Network Support and Control Ancillary Service (NSCAS) Description

PREPARED BY: PLANNING

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FINAL

This document has been created by the Planning Department and will be reviewed from time to time.

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Glossary

(a) In this document, a word or phrase *in this style* has the same meaning as given to that term in the NER.

(b) In this document, capitalised words or phrases or acronyms have the meaning set out opposite those words, phrases, or acronyms in the table below.

(c) Unless the context otherwise requires, this document will be interpreted in accordance with Schedule 2 of the *National Electricity Law*.

TERM	MEANING
FACTS	Flexible alternating current *transmission system*
HVDC	High *voltage* direct current
HVAC	High *voltage* alternating current
NLAS	Network loading *ancillary service*
NER	National Electricity Rules
NSCAS Tender Guidelines	The document referred to in clause 3.11.5 (b) of the NER and published by AEMO under that name
NTNDP	National Transmission Network Development Plan, as that term is defined in the *National Electricity Law*
PSS	Power system stabiliser
SCADA	Supervisory Control and Data Acquisition - SCADA refers to a system that collects data from various *metering* devices on the *power system* or in other remote locations and then sends this data to a central computer that then manages and controls the data.
SVC	*Static VAR compensator*
STATCOM	Static compensator - A device specifically provided on a *network* to *generate* and absorb *reactive power* similar to a *synchronous compensator*
TNSP	*Transmission Network Service Provider*
TOSAS	Transient and oscillatory stability *ancillary service*
VCAS	Voltage control *ancillary service*

1 Introduction

(a) This NSCAS Description is made in accordance with clause 3.11.4(a) of the National Electricity Rules (**NER**).

(b) This NSCAS Description commences on 5 April 2012.

(c) This NSCAS Description may only be amended in accordance with clause 3.11.4(c).

(d) If there is any inconsistency between this NSCAS Description and the NER, the NER will prevail to the extent of that inconsistency.

2 Purpose

The purpose of this document is to describe each type of *network support and control ancillary service* (**NSCAS**).

3 Application of this NSCAS Description

This NSCAS Description applies to:

- AEMO;
- *Transmission Network Service Providers* (**TNSPs**); and
- Respondents to any call for offers for NSCAS in accordance with the NSCAS Tender Guidelines.

4 Types of Network Support and Control Ancillary Services

AEMO has divided NSCAS into the following types:

- network loading *ancillary service* (**NLAS**);
- voltage control *ancillary service* (**VCAS**); and
- transient and oscillatory stability *ancillary service* (**TOSAS**).

5 Network Loading Ancillary Services

5.1 Description of NLAS

NLAS has the capability to control the *power* flow into or out of a *transmission network* in order to:

(a) maintain *power flow* in *transmission lines* within capacity ratings[1] following a *credible contingency event*; and

(b) maintain or increase the *power transfer capability* of that *transmission network,* by allowing increased loading on *transmission network* components, so as to maximise the present value of net economic benefit to all those who produce, consume or transport electricity in the *market.*

[1] Within the capability declared by the transmission asset owner

5.2 Purpose of NLAS

The purpose of NLAS is to allow an increase in the *power* transfer of a *transmission network* whilst ensuring that the *network* will still be in a *secure operating state*.

The available capacity of a *transmission system* can be increased by allowing *transmission lines* to be loaded to their short-term ratings following a contingency, if the loading can be controlled and reduced within a short period of time to avoid overloading. NLAS can be used to rapidly change the *power* flow on *transmission lines* allowing these short-term ratings to be used, while allowing AEMO to meet its *power system security* responsibilities to ensure that all *plant* and equipment under its control or co-ordination is operated within the appropriate operational or emergency limits advised to AEMO by the *Network Service Providers* or *Registered Participants* under clause 4.3.1(g) of the NER.

Power transfer of a *transmission network* can also be increased by TNSPs' installing equipment that controls (or even limits in some circumstances) power flows in particular *network* elements. This type of service, that is usually provided through the regulated asset base of a TNSP, could under some circumstances be provided as NLAS, through new assets installed in response to a call for a tender for the same service.

In the case of a HVDC *transmission system*, where the *active power* transfer capability is *constrained* due to inadequate fault levels in the system or a requirement for frequency control, the mechanisms for relieving the *constraint* and thus increasing *active power* transfer may also be considered as NLAS.

The benefit of NLAS is that it allows greater utilisation of *network* capability for the transfer of *active power* in situations where the capacity of the *transmission network* is limited by a *transmission line's rating* or because of a part of the *transmission* capacity had been used to provide other services. Without NLAS, AEMO would need to limit flows to ensure that the *power system* was operated in a *secure operating state*. Limiting flows conservatively is not AEMO's preferred method of managing *network* loading as it can result in more costs to the *market,* including *supply* shortfall and unnecessary pre-contingent *load shedding*.

5.3 Examples of NLAS

NLAS can be provided by *Generators*, *Network Services Providers*, *Market Customers* and other *Registered Participants*. They can provide NLAS through a variety of methods to control and maintain *transmission line* loadings below their short-term ratings following a contingency. Examples of NLAS provision include :

- standby *generation* capable of being brought online rapidly;
- fast runback of *scheduled generating units*;
- reducing *load* in response to certain signals; and
- utilisation of existing small-scale *generation*.

TNSPs control *power* flows in *transmission lines* through the installation of:

- Phase shift transformers;
- Series or shunt compensation; or
- Controlled series compensation.

These assets are usually provided from the TNSP regulated asset base, but under some circumstances new assets can be installed and provided as NLAS in response to AEMO's call for a tender for NLAS to fill a *NSCAS gap*.

Where the *power transfer capability* of an HVDC *transmission system* is limited below its maximum capacity because of inadequate fault levels, or because of part of its capacity is needed to transfer *frequency control ancillary services*, NLAS can include the use of *plant* to provide an increase in fault level or to reduce the requirement to transfer *frequency control ancillary services* (for example through the provision of additional inertia). The *plant* could include:

- *Generation plant* operating in *generating* or *synchronous condenser* mode; or
- TNSP-installed *synchronous condensers*.

The examples are not exhaustive and there may be other ways of providing NLAS.

6 Voltage Control Ancillary Service (VCAS)

6.1 Description of VCAS

VCAS has the capability to control *power* flow into or out of the *transmission network* in order to:

(a) maintain the *transmission network* within the *voltage* limits, and *voltage* stability; and

(b) maintain or increase the *power transfer capability* of that *transmission network,* by improving voltage control and voltage stability, so as to maximise the present value of net economic benefit to all those who produce, consume or transport electricity in the *market.*

6.2 Purpose of VCAS

The purpose of VCAS is to control the *power* flows of a *transmission network* for the control of *voltage* to be within defined operating limits and maintaining voltage stability.

Clause 4.5.1(e) of the NER requires AEMO to use its reasonable endeavours to maintain the *power system's voltage*, so that the *power system* remains in a *satisfactory operating state* and clause 4.5.1(f) requires AEMO to use reasonable endeavours to arrange the provision of *reactive power facilities* and *power system voltage* stabilising facilities in one of three ways, including the procurement and *dispatch* of VCAS.

Without adequate VCAS, the *power system* would need to be operated more conservatively to avoid unsatisfactory *voltage* conditions. Depending on the location of a *credible contingency event*, *generation* might need to be *constrained,* or a *supply* shortfall could arise, resulting in unnecessary *load shedding*.

6.3 Examples of VCAS

VCAS can be provided by:

- *Generators* from unused *reactive power* capacities of *generating units*, including wind farms, solar power generating units and any other forms of electricity generating units. The typical modes of operation are as follows:

    - **Synchronous Condenser Mode**[2]: a mode of operation of a *generating unit* with the *reactive power capability* to supply or absorb *reactive power* without producing *active energy*; and

    - **Generation Mode**: a mode of operation of a *generating unit* with the *reactive power capability* to supply or absorb *reactive power* in excess of its *performance standard* for *reactive power* while producing *active energy* in response to *dispatch* instructions.

    The *reactive power capability* of a *generating unit* for VCAS is the amount beyond the *reactive power capability* specified in the *performance standards* up to the limit specified in a capability diagram.

- TNSPs utilising *network reactive power plant*, such as:
    - capacitors, reactors;
    - *synchronous condensers, static VAR compensators* (SVCs), static compensators (STATCOMs) ; or
    - HVAC and HVDC *transmission lines*.

    These assets are usually provided from the TNSP regulated asset base, but under some circumstances new assets can be installed and provided in response to AEMO's call for a tender for VCAS to fill a *NSCAS gap*.

- Other participants using demand side management such as:
    - control of customer *load* in response to certain signals; and
    - installation of, or utilisation of, existing small scale *generation*.

These examples are not exhaustive and there may be other ways of providing VCAS.

7 Transient and oscillatory stability ancillary service (TOSAS)

7.1 Description of TOSAS

TOSAS is the capability to control *power* flow into or out of the *transmission network,* in order to:

(a) maintain the *transmission network* within its transient or oscillatory stability limits; and

(b) maintain or increase the *power transfer capability* of that *transmission network,* by improving transient or oscillatory stability, so as to maximise the present value of net economic benefit to all those who produce, consume or transport electricity in the *market.*

7.2 Purpose of TOSAS

The purpose of TOSAS is to increase *power* flows on a *transmission network* by increasing the transient or oscillatory stability limit of the *network*.

[2] Including *generating unit* or any equipment *connected* to the *generating unit* performing as SVC or STATCOM.

Clause S5.1a.3 of the NER requires that the *power system* should remain in *synchronism* and remain stable in the case of transient stability, following any *credible contingency event*, and for oscillatory stability in the absence of any *contingency event*. In parts of the *network* this requirement can determine the maximum *active power* flow that is acceptable into or out of a *transmission network*. Increasing the transient or oscillatory stability limit can allow increased *active power* transfers into or out of the *transmission network*.

Without adequate TOSAS, the *power system* would need to be operated more conservatively to avoid the risk of transient or oscillatory instability. Depending on the location of the stability *constraint*, *generation* might need to be *constrained,* or a *supply* shortfall could arise, resulting in unnecessary *load shedding*.

7.3 Examples of TOSAS

A transient stability limit or oscillatory stability limit can be increased in a number of ways including:

- fast change of load or generation (reduction or increase)
- Increasing system inertia;
- improving system *voltage* regulation;
- installing stability controllers (like PSS or, FACTS or HVDC, with damping control); and
- reducing system impedance.

The methods by which a TOSAS could be provided include:

- *Generators* running:
  - *generating plant,* with properly designed PSS for improving oscillatory stability;
  - *plant* in *synchronous condenser* mode; and
- TNSPs' utilising:
  - *synchronous condensers*;
  - *Power flow and Voltage control FACTS devises such as SVCs*
  - series compensation reducing system impedance; and/ or
  - breaking resistors.

  These assets are usually provided from the TNSP regulated asset base, but under some circumstances new assets can be installed and provided in response to AEMO's call for a tender for TOSAS to fill a NSCAS gap.

These examples are not exhaustive and there may be other ways of providing TOSAS.