Short Term PASA Procedures

Prepared by:	AEMO Operations Planning
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Approved for distribution and use by:

Approved by:	Michael Gatt
Title:	Executive General Manager - Operations
Date:	TBC

NOTE: National Electricity Amendment (Updating Short Term PASA) Rule 2022 No.4 requires AEMO to develop and publish procedure changes by 30 April 2025, and commence from 31 July 2025.

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Current version release details

Version	Effective date	Summary of changes
007 Draft	31 July 2025	Retitle document from ST PASA Process description to ST PASA Procedure. Updates as per National Electricity Amendment (Updating Short Term PASA) Rule 2022 No. 4 Clarifications to address consultation submissions

Note: There is a version history at the end of this document.

1. Preliminary

1.1. Purpose

This is the short term (ST) projected assessment of system adequacy (PASA) procedures made under 3.7.3(c) of the National Electricity Rules (NER) (Procedures).

This Procedures has effect only for the purposes set out in the NER. The NER and the National Electricity Law prevail over these Procedures to the extent of any inconsistency.

1.2. Definitions and interpretation

1.2.1. Glossary

Terms defined in the National Electricity Law and the NER have the same meanings in these Procedures unless otherwise specified in this clause.

Terms defined in the NER are intended to be identified in these Procedures by italicising them, but failure to italicise a defined term does not affect its meaning.

In addition, the words, phrases and abbreviations in the table below have the meanings set out opposite them when used in these Procedures.

Term	Definition
AEMO	Australian Energy Market Operator
CSV	Comma-separated values; a file format for exchanging data using commas as delimiters.
DB	Database
EMMS	Electricity Market Management System; software, hardware, network and related processes to implement the NEM
LHS	Left hand side of a constraint equation
LP	Linear program
Goal programming	An optimisation program that can be considered as an extension of LP algorithms to handle multiple objective measures.
MMS	Market Management System (see EMMS)
MNSP	Market Network Service Provider (Network Service Provider in the National Electricity Rules)
UIGF	Unconstrained Intermittent Generation Forecast of semi-scheduled generation
NEMDE	NEM Dispatch Engine
NER	National Electricity Rules; a specified clause or paragraph from the NER
PASA formulation	AEMO internal document: “Cegelec ESCA “Projected Assessment of System Adequacy: PASA” document
POE	Probability of exceedance
RHS	Right hand side of a constraint equation
SDL	Self-dispatch level
Recall period	Offered recall period of scheduled resource associated with its PASA Availability for each 30-minute interval.

Term	Definition
LOR2 condition	A contingency event is likely to result in involuntary load shedding (i.e. reserve is below the largest contingency).
LOR1 condition	The spare capacity reserves are inadequate to restore reserves following a contingency event (i.e. reserve is below the sum of the largest and the second largest contingency).
ST PASA	Short Term PASA as defined in NER 3.7.3. It consists of both PD PASA and 6-day PASA.
PD PASA	Short Term PASA as defined in NER 3.7.3, covers the most recently published pre-dispatch period.
6-day PASA	Short Term PASA as defined in NER 3.7.3, covers the period of six trading days starting from the end of the trading day covered by the most recently published pre-dispatch schedule.
Scheduled resources	*Scheduled generating unit, scheduled bidirectional unit, scheduled load* or *scheduled network service*.

1.3. Related documents

Title	Location
Reliability standard implementation guidelines (RSIG).	https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/forecasting-and-reliability/reliability-standard-implementation-guidelines
Reserve Level Declaration Guidelines (RLDG)	https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Power_System_Ops/Reserve-Level-Declaration-Guidelines.pdf
SO_OP_3703 - Short term reserve management	https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/system-operations/power-system-operation/power-system-operating-procedures
Spot market operations timetable	https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/market-operations/dispatch-information
SO_OP_3707_Intervention, Direction and Clause 4.8.9 Instructions	https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/system-operations/power-system-operation/power-system-operating-procedures
Demand Terms in EMMS Data Model	https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Dispatch/Policy_and_Process/Demand-terms-in-EMMS-Data-Model.pdf

2. Introduction

The PASA has the following objective:

Collect, analyse information, and disclosure of medium term and short-term power system security and reliability of supply prospects so that Registered Participants are properly informed to enable them to make decisions about supply, demand and outages of transmission networks in respect of periods up to 2 years in advance (or up to 3 years in advance, where specified) (the *PASA objective*).

AEMO is required to prepare PASA in two timeframes:

(i) ST PASA, as defined in NER 3.7.3, requires AEMO to cover each 30-minute period in the seven trading days from and including the day of publication. AEMO meets this requirement by determining and publishing PD PASA and 6-day PASA; and

(ii) Medium Term PASA (MT PASA)[1] requires AEMO to cover the 24 months (or the longer period of 36 months[2]) from the Sunday after the day of publication with a daily resolution.

This document, ST PASA Procedure[3], is developed by AEMO to describe the preparation of ST PASA for market participants and includes the processes and methodologies that AEMO applies to produce ST PASA information.

2.1. Scope

This Procedure provides the following information:

- How AEMO will prepare inputs for the short term PASA reflecting the factors outlined in NER 3.7.3(g).
- The detailed short term PASA information AEMO will publish to meet the requirements of NER 3.7.3(k).
- The processes or methodologies AEMO will apply to produce the short term PASA information.
- The period to be covered by the short term PASA in accordance with NER 3.7.3(b).
- Any other information that AEMO considers reasonably necessary to implement the *PASA objective*, having regard to the costs and benefits of collecting the relevant information.

The scope does not include processes that follow each ST PASA run (such as declaration of conditions, reserve trading and market intervention)[4].

3. Short Term PASA Inputs

3.1. AEMO inputs

Under clause 3.7.3(g) of the NER, AEMO is required to prepare the following information for input to the ST PASA;

- Forecast *load* and *unscheduled generation*, taking into account forecasting uncertainties.
- Forecast availability of *scheduled resources*, including any applicable *constraints*.

[1] MT PASA Process Description is available at https://aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2023/reliability-forecasting-guidelines-and-methodology-consultation/final/mt-pasa-process-description.pdf?la=en.

[2] NER 3.7.3(d)(1)(i), (d1) and (f)(5)

[3] NER 3.7.3(k)

[4] Refer SO_OP_3703 Short term reserve management. Available at https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/system-operations/power-system-operation/power-system-operating-procedures.

- Forecast network constraints and notified network outages.
- Any other factors AEMO considers relevant having regard to the *PASA objective*.

Additionally, AEMO also prepares the following information as input into the ST PASA;

- 10% POE and 50% POE demand forecasts for each region for each trading interval
- Reserve requirements for each region, determined in accordance with the short term capacity reserve standards.
- Forecast network constraints.
- Unconstrained intermittent generation forecasts for each semi-scheduled generating unit for each trading interval.

3.2. Participant inputs

Under clause 3.7.3(h) of the NER, each Registered Participant is required to prepare the following information for input to the ST PASA:

- Available capacity of each *scheduled resource* for each relevant 30-minute period.
- *PASA availability* of each *scheduled resource* for each relevant 30-minute period (refer Section 7.3).
- *Energy constraints* for *scheduled resources* or *wholesale demand response constraints* (as applicable) for *wholesale demand response units*;

3.3. PASA Availability

PASA availability is for market participants (through PASA Outputs) to advise the market on their available physical plant capability and any additional physical plant capability that can be made available during that period. For example, it could be provided under direction or by the participant.

The recall period is optional. If it is provided, it must be greater than zero and less than 168 hours (6-day period).

4. Modelling assumptions

4.1. Scheduled resources

Forecast availability of *scheduled* and *semi-scheduled* generating units and w*holesale demand response*, including any applicable constraints:

- Lowest bid available capacities over the six trading intervals for each 30-minute period are used[5].
- For semi-scheduled generating units: min (Available Capacity, UIGF).

[5] AEMO has the functionality to use one of average, minimum or the last trading interval available capacity from the six trading intervals for each 30-minute period for ST PASA. The current selection is the minimum.

4.2. Scheduled loads

If present, regional normally-on dispatchable loads (*scheduled loads*) are dispatched off for LOR reserve assessment.

4.3. Bidirectional units (BDUs)

ST PASA is capable of modelling Daily Energy Constraints only and does not support charging/discharging cycles of BDUs. It is capable of modelling single discharging cycle only making ST PASA reserve calculation conservative.

BDU contribution for regional LOR reserve is included under the 'Constrained Capacity' for the region.

PD PASA:

A basic workaround to model charging/discharging capability of BDU is used in PD PASA as follows:

Available Capacity = Daily Energy Constrained Availability from the corresponding Pre-dispatch run and 30-minute period, where

Daily Energy Constrained Availability = min (bid Available Capacity from last trading interval of HH, Pre-dispatch Initial Energy Storage for 30-minute period / 2).

6-day PASA:

Available Capacity = Lowest bid Available Capacity over the six trading intervals for each 30-minute period

Daily Energy Constraint = Registered MaxOperationalStateOfCharge (if opted in) else MaxStorageCapacity

4.4. Wholesale demand response

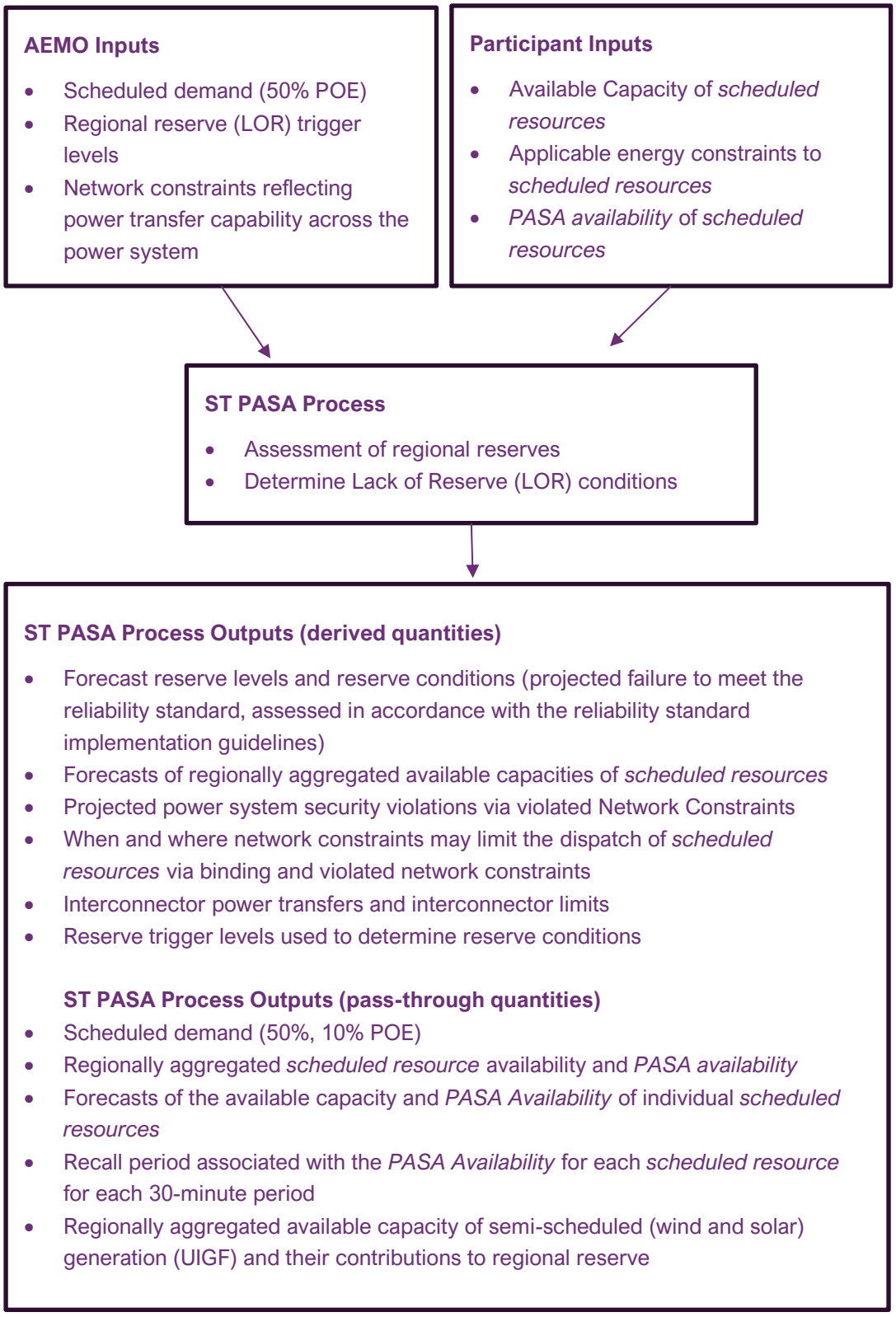
Wholesale demand response (WDR) scheduled entities are treated like normally off *scheduled load*s, hence would not participate in the LOR reserve assessment.

5. Short Term PASA Process

ST PASA collects information from a number of sources to provide a forecast of the adequacy of the supply/demand balance on a half hourly basis for a six-day period commencing from the end of the trading day covered by the most recent pre-dispatch schedule.

Figure 1 summarises the ST PASA process. The following provides additional specific information on those processes.

Figure 1 ST PASA Processes[6]



[6] Refer AEMO Demand Terms in EMMS Data Model document available at https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Dispatch/Policy_and_Process/Demand-terms-in-EMMS-Data-Model.pdf.

The details of the ST PASA process are as follows. Two parts of the ST PASA – PD PASA and 6-day PASA use the same optimisation model.

- Market Participants prepare their bids and send this information to AEMO. The File Loader Bids application loads valid Energy (resource and MNSP) from the Participant File Server into MMS Database. Bid Acknowledgment files are returned to Participants.
- The ST PASA process is initiated by MMS Timer on a cyclic basis every hour.
- The PASA Case Loader is used in PD PASA and ST PASA processes to create the input files for the ST PASA Solver.
- (For PD PASA only) The PASA Case Loader obtains SCADA snapshots from the MMS EMS Server.
- The PASA Solver—a goal programming solver—takes these input files and solves the case according to the PASA Formulation.
- The PASA process writes its solution to an output file (PASA Solver Solution file). The PASA output file triggers the PASA Solution Loader to load a merged PASA Solution into the NEM Database. A CSV Report is generated and published to Market Participants.
- Another automatic process replicates ST PASA solution data to the Participant File Share. AEMO publishes ST PASA outputs via:
  - PD PASA and ST PASA NEM Reports (via Data Interchange) if subscribed
  - Participant Data Model tables (uses these NEM Reports)
  - AEMO Market Data NEMWeb[7]
  - AEMO Markets Portal (Web Portal)[8]

6. Concepts and definitions

A number of concepts and definitions are used by PASA and these are discussed below, before commencing a detailed explanation of the PASA processes.

6.1. "Probability of exceedance" demand forecasts

Refer SO_OP_3710 – Load Forecasting[9] for the AEMO method of determining 50% and 10% probability of exceedance (POE) Regional demand forecasts.

[7] AEMO Market Data NEMWeb can be accessed using:

https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/data-nem/market-data-nemweb

[8] AEMO Markets Portal can be access using the following link. Participants must communicate with AEMO Support Hub obtain access to AEMO Market Portal.

https://portal.prod.nemnet.net.au/#/

[9] AEMO operating procedure SO_OP_3710 – Load Forecasting is available at: https://aemo.com.au/-/media/files/electricity/nem/security_and_reliability/power_system_ops/procedures/so_op_3710-load-forecasting.pdf?la=en.

6.2. LOR trigger levels and Forecast Uncertainty Measure (FUM)

LOR1 and LOR2 trigger levels are determined using the following PASA information.

LCR: Largest Credible Risk.

LCR2: Sum of the largest and the second large credible risks

LCR and LCR2 are determined by the ST PASA calculation dynamically. AEMO has the functionality to provide following manual inputs to correctly determine half hourly LCR and LCR2:

- Select loss of an element of an interconnector as a credible contingency.
- Select one physical generating unit of an aggregated generating unit as a credible contingency. This functionality is used to model loss of a gas turbine of combine cycle power station as a credible contingency.
- Select a group of generating units or power stations that are connected to the power system via a radial transmission line as a credible contingency.

AEMO also determines half-hourly Forecast Uncertainty Measure (FUM)[10] for the proceeding 72 hours. FUM is the measure of uncertainty in determining 50% POE regional demand, interconnector transfers determined by ST PASA as well as the supply side variables such as semi-scheduled wind and solar generation.

LOR2 trigger level = MAX (LCR, FUM)

LOR1 trigger level = MAX (LCR2, FUM)

Refer RLDG for details on the FUM methodology as well as its incorporation into LOR trigger levels.

6.3. Network constraints

Power transfer capability of the power system is modelled using network constraints. For example, flow on an interconnector can be expressed as a linear combination of various quantities such as regional demand, generation configuration and network outages. This flow can be constrained to be less than, equal to or greater than a certain limit.

A network constraint will take the form that consists of the following three terms:

- A left-hand side (LHS) variable that represents the calculated value of the quantity being constrained.
- An operator term that defines inequality (>= or <=) or equality.
- A right-hand side (RHS) that represents the limit being applied.

[10] Refer Reserve Level Declaration Guidelines document for details on FUM and its application.

https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Power_System_Ops/Reserve-Level-Declaration-Guidelines.pdf

AEMO will invoke a set of constraints depending on the particular system conditions (such as prior line outages). When the limit applied by a network constraint has been reached, the constraint is known as a binding constraint.

Each network constraint also has an associated violation penalty. These allow the bounds defined by the constraint to be violated at a cost. The “cost” is not an actual dollar value as ST PASA does not comprise pricing data, but rather a penalty associated with the violation of the constraint that indicates its relative importance. Provided the violation penalties are set at a level whereby they are only used as a last resort, constraints will only be violated when it would otherwise be impossible to determine a feasible solution. The assigning of different penalties can prioritize constraints, i.e. a constraint with a low penalty would be violated before a constraint with a higher penalty.

6.4. Energy constrained plant

Generating plant such as hydroelectric power stations cannot generally operate at maximum capacity indefinitely otherwise their energy source will be used up. Such plant is known as energy limited plant.

The ST PASA includes a process for allocating the contribution of energy limited plant to particular parts of each day so that it maximises reserves throughout each day of the PASA period. Generally, this is done by allocating energy limited plant at times when regional demand is proportionally high.

The Bidirectional Storage Units (BDUs) are generally energy limited. The load side of BDUs are not modelled on ST PASA. Refer section 4.3 above for further details.

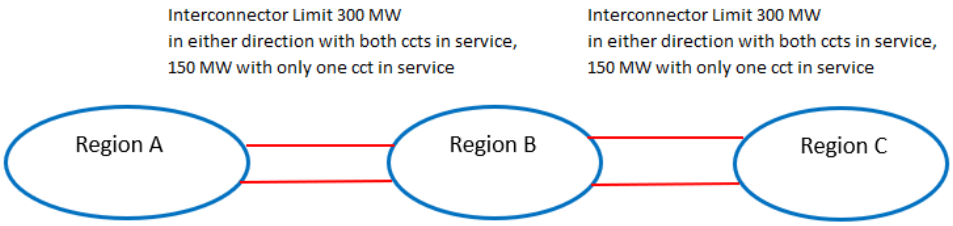
6.5. Lack of Reserve assessment

Regional Lack of Reserve modelling has the following attributes:

- Physical power system is modelled hence use 50% POE demand with planned network outages included.
- Since LOR assessment is required for each region in the NEM, ST PASA runs a separate reserve assessment for each region.
- The region for which the LOR reserve is assessed is taken as the study region. Supply demand balance is met in other regions and the surplus/deficit supply in other regions is transferred to the study region, subjected to network constraints. Then the reserves are assessed for the study region to determine reserves and LOR conditions. Each region is taken as study region in-turn and the reserve assessment is conducted.

See Figure 2 for a simple example of assessing LOR reserves and LOR Reserve conditions.

Figure 2 A simple example of LOR reserve assessment



Regional Demand (MW)	1200					2000				3000
Regional Generation (MW)	1000					2500				4000
Largest contingency	200					500				500
Largest + Second large contingency	400					1000				1000
			←						←	
LOR Run for StudyRegion = Region A										
Net Interconnector flow	300		From B to A					300	From C to B	
LOR2 trigger level	200									
LOR1 trigger level	400									
Total Supply	1300									
Reserve	100									
Reserve condition	LOR2									
			←						←	
LOR Run for StudyRegion = Region B										
Net Interconnector flow	200		From B to A			100		300	From C to B	
LOR2 trigger level						500				
LOR1 trigger level						1000				
Total Supply						2600				
Reserve						600				
Reserve condition						LOR1				

6.6. Assessment of LOR Reserve and LOR condition

The objective of the assessment of LOR reserves is to avoid the LOR3, LOR2 and LOR1 condition in that priority order.

The assessment utilises the security constrained Goal Programming model that evaluates LOR reserves, published as regional MaxSpareCapacity (MSC). The goals of the model are:

Find the maximum spare capacity available in each study region subjected to:

(i) Must obey the network and resource level constraints.

(ii) Avoid lack of capacity in the study region under several possible contingency conditions.

(iii) Avoid deficit capacity in non-study regions.

(iv) Any deficit capacity must be encouraged to appear in the study region rather than other regions.

(v) LOR1, LOR2 and LOR3 deficit capacity must be shared across as many time periods as possible.

(vi) Any degenerate solutions must be avoided.

The MSC for any region of the NEM in a given period is used to determine Lack Of Reserve (LOR) Conditions as follows:

If MSC < 0 level, then the LOR condition is LOR 3

Else

If MSC < LOR 2 trigger level, then the LOR condition is LOR 2

Else

If MSC < LOR 1 level, then the LOR condition is LOR 1

Else

No LOR Condition

7. Short Term PASA outputs

ST PASA outputs are required under the NER to be published daily but AEMO publishes the ST PASA every hour to accommodate frequent changes in the market.

The published outputs of the LOR reserve assessment are as follows.

- Demand forecasts for each region with 10%, 50% and 90% probability of being exceeded.
- Short Term Capacity Reserve requirement (LOR trigger levels) for each region.
- Regional LOR reserves (MaxSpareCapacity in ST PASA outputs)
- Net Interchange for each region over interconnectors with other regions to achieve reserve sharing.
- LOR Condition – LOR 0, 1, 2 or 3.

For specific details of the data contained in the ST PASA Public .csv file, please refer to the MMS data model document[11] published on the AEMO website.

Refer Appendix A for a complete list of other ST PASA outputs.

Features of ST PASA outputs

Each ST PASA LOR runs determine optimum levels of LOR reserve for each study region. Hence the ST PASA model does not use supply demand balance equation. Predispatch includes supply demand balance equation because its objective is to determine the most cost-effective (i.e. based on the offers and bids) secure dispatch of energy and FCAS to meet demand. Because of this reason, outputs of ST PASA are different to Predispatch outputs.

[11] MMS data model document is available at:

Regional LOR reserve, net interchange, interconnector flows/limits and binding/violated constraints:

- Given that there are five sets of ST PASA outputs, AEMO selects regional LOR reserve, interconnector limits and binding/violated constraints for publication as follows:
  - Regional reserve and Net Interchange for study regions only.
  - Interconnector flows, interconnector limits, binding constraints and violated constraints from all ST PASA runs. Users must select RunType = LOR and then the StudyRegionId = RegionX to access these ST PASA outputs.

Appendix A. ST PASA outputs

Refer MMS Data Model Reports[12] for explanations of the listed data items below.

REGIONSOLUTION		
RUN_DATETIME	MAXSURPLUSRESERVE	UIGF
INTERVAL_DATETIME	MAXSPARECAPACITY	SEMISCHEDULEDCAPACITY
REGIONID	LORCONDITION	LOR_SEMISCHEDULEDCAPACITY
DEMAND10	AGGREGATECAPACITYAVAILABLE	LCR
DEMAND50	AGGREGATESCHEDULEDLOAD	LCR2
DEMAND90	AGGREGATEPASAAVAILABILITY	FUM
RESERVEREQ	LASTCHANGED	SS_SOLAR_UIGF
CAPACITYREQ	RUNTYPE	SS_WIND_UIGF
ENERGYREQDEMAND50	ENERGYREQDEMAND10	SS_SOLAR_CAPACITY
UNCONSTRAINEDCAPACITY	CALCULATEDLOR1LEVEL	SS_WIND_CAPACITY
CONSTRAINEDCAPACITY	CALCULATEDLOR2LEVEL	SS_SOLAR_CLEARED
NETINTERCHANGEUNDERSCARCITY	MSRNETINTERCHANGEUNDERSCARCITY	SS_WIND_CLEARED
SURPLUSCAPACITY	LORNETINTERCHANGEUNDERSCARCITY	WDR_AVAILABLE
SURPLUSRESERVE	TOTALINTERMITTENTGENERATION	WDR_PASAAVAILABLE
RESERVECONDITION	DEMAND_AND_NONSCHEDGEN	

INTERCONNECTORSOLN
STUDYREGIONID
RUN_DATETIME
INTERVAL_DATETIME
INTERCONNECTORID
CAPACITYMWFLOW
CAPACITYMARGINALVALUE
CAPACITYVIOLATIONDEGREE
CALCULATEDEXPORTLIMIT
CALCULATEDIMPORTLIMIT
LASTCHANGED
RUNTYPE
EXPORTLIMITCONSTRAINTID
IMPORTLIMITCONSTRAINTID

CONSTRAINTSOLUTION
STUDYREGIONID
RUN_DATETIME
INTERVAL_DATETIME
CONSTRAINTID
CAPACITYRHS
CAPACITYMARGINALVALUE
CAPACITYVIOLATIONDEGREE
LASTCHANGED
RUNTYPE

Publication of the Available Capacity, PASA Availability and the Recall Period

For all *scheduled resources*, following information will be published starting from the current 30-minute period to the end of the ST PASA period.

If an energy bid does not exist for a trading day, the latest valid energy bid received for the prior trading day is brought forward.

[12] AEMO Data Model Reports are available at:

https://visualisations.aemo.com.au/aemo/di-help/Content/Data_Model/MMS_Data_Model.htm

Run_DateTime (current half hour ended interval).
Interval_DateTime (half--hour ended).
DUID
Scheduled Resource Maximum Availability (MW).
Scheduled Resource PASA Availability (MW).
Scheduled Resource Recall Period (hours).

Version release history

Version	Effective date	Summary of changes
007	31 July 2025	Retitle document from ST PASA Process description to ST PASA Procedure. Updates as per National Electricity Amendment (Updating Short Term PASA) Rule 2022 No. 4 Clarifications to address consultation submissions
006	15/03/2012	ST PASA Process Description updated to reflect changed process (removal of the System (NEM) LRC run
005	25/05/2011	ST PASA Process Description updated: • Included semi-dispatch. • Updated section 3. • Updated section 5. • Deleted old references. • Corrected typos.
004	01/07/2010	Change to AEMO document