# Transmission Network Design and Reliability Standard for NSW

December 2010

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## Introduction

The NSW transmission network has previously been planned and developed by TransGrid and its predecessor organisations, commencing with the Electricity Commission of NSW, for over 50 years.

Under the requirements of the National Electricity Rules (NER) a Transmission Network Service Provider (TNSP) such as TransGrid is obliged to meet certain obligations. In particular, a TNSP is obliged to meet the requirements of clause S 5.1.2.1:

> *"Network Service Providers* must plan, design, maintain and operate their *transmission networks* to allow the transfer of power from *generating units* to *Customers* with all *facilities* or equipment associated with the *power system* in service and may be required by a *Registered Participant* under a *connection agreement* to continue to allow the transfer of power with certain facilities or *plant* associated with the *power system* out of service, whether or not accompanied by the occurrence of certain faults (called "*credible contingency events*").

The NER sets out the required processes for developing networks as well as minimum performance requirements of the network and connections to the network. It also requires A TNSP to consult with Registered Participants and interested parties and to apply the Australian Energy Regulator's (AER)'s regulatory test to development proposals.

Transmission augmentations are subjected to a cost-benefit assessment where the AER's regulatory test (RIT-T from 1$^{st}$ August 2010) is applied to meet the requirements of Chapter 5 of the NER.

## General Obligations

A TNSP's planning process must be interlinked with the licence obligations placed on Distribution Network Service Providers (DNSP) in NSW. A TNSP must ensure that their transmission network is adequately planned to enable the DNSP licence requirements to be met.

Consistent with the principle objectives for energy transmission operators as set out in section 6B of the *Energy Services Corporations Act 1995* a TNSP has general obligations: -

- to exhibit a sense of social responsibility by having regard to the interests of the community in which it operates and ,
- to protect the environment by conducting its operations in compliance with the principles of ecologically sustainable development contained in section 6 (2) of the *Protection of the Environment Administration Act 1991*,
- to exhibit a sense of responsibility towards regional development and decentralisation in the way in which it operates,
- to operate efficient, safe and reliable facilities for the transmission of electricity and other forms of energy,

Hence, a TNSP shall meet community expectations in relation to the supply of electricity, including ensuring that developments are undertaken in a socially and environmentally responsible manner.

In meeting these obligations a TNSP's approach to network planning shall be consistent with both the NER and the AER regulatory test, or Regulatory Investment Test – Transmission, as appropriate. This must include consideration of non-network options such as demand side response and Demand Management (DM) and/or embedded generation, as an integral part of the planning process in accordance with the NER.

Joint planning with DNSPs, directly supplied industrial customers, generators and interstate TNSPs shall also be carried out to ensure that the most economic options, whether network options or non-network options, consistent with customer and community requirements are identified and implemented.

A TNSP shall plan their transmission network to achieve supply at least overall community cost, without being constrained by State borders or ownership considerations.

### Jurisdictional Planning Requirements

In addition to meeting requirements imposed by the NER, environmental legislation and other statutory instruments, a TNSP shall plan and develop its transmission network on an “n-1” basis. That is, unless specifically agreed otherwise by a TNSP and the affected distribution network owner or major directly connected end-use customer, there will be no inadvertent loss of load (other than load which is interruptible or dispatchable) following an outage of a single circuit (a line or a cable) or transformer, during periods of forecast high load.

In fulfilling this obligation, a TNSP must recognise specific customer requirements as well as the Australian Energy Market Operator’s (AEMO)’s role as system operator for the NEM. To accommodate this, the standard “n-1” approach can be modified in the following circumstances:

- Where agreed between a TNSP and a distribution network owner or major directly connected end-use customer, agreed levels of supply interruption can be accepted for particular single outages, before augmentation of the network is undertaken (for example the situation with radial supplies);
- Where requested by a distribution network owner or major directly connected end-use customer and agreed with a TNSP there will be no inadvertent loss of load (other than load which is interruptible or dispatchable) following an outage of a section of busbar or coincident outages of agreed combinations of two circuits, two transformers or a circuit and a transformer (for example supply to the inner metropolitan/CBD area of Sydney); or
- The main transmission network should have sufficient capacity to accommodate AEMO’s operating practices without inadvertent loss of load (other than load which is interruptible or dispatchable) or uneconomic constraints on the energy market.

In 2005, the NSW Government introduced mandatory licence conditions on DNSPs which set out reliability standards for sub-transmission and distribution networks. The licence conditions specify “n-1, 1 minute” reliability standards for sub-transmission lines and zone substations supplying loads greater than or equal to specified minimums, e.g. 15MVA in urban and non-urban areas.

The TNSP network must provide a commensurate level of reliability in supplying the NSW DNSPs. These jurisdictional requirements and other obligations require the following to be observed in planning:

- At all times when the system is either in its normal state with all elements in service or following a credible contingency:
    - Electrical and thermal ratings of equipment will not be exceeded; and
    - Stable control of the interconnected system will be maintained, with system voltages maintained within acceptable levels.
- A quality of electricity supply at least to NER requirements is to be provided;
- A standard of connection to individual customers as specified by Connection Agreements is to be provided;

- As far as possible connection of a customer is to have no adverse effect on other connected customers;
- Environmental and social objectives of the TNSP are to be satisfied;
- Acceptable safety standards are to be maintained; and
- The power system in NSW is to be developed at the lowest cost possible whilst meeting the constraints imposed by the above factors.

Consistent with a responsible approach to the environment planning of the network must aim to reduce system energy losses where economic. A further consideration is the provision of sufficient capability in the transmission network to allow components to be maintained in accordance with a TNSP's asset management strategies as described in the TNSP Network Management Plan.

## The Network Planning Process

The network planning process will be undertaken at five levels:

### *Connection Planning*

Connection planning is concerned with the local network directly related to the connection of loads and generators. Discussions will be held with customers seeking to connect to the transmission network where there is a need for augmentation or for provision of new connection points.

### *Network Planning within the New South Wales Region*

The main 500 kV, 330 kV and 220 kV transmission systems will be developed in response to the overall load growth and generation requirements and may be influenced by interstate interconnection power transfers. Any developments shall include negotiation with affected NSW and interstate parties.

The assessment of the adequacy of 132 kV systems will be undertaken via a joint planning process with DNSPs. This will ensure that development proposals are optimal with respect to both TNSP and DNSP requirements leading to the lowest possible cost of transmission to the end customer. This is particularly important where the DNSP's network operates in parallel with the transmission network, forming a meshed system.

### *Inter-regional Planning*

The development of interconnectors between regions and of augmentations within regions that have a material effect on inter-regional power transfer capability shall be coordinated with network owners in other states in accordance with the NER. The inter-regional developments will be consistent with the National Transmission Network Development Plan (NTNDP).

### *Consideration of Non-Network Alternatives*

A TNSP's planning process shall include consideration and adoption where economic of non-network alternatives which can address the emerging constraint(s) under consideration which may defer or cancel the need for network augmentations.

### *Compliance with NER Requirements*

A TNSP's approach to the development of the network shall be in accordance with NER and other rules and guidelines promulgated by the AER and the Australian Energy Market Commission (AEMC).

## Planning Horizons and Reporting

Transmission planning will be carried out over a short-term time frame of one to five years and also over long-term time frames of five to 20 years. The short-term planning shall support commitments to network developments with relatively short lead-times.

The long-term planning shall consider options for future major developments and provide a framework for the orderly and economic development of the transmission network and the strategic acquisition of critical line and substation sites.

The TNSP shall prepare and publish an Annual Planning Report (APR) that identifies, on an indicative basis, the constraints that appear over long-term time frames.. The timing and capital cost of possible network options to relieve them may change significantly as system conditions evolve. A TNSP shall publish outline plans for long-term developments.

### Identifying Network Constraints and Assessing Possible Solutions

Emerging constraint shall be identified during various planning activities covering the planning horizon through:

- A TNSP's planning activities;
- Joint planning with a DNSP;
- The impact of prospective generation developments;
- The occurrence of constraints affecting generation dispatch in the NEM;
- The impact of network developments undertaken by other TNSPs; or
- As a result of a major load development.

During the initial planning phase all options for addressing the constraint shall be considered and developed. In accordance with NER requirements, consultation with interested parties shall be carried out to determine a range of options including network, DM and local generation options and/or to refine existing options.

A cost effectiveness or cost-benefit analysis shall be carried out in which the costs and benefits of each option are compared in accordance with the AER's regulatory test, or Regulatory Investment Test – Transmission, as appropriate. In applying the regulatory test the cost and benefit factors may include:

- Avoiding unserved energy caused by either a generation shortfall or inadequate transmission capability or reliability;
- Loss reductions;
- Alleviating constraints affecting generation dispatch;
- Avoiding the need for generation developments;
- More efficient generation and fuel type alternatives;
- Improvement in marginal loss factors;
- Deferral of related transmission works; and
- Reduction in operation and maintenance costs.

Options with similar Net Present Value will be assessed with respect to factors that may not be able to be quantified and/or included in the regulatory test, but nonetheless may be important from environmental or operational viewpoints. These factors include:

- Reduction in greenhouse gas emissions or increased capability to apply greenhouse-friendly plant;
- Improvement in quality of supply above minimum requirements; and
- Improvement in operational flexibility.

### Application of Power System Controls and Technology

A TNSP shall seek to take advantage of the latest proven technologies in network control systems and electrical plant where these are found to be economic.

## Planning Criteria

The NER specifies the minimum and general technical requirements in a range of areas and in addition to adherence to NER and regulatory requirements, TNSP's transmission planning approach shall take into account the historical performance of the components of the NSW system, the sensitivity of loads to supply interruption and state-of-the-art asset maintenance procedures. It shall consider the need for orderly development of the system taking into account the long-term requirements of the system to meet future load and generation developments.

A set of deterministic criteria, detailed below, are to be applied as a point of first review, from which point a detailed assessment of each individual case shall be made.

### Main Transmission Network

The NSW main transmission system is the transmission system connecting the major power stations and load centres and providing the interconnections from NSW to Queensland and Victoria. Power flows on the main transmission network are subject to overall State load patterns and the dispatch of generation within the NEM, including interstate export and import of power.

Where the main 500 kV, 330 kV and 220 kV transmission systems are augmented in response to the overall load growth and generation requirements they may also be influenced by interstate interconnection power transfers. Any developments shall be negotiated with affected NSW and interstate parties including AEMO to maintain power flows within the capability of the NSW and other regional networks.

In performing its planning analysis, a TNSP must consider AEMO's imperative to operate the network in a secure manner. Therefore in the first instance, a TNSP's planning of its main network shall concentrate on the security of supply to load connection points under sustained outage conditions, consistent with the overall principle that supply to load connection points must be satisfactory after any single contingency.

The reliability of the transmission network components and the ability to withstand a disturbance to the system is critically important in maintaining the security of supply to NSW customers. A high level of reliability requires a robust transmission network.

The TNSP shall plan their transmission network to take into account the risk of forced outages of a transmission element coinciding with adverse conditions of load and generation dispatch. Two levels of load forecast (summer and winter) shall be considered, as follows.

> <u>Loads at or exceeding a one in two year probability of occurrence (50% probability of exceedence)</u>
>
> The system will be able to withstand a single contingency under all reasonably probable patterns of generation dispatch or interconnection power flow. In this context a single contingency is defined as the forced outage of a single transmission circuit, a single generating unit, a single transformer, a single item of reactive plant or a single busbar section.
>
> Provision will be made for a prior outage (following failure) of a single item of reactive plant.
>
> Further the transmission network will be able to be secured by re-dispatching generation (AEMO action), without the need for pre-emptive load shedding, so as to withstand the impact of a second contingency.

<u>Loads at or exceeding a one in ten year probability of occurrence (10% probability of exceedence)</u>

The transmission network will be able to withstand a single contingency under a limited set of patterns of generation dispatch or interconnection power flow.

Further the transmission network will be able to be secured by re-dispatching generation (AEMO action), without the need for pre-emptive load shedding, so as to withstand the impact of a second contingency.

These criteria do not apply to radial sections of the TNSP's transmission network.

The analysis of network adequacy will take into account the probable load patterns, typical dispatch of generators and loads, the availability characteristics of generators (as influenced by maintenance and forced outages), energy limitations and other factors relevant to each case.

Options to address an emerging inability to meet all connection point loads shall be considered with allowance for the lead time for a network augmentation solution.

Before this time consideration will be given to the costs involved in re-dispatch in the energy and ancillary services markets to manage single contingencies. In situations where these costs appear to exceed the costs of a network augmentation this will be brought to the attention of network load customers for consideration. A TNSP may then initiate the development of a network or non-network solution through a consultation process.

### Relationship with Inter-Regional Planning

In addition to concerns about security of supply to load point connections, a TNSP will also monitor the occurrence of constraints in their transmission network that affect generator dispatch. A TNSP's planning therefore shall also consider the scope for network augmentations to reduce constraints that satisfy the regulatory test.

Under the provisions of the NER, a Region may be created where constraints to generator dispatch are predicted to occur with reasonable frequency when the network is operated in the "system normal" (all significant elements in service) condition. The creation of a Region does not however consider the consequences to load connection points if there should be a network contingency.

However, while AEMO does not operate on the basis that the contingency may be sustained, the TNSP must consider the impact of a prolonged plant outage. As a consequence for parts of the network that are critical to the supply to loads, a TNSP must initiate augmentation to meet an 'n-1' criterion before the creation of a new Region.

The development of interconnectors between regions will be undertaken where the augmentation satisfies the regulatory test. The planning of interconnections will be undertaken in consultation with the jurisdictional planning bodies of the other states.

It is not planned to maintain the capability of an interconnector where relevant network developments do not satisfy the regulatory test.

### Networks Supplied from the Transmission Network

Some parts of a TNSP's transmission network will be primarily concerned with supply to local loads and not significantly impacted by the dispatch of generation (although they may contain embedded generators). The loss of a transmission element within these parts of the network does not have to be considered by AEMO in determining network constraints, although ancillary services may need to be provided to cover load rejection in the event of a single contingency.

## Supply to Major Load Areas and Sensitive Loads

The NSW transmission network contains six major load areas with indicative loads as follows:

| Load Area | Indicative Peak Load |
|---|---|
| The NSW north, supplied from the Hunter Valley, Newcastle and over QNI | 1,000 MW |
| Newcastle area | 2,400 MW (this includes aluminium smelters with a load greater than 1,000 MW) |
| Greater Sydney | 6,000 MW |
| Western Area | 600 MW |
| South Coast | 700 MW |
| South and South West | 1,600 MW |

Some of these load areas, including individual smelters, are supplied by a limited number of circuits, some of which may share double circuit line sections. It is strategically necessary to ensure that significant individual loads and load areas are not exposed to loss of supply in the event of multiple circuit failures. As a consequence it is necessary to assess the impact of contingency levels that exceed 'n-1'.

Outages of network elements for planned maintenance must also be considered. Generally this will require 75% of the peak load to be supplied during the outage. While every effort must be made to secure supplies in the event of a further outage, this may not be always be possible. In this case attention must be directed to minimising the duration of the plant outage.

## Urban and Suburban Areas

Generally the urban and suburban networks are characterised by a high load density served by high capacity underground cables and relatively short transmission lines. The connection points to a TNSP's transmission network are usually the low voltage (132 kV) busbars of 330 kV substations. There may be multiple connection points and significant capability on the part of the Distributor to transfer load between connection points, either permanently or to relieve short-time loadings on network elements after a contingency.

The focus of joint planning with the DNSP will be the capability of the meshed 330/132 kV transmission network and the capability of the existing connection points to meet expected peak loadings. The joint planning process shall address the need for augmentation to the meshed 330/132 kV transmission network and a TNSP's connection point capacity or to provide a new connection point where this is the most economic overall solution.

Supply to high-density urban and central business districts shall be given special consideration. Specifically, the inner Sydney metropolitan network serves a large and important part of the State load. Supply to this area is largely via two 330 kV cables that are part of TransGrid's network and the 132 kV cable system is part of EnergyAustralia's network.

A target reliability standard for the inner Sydney metropolitan area shall be jointly developed so that the system will be capable of meeting the peak load under the following contingencies:

a) The simultaneous outage of a single 330 kV cable and any 132 kV feeder or 330/132 kV transformer; or

b) An outage of any section of 132 kV busbar.

Thus an 'n-1' criterion shall be applied separately to the two networks.

The above criterion will applied in the following manner in planning analysis:

1. Under system normal conditions all elements must be loaded within their "recurrent cyclic" rating;
2. System loadings under first contingency outages will remain within equipment recurrent cyclic ratings without corrective switching other than for automatic switching or "auto-change-over";
3. Cyclic load shedding (in areas other than the Sydney CBD) may be required in the short term following a simultaneous outage of a single 330 kV cable and any 132 kV transmission feeder or 330/132 kV transformer in the inner metropolitan area until corrective switching is carried out on the 330 kV or 132 kV systems;
4. The system shall be designed to remove the impact of a bus section outage at existing transmission substations. New transmission substations shall be designed to cater for bus section outages;
5. The load forecast to be considered is based on "50 percent probability of exceedence";
6. Loading is regarded as unsatisfactory when 330/132 kV transformers and 330 kV or 132 kV cables are loaded beyond their recurrent cyclic rating; and
7. Fault interruption duty must be contained to within equipment ratings at all times.

Outages of network elements for planned maintenance shall also be considered. Generally this will require 75% of the peak load to be supplied during an outage. While every effort would be made to secure supplies in the event of a further outage, this may not be always possible. In this case attention must be directed to minimising the duration of the outage.

## Non Urban Areas

Generally these areas are characterised by lower load densities and, generally, lower reliability requirements than urban systems. The areas are often supplied by relatively long, often radial, transmission systems. Connection points are either on 132 kV lines or on the low voltage busbars of 132 kV substations. Although there may be multiple connection points to a Distributor they are often far apart and there will be little capacity for power transfer between them. Frequently supply limitations will apply to the combined capacity of several supply points together.

The focus of joint planning with the DNSP will usually relate to:

- Augmentation of connection point capacity;
- Duplication of radial supplies;
- Extension of the 132 kV system to reinforce or replace existing lower voltage systems and to reduce losses; and
- Development of a higher voltage system to provide a major augmentation and to reduce network losses.

A TNSP shall provide a level and reliability of supply at connection points that is complementary to that provided by the DNSP within its own network.

Supply to one or more connection points shall be considered for augmentation when the forecast peak load at the end of the planning horizon exceeds the load firm ‘n-1’ capacity of a TNSP’s transmission network. However, consistent with the lower level of reliability that may be appropriate in a non-urban area, following negotiation with the relevant DNSP, an agreed level of risk of loss of supply may be accepted. Thus augmentations may actually be undertaken:

- When the forecast load exceeds the firm capacity by an agreed amount;
- Where the period that some load is at risk exceeds an agreed proportion of the time; or
- An agreed amount of energy (or proportion of annual energy supplied) is at risk.

As a result of the application of these criteria some radial parts of the 330 kV and 220 kV network need not be able to withstand the forced outage of a single circuit line at time of peak load, but in these cases provision will been made for under-voltage load shedding.

Provision is also required for the maintenance of the network. Additional redundancy in the network is required where maintenance cannot be scheduled without causing load restrictions or an unacceptable level of risk to the security of supply.

### Transformer Augmentation

In considering the augmentation of transformers, appropriate allowance shall be made for the transformer cyclic rating and the practicality of load transfers between connection points. The outage of a single transformer (or single-phase unit) or a transmission line that supports the load carried by the transformer shall be allowed for.

Provision is also required for the maintenance of transformers. This is a critical issue at a number of sites in NSW where there are multiple transformers in service. To enable maintenance to be carried out, additional transformer capacity or a means of transferring load to other supply points via the underlying lower voltage network may be required.

### Consideration of Low Probability Events

Although there is a high probability that loads will not be shed as a result of system disturbances no power system can be guaranteed to deliver a firm capability 100% of the time, particularly when subjected to disturbances that are severe or widespread. In addition extreme loads, above the level allowed for in planning, can occur, usually under extreme weather conditions.

The NSW transmission network contains numerous lines of double circuit construction and whilst the probability of overlapping outages of both circuits of a line is very low, the consequences could be widespread supply disturbances.

Thus there is a potential for low probability events to cause localised or widespread disruption to the power system. These events can include:

- Loss of several transmission lines within a single corridor, as may occur during bushfires;
- Loss of a number of cables sharing a common trench;
- Loss of more than one section of busbar within a substation, possibly following a major plant failure;
- Loss of a number of generating units; and
- Occurrence of three-phase faults, or faults with delayed clearing.

In a TNSP's transmission network, appropriate facilities and mechanisms shall be put in place to minimise the probability of such events and to ameliorate their impact. The decision process shall consider the underlying economics of facilities or corrective actions, taking account of the low probability of the occurrence of extreme events. A TNSP will take measures, where practicable, to minimise the impact of disturbances to the power system by implementing power system control systems at minimal cost in accordance with the NER.

## Steady State Stability

The requirements for the control of steady state stability are included in the NER. For planning purposes steady state stability (or system damping) is considered adequate under any given operating condition if, after the most critical credible contingency, simulations indicate that the halving time of the least damped electromechanical mode of oscillation is not more than five seconds.

The determination of the steady state stability performance of the system is undertaken using software that has been calibrated against commercially available software and from data derived from the monitoring of system behaviour.

In planning the transmission network, maximum use shall be made of existing plant, through the optimum adjustment of plant control system settings, before consideration is given to the installation of high capital cost plant.

## Line and Equipment Thermal Ratings

Line thermal ratings will be based on a fixed continuous rating and a fixed short-time rating. A TNSP shall apply probabilistic-based line ratings, which are dependent on the likelihood of coincident adverse weather conditions and unfavourable loading levels.

This approach will be applied to selected lines whose design temperature is approximately 100 degrees Celsius or less. For these lines a contingency rating and a short-time emergency rating have been developed. The short-time rating should be based on a load duration of 15 minutes, although the duration can be adjusted to suit the particular load pattern to which the line is expected to be exposed. The duration and level of loading must take into account any requirements for re-dispatch of generation or load control.

A TNSP shall install ambient condition monitors on critical transmission lines to enable the application of real-time line conductor ratings in the generation dispatch systems.

Transformers shall be rated according to their specification. Provision shall also be made for use of the short-time capability of the transformers during the outage of a parallel transformer or transmission line.

330 kV cables shall be rated according to manufacturer's recommendations that have been checked against an appropriate thermal model of the cable.

The rating of line terminal equipment shall be based on manufacturers' advice.

## Transmission Line Voltage and Conductor Sizes Determined by Economic Considerations

Consideration shall be given to the selection of line design voltages within the standard nominal 132 kV, 220 kV, 275 kV, 330 kV and 500 kV ranges, taking due account of transformation costs.

Minimum conductor sizes shall be governed by losses, radio interference and field strength considerations.

A TNSP shall strive to reduce the overall cost of energy and network services by the economic selection of line conductor size. The actual losses that occur are governed by generation dispatch in the market.

For a line whose design is governed by economic loading limits the conductor size shall be determined by a rigorous consideration of capital cost versus loss costs. Hence the impact of the development on generator and load marginal loss factors in the market shall be considered. For other lines the rating requirements will determine the conductor requirements.

Double circuit lines shall be built in place of two single circuit lines where this is considered to be both economic and to provide adequate reliability. Consideration shall be given to the impact of a double circuit line failure, both over relatively short terms and for extended durations. Supply to a relatively large load may require single rather than double circuit transmission line construction where environmentally acceptable.

In areas prone to bushfire any parallel single circuit lines shall be routed well apart.

## Power System Control and Communication

In the design of the transmission network and its operation to designed power transfer levels, the following control facilities shall be provided where appropriate:

- Automatic excitation control on generators;
- Power system stabilisers on generators and SVCs;
- Load drop compensation on generators and transformers;
- Supervisory control over main network circuit breakers;
- Under-frequency load shedding;
- Under-voltage load shedding;
- Under and over-voltage initiation of reactive plant switching;
- High speed transformer tap changing;
- Network connection control;
- Check and voltage block synchronisation;
- Control of reactive output from SVCs; and
- System Protection Schemes (SPS).

The following communication, monitoring and indication facilities shall also be provided where appropriate:

- Network wide SCADA and Energy Management System (EMS);
- Telecommunications and data links;
- Mobile radio;
- Fault locators and disturbance monitors;
- Protection signalling; and
- Load monitors.

Protection signalling and communication may be provided over a range of media including pilot wire, power line carrier, microwave links and increasingly optical fibres in overhead earthwires.

## Scenario Planning

Scenario planning assesses network capacity, based on the factors described above, for a number of NEM load and generation scenarios. The process shall include but not be limited to:

1. Identification of possible future load growth scenarios. These shall be generally based on the Baseline, High, and Low economic growth scenarios in the most recent TNSP load forecast for NSW or the Statement of Opportunities, published by AEMO for other states. They should also incorporate specific possible local developments such as the establishment of new loads or the expansion of existing industrial loads.
2. Development of a number of generation scenarios for each load growth scenario. These generation scenarios relate to the development of new generators and utilisation of existing generators. This shall be generally undertaken by a specialist electricity market modelling consultant, using their knowledge of relevant factors, including:
   a. Generation costs;
   b. Impacts of government policies; and
   c. Impacts of energy related developments such as gas pipeline projects.
3. Modelling of the NEM for load and generation scenarios to quantify factors which affect network performance, including:
   a. Generation from individual power stations; and
   b. Interconnector flows.
4. Modelling of network performance for the load and generation scenarios utilising the data from the market modelling.

The resulting set of scenarios shall then be assessed over the planning horizon to establish the adequacy of the system and to assess network and non-network augmentation options.

The future planning scenarios developed by the TNSP shall take into account AEMO's future scenarios.