point tests are required and is likely to be at energisation (0%, 25%, 50%, 75% and 100% capacity).

When the applicant has demonstrated full compliance they are approved for market dispatch.

Applicant input

- proposed compliance and commissioning test plan
- hold point testing
- hold point report
- reliability run (a 30-day period of commercial dispatch, under a risk notice, to collect performance data for inclusion in the R2 connection package)
- reliability report
- R2 connection package (registered data) for:
 - RMS
 - EMT
 - studies.
- on-going compliance monitoring plan
- market registration for dispatch.

Power and Water outputs

- approve compliance test plan. (template compliance test plans are available on request from MajorConnection.pwc@powerwater.com.au).
- hold points and reliability run reports compliance review:
 - compliance issue register.
 - compliance approval.
- commencement of service approval
- R2 connection package compliance review:
 - compliance issue register
 - compliance approval.
- operating protocol
- market registration
- market dispatch
- ongoing compliance plan approval.

Estimated delivery time

8 to 12 months.

The delivery of the compliance test plan (CTP) and validation is subject to the agreed CTP.

A general indication of duration for the tasks is:

- hold point test – 10 business days
- hold point report drafting – 20 business days
- hold point report validation – 20 business days
Note that approval to progress to subsequent hold points is contingent on no high risks being identified in the preliminary report review.
- reliability run – 20 business days
- reliability run report development 20 business days
- reliability run report validation – 20 business days
- R2 connection package drafting– 60 days
- R2 connection package validation – 60 days.

Estimated costs

The cost for the compliance validation testing is subject to the compliance testing plan.

Power and Water estimates for a major generator connection (>2MW) that delivery cost will range from \$150,000 to \$250,000 (excluding GST).

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