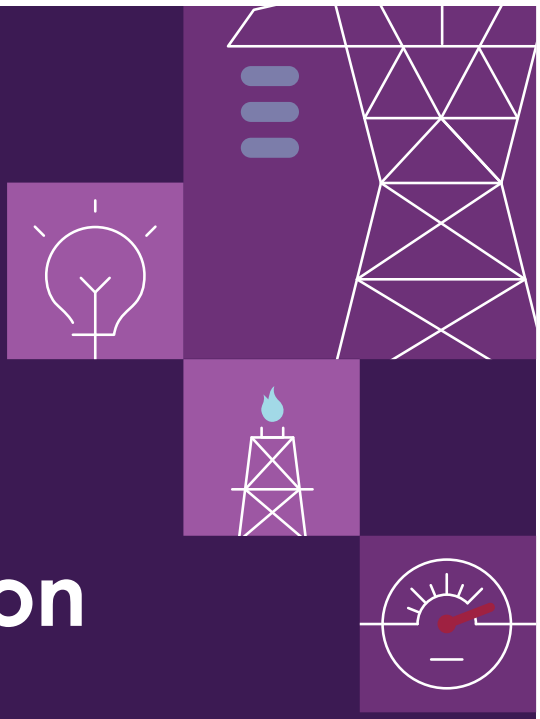

Energy adequacy assessment projection (EAAP) guidelines

Prepared by:	AEMO Forecasting
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Approved for distribution and use by:

Approved by:	Merryn York
Title:	Executive Group Manager, System Design
Date:	24 April 2023

Contents

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Version	Effective date	Summary of changes
1.8	24 April 2023	Updates reflecting the Reliability Forecasting Guideline and methodology Consultation, including changes which are effective from 3 June 2024 under the National Electricity Amendment (Integrating energy storage systems into the NEM) Rule 2021 No. 13

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

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1. Introduction

1.1. Purpose and scope

These are the *EAAP Guidelines* made under clause 3.7C(k) of the National Electricity Rules (NER) (**Procedures**).

These Procedures have 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~~

~~1.2.2.~~

Terms defined in the National Electricity Law, ~~and~~ the NER and the National Electricity Amendment (Integrating energy storage systems into the NEM) Rule 2021 No. 13 (IESS Rule)[1] have the same meanings in these Procedures unless otherwise specified in this clause.

Defined terms/Terms defined in the NER and the IESS Rule are intended to be identified in these Procedures by italicising them, but failure to italicise a defined term does not affect its meaning.~~ng.~~

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

~~gg...Term~~	~~Definition~~
~~*10% POE demand traces*~~	~~Hourly 10% POE demand profiles used in *EAAP*. The method of developing demand traces is explained in Schedule 1 of this document.~~
~~*50% POE demand traces*~~	~~Hourly 50% POE demand profile used in *EAAP*. The method of developing demand traces is explained in Schedule 1 of this document.~~
~~*90% POE demand traces*~~	~~Hourly 90% POE demand profile optionally used in *EAAP*. The method of developing demand traces is explained in Schedule 1 of this document.~~
~~*10% POE simulation case*~~	~~The *EAAP* simulation using a *GELF* for a given Scenario with 10% POE demand traces.~~
~~*50% POE simulation case*~~	~~The *EAAP* simulation using a *GELF* for a given Scenario with 50% POE demand traces.~~

[1] See https://www.aemc.gov.au/rule-changes/integrating-energy-storage-systems-nem

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gg...Term	Definition
Baseload generation	*Generating units* that typically run all times through the year except during maintenance *outages*. Coal-fired *generating units* are a typical example of baseload *generating units*.
ESOO	Electricity *statement of opportunities*
FCAS	Frequency control *ancillary services*, as that term is defined in section 4.1 of AEMO's Procedure SO_OP 3708A Frequency Control Ancillary Services[2].
FOR	Forced outage rate (unplanned outage data used stochastically in the modelling).
Forecast generation capability	The maximum *generation* in GWh each of the *scheduled generating units*, a group of *scheduled generating units* or the *power station* (as appropriate) is capable of producing, taking the *energy* limitations anticipated under various *scenarios* into consideration.
GELF	*Generator Energy Limitation Framework*
Hydro power scheme	One or more hydro *power stations* including pump storage units relying on a common river system for their energy source can be defined as a *hydro power scheme*, including run-of-the-river hydro *power stations*.
*Monte Carlo simulations*Intermediate generation	Probabilistic computational algorithmssimulation cases that rely on repeated random sampling to compute their results. Monte Carlo methods are useful in studying complex systems with significant uncertainty in inputs.Generating units that are not included in baseload generation or peaking generation are generally included in this category.
Monte Carlo simulations	Probabilistic computational algorithms that rely on repeated random sampling to compute their results. Monte Carlo methods are useful in studying complex systems with significant uncertainty in inputs.

[2] This document is available at: https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Power_System_Ops/Procedures/SO_OP_3708--Non-market-Ancillary-Services.pdf

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gg...Term	Definition
NSCAS	Network support and control ancillary services
Network Support Agreement[3]	An agreement between a *Network Service Provider* and a *Market Participant* to provide a non-*network* alternative to a *network augmentation* to improve *network* capability.
Peaking generation	*Generating units* that are relatively expensive to run and generally run only for few hours a day when the demand is high.
Study period *Run-of-river hydro power stations*	24 month period under investigation by *EAAP*. The hydro *power stations* utilizing the natural flow and elevation drop of a river to *generate* electricity. *Power stations* of this type are built on rivers with a consistent and steady flow, either natural or through the use of a large reservoir at the head of the river that then can provide a regulated steady flow for the down-stream *power station*.
Simulation case *Scenarios*	An *EAAP* simulation with a *GELF* for a given Scenario and with a given POE demand trace (10% POE or 50% POE).As defined in section 4.1 of this document.

Interpretation

These Procedures are subject to the principles of interpretation set out in Schedule 2 of the National Electricity Law..NER RequirEments

AEMO is required to develop and publish the *EAAP guidelines* in accordance with Rule 3.7C, which states:

EAAP guidelines

(k) *AEMO* must develop and *publish* guidelines (the *'EAAP guidelines'*) that:

(1) define scenarios that *AEMO* must study in preparing the *EAAP*;

(2) define modelling assumptions for the *EAAP*;

[3] This definition is included in the "New Chapter 10 Glossary Terms" section (refer page 361) of the Final Report of the Congestion Management Review by Australian Energy Market Commission. This report can be accessed at: https://www.aemc.gov.au/markets-reviews-advice/congestion-management-review

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(3) define the components of a *GELF* that a *Scheduled Generator* must include in a *GELF* submitted under paragraph (g);

(4) provide detail on the forms of the *GELF* sufficient for a *Scheduled Generator* to meet the requirements of paragraph (g);

(5) define variable parameters specific to a *GELF* ('*GELF parameters*') that are likely to have a material impact on the *GELF* and therefore the *EAAP*, and which may include, but are not limited to, parameters in relation to:

(i) hydro storage including pump storage;

(ii) thermal generation fuel;

(iii) cooling water availability; and

(iv) gas supply limitations;

(6) define circumstances where a *GELF* submitted under paragraph (g) can apply to a collection of *scheduled generating units* that face common *energy constraints* due to their geographic location, access to fuel source or another similar reason;

(7) define the form of information to be submitted by each *Scheduled Generator* in accordance with paragraph (e);

(8) define arrangements for managing the confidentiality of information submitted to *AEMO* under this rule 3.7C; and

(9) specify when a *Scheduled Generator* is required to update a *GELF* under paragraph (h)(2).

In preparing the *EAAP Guidelines*, *AEMO* is required to comply with Rule 3.7C(l), which states:

(l) The scenarios that are defined for the purposes of subparagraph (k)(1) may include, but are not limited to:

(1) water conditions such as normal rainfall and drought;

(2) material restrictions on the supply of a significant fuel source;

(3) other limits on a fuel source for a major form of generation; and

(4) any other scenario that AEMO reasonably considers will have a material impact on the *EAAP*.

EAAP principles

Rule 3.7C(m) requires AEMO to comply with the EAAP principles in preparing the EAAP guidelines. The EAAP principles are specified in Rule 3.7C(b), which provides:

(b) The *EAAP* must:

(1) cover a 24 month period;

(2) be *published* at least once in every 12 month period and more frequently if required under paragraph (d);

(3) provide a probabilistic assessment of projected *energy* availability for each *region*;

(4) provide projected *unserved energy* levels for each *region* with a monthly resolution;

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(5) provide aggregated information on the adequacy of *energy* availability for each scenario that *AEMO* defines for the purposes of the EAAP, based on information received from *Registered Participants* and on anticipated *power system* constraints;

(6) take into account:

(A) where relevant, the information and *medium term PASA* inputs referred to in clauses 3.7.1 and 3.7.2;

(B) where relevant, the matters AEMO considers in, and for the purposes of, developing the Integrated System Plan (ISP)

(C) *Generator Energy Limitation Frameworks* provided in accordance with paragraph (g), including *GELF*s that apply to more than one *scheduled generating unit* under clause 3.7C(k)(6) where those *GELF*s adequately represent the relevant *generating units*; and

(D) *GELF parameters* for each *GELF* which are provided in accordance with the *EAAP guidelines* and are updated in accordance with the *timetable*.

In addition, AEMO must comply with Rules 3.7C (o) and (q) in developing, publishing and amending the *EAAP Guidelines*. These state:

(o) AEMO must develop and *publish* the *EAAP guidelines* in accordance with the *Rules consultation procedures*.

(q) AEMO may from time to time in accordance with the *Rules consultation procedures* amend or replace the *EAAP guidelines*.

This document details the *EAAP guidelines* as required by Rule 3.7C(k).

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2. Preparation of the EAAP

AEMO is required by Rule 3.7C(d) to *publish* an *EAAP:*

1. at least once in every 12 month period in accordance with the *timetable;* and
2. as soon as practicable after becoming aware of any new information that may materially alter the most recently published *EAAP*.

The *EAAP* will be prepared and *published* in accordance with Rule 3.7C using methodologies and inputs consistent with AEMO's Electricity Statement of Opportunities (**ESOO**) and other inputs derived through the Generator Energy Limitations Framework (**GELF**). Consistent with the ESOO, ~~T~~the *EAAP* will use probabilistic modelling to determine the *regional Unserved Energy* (**USE**) at an hourly resolution during the *Study Period*. This involves the use of time-sequential, security constrained optimal dispatch simulations, incorporating Monte-Carlo Simulations.

~~The annual percentage of USE per *region* will be the key indicator of *energy* adequacy in the *NEM*. The *EAAP* will cover the scenarios listed in section 4.1 of this document.~~

AEMO will use the modelling assumptions listed in section 3.2 of this document in preparing the *EAAP*. At least once in every 12 month period, or when notified by AEMO that an additional *EAAP* is required, the *GELF parameters* will be submitted by *Scheduled ~~Generators~~ production units* , consistent with the selected form of *GELF* as explained in section~~s~~ ~~3.3~~4.3, ~~1.1~~4.4, ~~3.4~~4.5 ~~and 3.5~~4.~~6~~3 of this document.

3. EAAP Guidelines

These EAAP guidelines cover the following areas, as required by Rule 3.7C(k):

- scenarios that AEMO must study in preparing the EAAP;
- modelling assumptions for the EAAP;
- components of a GELF that a Scheduled production unit~~Generator~~ must include in a GELF submitted under Rule 3.7C(g);
- the forms of the GELF sufficient for a Scheduled ~~Generator~~ production unit to meet the requirements of Rule 3.7C(g);
- variable GELF parameters that are likely to have a material impact on the GELF;
- circumstances where a GELF submitted under Rule 3.7C(g) can apply to a collection of scheduled production ~~generating~~ units that face common energy constraints due to their geographic location, access to fuel source or another similar reason;
- the form of information to be submitted by each ~~Scheduled Generator~~ production unit in accordance with Rule 3.7C(e);
- arrangements for managing the confidentiality of information submitted to AEMO under Rule 3.7C.;
- when a Scheduled ~~*Generator*~~ *production unit*~~r~~ is required to update a GELF under paragraph (h)(2).

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3.1. Scenarios that must be studied in preparing the *EAAP*

The following scenarios will be included in the *EAAP*:

~~(i) Low rainfall – based on rainfall experienced in a specified historical period;~~

~~(ii) Short-term average rainfall – based on the average rainfall recorded over the past 10 years; and~~

(i) ~~Long-term average rainfall – based on the average rainfall recorded over the past 50 years, or the longest period for which rainfall data is available should this be less than 50 years.~~ Central scenario– – based on the most likely fuel availability used for generation purposes e.g. gas, coal, diesel, hydrogen and water resources. Water inflows should be based on the average rainfall recorded over the past 10 years.

(ii) *Low Rainfall* scenario – based on the most likely fuel availability for thermal production units (as per the *Central* scenario) and considering water availability reflecting rainfall recorded in a specific historical period.

(iii) *Low Thermal Fuel scenario* – based on 90% probability of exceedance (POE) energy availability (an estimate that is expected to be exceeded 9 out of 10 years) for thermal generators that should consider applicable limitations for each site, including the potential impacts of wet coal, longwall moves, train and truck deliveries, loader outages and likely market limitations. The scenario is not designed to reflect a disaster situation, but instead to reflect coincident energy shortfall situations that apply to each site from time to time.

Where the conditions associated with 90% POE energy availability, as applicable for each site, could reasonably occur for multiple months, participants are requested to submit energy limits for the entire 24 month horizon consistent with these conditions.

Where the conditions associated with 90% POE energy availability, as applicable for each site, would only reasonably occur for a duration of a month or less, participants are requested to submit energy limits consistent with these conditions for January and June each year only. All other months should be submitted consistent with the central scenario.

Hydro generators should submit water inflows consistent with the Central scenario.

(Collectively referred to as '**Scenarios**').

3.1.1. Sensitivities in the EAAP

When AEMO publishes sensitivities in the EAAP they will state the relevant assumptions and give a qualitative indication of the probability of each sensitivity.

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Simulation cases

Each *Scenario* will be simulated with 10% POE demand traces (**10% POE simulation case**) as well as 50% POE demand traces (**50% POE simulation case**) for all *regions*[4].

This means that there will be up toat least six simulation cases studied for the *EAAP*. They are:

1. Simulation case 1: Low rainfall scenario with *10% POE demand traces*
2. Simulation case 2: Low rainfall scenario with *50% POE demand traces*
3. Simulation case 3: Short-term average rainfall scenario with *10% POE demand traces*
4. Simulation case 4: Short-term average rainfall scenario with *50% POE demand traces*
5. Simulation case 5: Long-term average rainfall scenario with *10% POE demand traces*
6. Simulation case 6: Long-term average rainfall scenario with *50% POE demand traces*

If the need arises, AEMO will conduct simulations of *90% POE demand traces* or additional scenarios as appropriate in future using the *GELF* information provided by *Scheduled Generators* in accordance with these *EAAP guidelines*. Any extra scenarios that would require additional information from participants will be done in consultation with stakeholders where practical.

3.2. Modelling assumptions for the *EAAP*

3.2.1. Modelling of demand in the EAAP

All EAAP scenarios will be assessed using demand forecasts from the ESOO scenario that is considered most likely, or Central.

Number of Monte Carlo simulations to be performed

AEMO will use a sufficient number of *Monte Carlo simulations* for each of the simulation cases to achieve convergence of monthly *USE* values to within an acceptable tolerance.

Sharing *USE* among regions

Whenever *USE* is predicted in a simulation, *USE* will be shared between *regions* in proportion to the *regional* demands until *interconnector* limits are reached. After reaching the *interconnector* limits, the remaining *USE* will be reported for the *region* it belongs to in addition to the shared component of *USE* for that *region*.

Number of Monte Carlo simulations to be performed

AEMO will use a sufficient number of *Monte Carlo simulations* for each of the simulation cases to achieve convergence of monthly *USE* values to within an acceptable tolerance.

Determination of hourly *USE* for Scenarios

For each of the *Scenarios*, the 10% POE simulation case hourly *USE* results will be combined with the 50% POE simulation case hourly *USE* results using weighting factors consistent with the weighting factors used for the *ESOO* to determine the hourly *USE* for the *Scenario*.

[4] The method of developing demand traces is explained in Schedule 1 of this document.

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AEMO is not explicitly modelling simulation cases for 90% POE demand traces unless USE outcomes are expected to be materially different from 50% POE outcomes. If not explicitly modelled, USE values included in the probability weighted calculation of expected USE arising from 90% POE demand traces are assumed to be zero.

3.2.2. Modelling of generation plant forinfor -the EAAP

All existing and new operational production units that meet AEMO's commitment criterias are included in the EAAP, consistent with the methodology applied to the ESOO.

Scheduled capacities for each unit, as submitted to AEMO's Generation Information page[5] will be used to model the capacity of each unit per season. AEMO applies scheduled outages to these units in EAAP only in circumstances where material outages submitted to *MT PASA* are specified as not being recallable.

Semi-scheduled production units-, will be modelled consistent with the ESOO.

Retiring production units that are considered operational will be modelled as unavailable after the decommissioning date published on the AEMO Generation Information page, applying a methodology consistent with the ESOO.

All generators that contribute to operational demand[6] are modelled in the EAAP, consistent with the approach used in both the *medium term* PASA and Electricity Statement Of Opportunities (ESOO).

Existing Generation

Generating units included in the most recent *medium term* PASA at the time the *GELF* is submitted will be modelled for *EAAP*.

New Generation

New *generating units* for the upcoming two years will be modelled once they are 'committed', as reported in the latest NEM *ESOO*, as well as the most recent information that is available on the AEMO Generation Information webpage.[7]

Retiring Generation

AEMO will consider a *Scheduled Generator's* advice regarding the decommissioning of *generating units* submitted for the *medium term PASA* as well as for the purposes of the NEM *ESOO* or *published* on the AEMO Generation Information webpage. The *generating units* will be modelled as unavailable after the proposed decommissioning date.

[5] The AEMO Generation Information webpage can be accessed at: http://www.aemo.com.au/Electricity/Planning/Related-Information/Generation-Information.

[6] For details on operational demand, please refer to demand definitions here https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/system-operations/dispatch-information

[7] The AEMO Generation Information webpage can be accessed at: http://www.aemo.com.au/Electricity/Planning/Related-Information/Generation-Information.

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Capacity of Generating Units

The *PASA availability* of *generating units* submitted for the most recent generator information (unless *medium term* PASA) will be used to represent the availability of *generating units* for *EAAP* modelling.

Scheduled outages of Generating Units

AEMO proposes that maintenance outages be modelled using the most recent information submitted for the *medium term PASA*.

If *USE* is predicted in periods where *outages* of *scheduled generating units* are planned to occur, where possible, the *outages* will be shifted to periods where *USE* is not predicted.This approach is based on the assumption that *scheduled generating unit* planned *outages* would be re-arranged if they caused *USE* in one or more *regions*. If AEMO has been advised by the *Scheduled Generator* that it is not feasible to shift the *outage*, it will be modelled to occur at the periods advised.

Generator price input

AEMO will use a suitable pricing structure for *generating units* reflecting the submitted *GELF parameters* to achieve realistic *dispatch* of *generating units* modelled in the *EAAP*. The pricing structure will also take into account the requirement to minimise *USE*.

Generator Forced Unplanned Outage Rates (FOR)

The *EAAP* will use FOR unplanned outage data collected on an annual basis for the purpose of producing publications such as *ESOO, MT PASA, EAAP* and the ISP.

Static and variable GELF parameters are then applied to each scheduled production unit, consistent with the EAAP scenario specification.

3.2.3. NEM Network model

Generator marginal loss factors, transmission inter-regional loss factors and power system and network constraints are applied consistent with the ESOO.A five-region model will be used, and includes:

3.2.4. FuelEnergy limitations

AEMO will apply variable GELF parameters to the EAAP for each scheduled participant, or collection of scheduled participants for which a GELF submission has been requested. AEMO will apply static GELF parameters where relevant only to the degree they apply to the unit/s and scenario narrative of each EAAP scenario. In addition to GELF parameters submitted for each participant, or collection of scheduled participants, AEMO may apply grouped limitations for relevant scheduled production units that utilise a common fuel supply based on appropriate regional analysis. For example, AEMO may apply regional gas supply limits based on the

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outputs of GSOO modelling, or diesel supply limits based on appropriately rigorous supply chain analysis.

AEMO will apply hydro modelling assumptions consistent with the ESOO, which requires that all storages return to the starting storage value by the end of the forecast year, thereby ensuring that storages are not modelled to deplete within each forecast year. In cases where AEMO becomes aware that reliability outcomes are being affected by the static end of year storage levels, a sensitivity ~~would~~will be published demonstrating the impact of moderate inter-year sharing of storages. ~~be run allowing these to be flexible.the~~

~~When preparing the EAAP model AEMO may consider any grouped limitations on fuel supply that it deems appropriate. This may include global fuel supply limits on fuels like diesel or gas supply limits to certain regions based on GSOO modelling. These limits would not be captured in the individual GELF submissions and may be deemed appropriate under certain conditions.~~

- ~~, consistent with the ESOO~~Generator marginal loss factors; and
- ~~Inter-regional loss factor models.~~

~~Refer to Schedule 2 for details of the *inter-regional* loss model and the *marginal loss factors* used in the *EAAP*.~~

~~3.2.5. Power transfer capability and network constraints~~

~~*Network* power transfer capability is defined by a set of *network* constraint equations. The *network* model is used to constrain the dispatch of *interconnectors* and *generation* to avoid power flows exceeding *network* capability.~~

~~This section describes the set of constraint equations used in the *EAAP* simulations to model the existing and future *network* capability.~~

~~The *EAAP* simulations model the power transfer capability of the *network* using system normal ST PASA formulated constraint equations only. *Outage* and other types of constraint equations are excluded from the simulations. The reasons for this are as follows:~~

- ~~*Network outages* would normally be moved if they were likely to cause security or reliability issues;~~
- ~~FCAS constraint equations are not represented in the *EAAP* simulations because under system normal conditions, Basslink is the only *interconnector* affected by FCAS constraints;~~
- ~~*Interconnector* rate of change and other types of constraint equations are not represented in the *EAAP* as these equations are generally invoked as required, depending on *power system* conditions. It is not appropriate to assume these constraint equations are active across the *study period*. *Interconnector* rate of change constraint equations are also not meaningful when applied to an hourly data resolution.~~

~~The constraint equations will factor in:~~

- ~~the demand profile of the selected *simulation case*;~~
- ~~seasonal equipment ratings;~~
- ~~*PASA availability* of *scheduled generating units* as submitted for the *medium term PASA*;~~
- ~~use/enabling of control schemes, *NSCAS* and *Network Support Agreements* to achieve maximum power transfer capability levels;~~

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- future *generation* relevant for the *study period*;
- future *network augmentations* relevant for the *study period*.

3.3. Components of static *GELF* parameters that a Scheduled Generator production units must include in a *GELF* submitted under Rule 3.7C(g)

Components of a *GELF* to be submitted must be on the basis of *production units*. Components of a *GELF* can be submitted for groups of *scheduled generating units* within a *power station* or on a *power station* provided the impact of the energy limitation applies equally across the *generating units* in the group or in the *power station* (as the case may be). Aggregation of two or more *power stations* will not be permitted for providing *GELF parameters* except for hydro *power stations* constituting *hydro power schemes*.

The components of a *GELF* should include:

- power station or group name (this will be defined by AEMO in consultation with each participant);
- Units included in the power station (this will be defined by AEMO in consultation with each participant this will be defined by AEMO);

- in the case of hydro power stations, the name of the hydro power scheme it belongs to;
- type of power stationprimary fuel used (coal-fired, natural gas-fired, hydro, GT etc);
- type of secondary fuel used (If applicable);
- maximum capacity for each fuel type;

- number of generating units at the power station and their MW capacities;

- state whether energy or capacity limitations (or both) are likely to be experienced by the power station or the hydro scheme under the Scenarios considered for the EAAP – briefly explain each of the limitations and the cause of these restrictions;

- Monthly Mminimum and maximum storage levels for primary (and secondary if applicable) fuels or reservoirs; that can be reached in each month of the *study period* without violating long-term reservoir management policy;

- Monthly Maximum storage levels for primary (and secondary if applicable) fuel;
- Eexpected inflows (for primary ((and secondary if applicable)) fuel or reservoirs in ML or MWh (as specified by AEMO);
- Expected storage for primary (and secondary if applicable) fuel, or water at the beginning of the month in ML or MWh (as specified by AEMO);
- Monthly inflows for which a firm contract for supply applies for primary (and secondary if applicable) fuel in MWh (if requested by AEMO);
- Monthly Llimits on continuous operation for both primary (and secondary if applicable) (If requested by AEMO);
- Monthly Llimits on unit starts (If requested by AEMO);

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- Monthly ~~E~~expected number of unit starts (If requested by AEMO):~~.~~

~~of for thermal power stations not belonging to hydro power schemes, state whether the energy/capacity restrictions apply to the whole power station, to a group of generating units at the power station or to individual generating units at the power station; and~~

~~State the generation group the generating units belong to. All generating units modelled in the EAAP must be categorised into Baseload, Intermediate or Peaking generation groups. Refer to the Glossary for the definitions.~~

~~3.4. Additional components of static *GELF* parameters associated with Hydro Power Schemes~~

~~Cascaded pump storage *hydro power schemes* can be complex in their operation. Five typical models representing *hydro power schemes* have been included in Schedule 3 as examples.~~

~~*Scheduled Generators* should select the model best representing their *hydro power schemes*, giving consideration to the inflow patterns consistent with the scenarios as well as the configuration of the *hydro power schemes* when establishing static *GELF parameters* and advise the selected model to AEMO. AEMO will then review the proposed model and decide if it is adequate for the purposes of the *EAAP*. If not, AEMO will discuss the inadequacies of the proposed model with the *Scheduled Generator* in question to establish an adequate model. The timeframe to complete this task is covered in section 4.8 of this document.~~

~~The following information must be provided for each of the reservoirs associated with a *hydro power scheme*:~~

- ~~Maximum active reservoir storage (GL);~~
- ~~Minimum active reservoir storage (GL).~~

~~The following information on tunnels associated with *hydro power schemes* would form a part of *GELF* if AEMO, in conjunction with the *Scheduled Generator* who owns the *hydro power scheme*, determines it is required to accurately model the *hydro power scheme* for the purposes of the *EAAP*:~~

- ~~The rate at which water can be transferred through the tunnel (ML/hour); and~~
- ~~The reservoirs to which the tunnels are connected.~~

~~In addition, each of the *hydro power stations* has the following static *GELF parameters*:~~

- ~~Water utilisation factor for generation and pumping for each generating unit or for the power station in GWh per GL;~~
- ~~Connected to which reservoirs (e.g. upstream reservoir and downstream reservoir).~~

~~3.5.~~3.4. The forms of the *GELF* sufficient for a Scheduled ~~Generator~~production unit to meet the requirements of Rule 3.7C(g)

Scheduled ~~*Generators*~~*production units* should submit a *GELF* representing *energy* *or operating* limitations likely to be experienced by their *power stations*. ~~It is acknowledged that the *energy* limitations experienced by some of the *generating units* or *power stations* can be better expressed in the form of a capacity limitation; hence,~~

it is proposed to allow the *energy* limitations to be expressed as an *energy* limitation or a capacity limitation.

Energy limitations in a *GELF* could be due to (but not limited to):

- limitations on a primary energy source (i.e. coal, gas or availability/allocation of water for hydro power generation);
- limitations on power station services (i.e. cooling and demineralised water, high cooling water temperatures, boiler feed water, etc.); and
- environmental issues, such as emission limits, operation allowed only at specific times of the day/week, etc.; and
- Llimits on units starts or continuous operation.

3.6.3.5. Variable parameters to be specified in a *GELF*

The variable parameters *Scheduled Generators production units* must submit in a *GELF* should cover the full *study period* and have a monthly resolution, unless a different resolution has been previously agreed with AEMO.

A separate set of variable *GELF parameters* should be submitted for each of the *Scenarios* included in the *EAAP*.

Water-related *energy* limitations included in *forecast generation capability* submitted as a variable *GELF parameter* should be based on the known current share of water available for *generation*, as advised by jurisdictions and water authorities, without assuming . *Scheduled Generators* should not assume that water allocations above this level would be made available in the future.

Variable *GELF* parameters to be submitted for scheduled by non-hydro power stationsSGproduction units

- Monthly forecast generation capability in GWh MWh or GL taking into account the energy limitations anticipated in each Scenario for each group of the scheduled generating unitsproduction units (the required units may be specified by AEMO for some hydro power scheme)., group of scheduled generating units within the power station or for the power station; and Monthly energy output limits or water inflows under the EAAP Scenarios that consider all relevant operational characteristics of the site;
- Accompanying brief explanation of each of the EAAP scenario energy limitations and the cause of these restrictions.

If there are any capacity limitations associated with the energy restrictions, monthly capacity profiles for each of the scheduled generating units should also be submitted.

Variable *GELF* parameters to be submitted for *hydro power schemes*

Active reservoir storage at the beginning of the *study period* in G.L;Monthly inflows to reservoirs in GL during the *study period*;

Minimum reservoir level that can be reached in each month of the *study period* without violating long-term reservoir management policy; and

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Any other limitations on reservoir capacities or levels that should be considered within the *study period*.

3.7.3.6. Circumstances where a *GELF* can apply to a collection of scheduled Scheduled generating production units that face common energy constraints due to their geographic location, access to fuel source or another similar reason

The *GELF* can be submitted fort any *generating**production units* within a *power station* or a group of power stations that may have common *energy constraints* and are owned by the same participant and have for *power stations* that do not constitute *hydro power schemes* will cover common *energy constraints* applying to them*generating units* within a *power station* only and will not cover common *energy constraints* applicable for multiple *power stations* due to the difficulty in modelling them.

In addition to GELF parameters submitted for each participant, or collection of scheduled participants, AEMO may apply grouped limitations for relevant scheduled generators generating production units that utilise a common fuel supply based on appropriate regional analysis. For example, AEMO may apply regional gas supply limits based on the outputs of the most recent Gas Statement of Opportunities (GSOO) modelling, or diesel supply limits based on appropriately rigorous supply chain analysis.

3.8.3.7. The form of information to be submitted by each *Scheduled Generator**production unit* in accordance with Rule 3.7C(e)

The *GELF parameters* are to be submitted by each *Scheduled Generator production unit* , in an electronic format using the interface developeda format developed by AEMO for this purpose. This interface will include features that will enable the *Scheduled Generators* to submit *GELF* parameters conveniently at a relatively low administrative cost.

Scheduled Generators will be responsible for maintaining the accuracy of static *GELF parameters* associated with the scheduled generating units and the hydro power schemes they own. Any errors in the static *GELF* parameters should be reported to AEMO promptly.

The variable GELF parameters must be submitted by each *Scheduled Generator production unit* within three weeks from the time AEMO issues an AEMO Communication forfor a request *for EAAP* reporting.

To assist with resource planning, in the event that additional *EAAP* reporting is not required, AEMO will target an *EAAP* publication date of end of November August each year (as part of the annual ESOO publication), with the deadline for submitting a *GELF* being before the end of fifth business day in OctoberApril (in line with unplanned outage rate data collection).

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~~3.9.~~3.8. When a *Scheduled ~~Generator~~production unit* is required to update a *GELF* under paragraph (h)(2)

~~Additional EAAP reporting will be required if AEMO becomes aware of any new information that may materially alter the most recently published *EAAP*. The factors AEMO will consider in determining whether additional EAAP reporting is required are outlined in the *Reliability Standard Implementation Guidelines*.~~

Participants should revise and re-submit their GELF in circumstances where there has been a material change which has an impact on the energy constraints associated with that GELF. When assessing the materiality of a change, participants should assess against the last published EAAP Central scenario only.~~\~~

Where AEMO considers it necessary to produce another EAAP, consistent with NER 3.7C(d)(2), it will only consider requesting updated data from relevant participants where it believes GELF parameters have changed materiality.

~~At AEMO's discretion, some or all *Scheduled Generators* will be required to update and resubmit variable *GELF parameters* when AEMO has an obligation to publish an EAAP under clause 3.7C(d)(2), and an AEMO Communication will be issued to this effect.~~

~~In exercising this discretion, AEMO will consider whether the new information is likely to have materially impacted the variable *GELF parameters* most recently submitted by each *Scheduled Generator*.~~

~~3.10.~~3.9. Information to be included in the publication of the EAAP

~~There will be two versions of the EAAP published:~~

~~a public version; and~~

~~a version covering individual scheduled generating units or hydro power schemes. The second version will be available only to the Scheduled Generator who owns the relevant scheduled generating units or the hydro power scheme.~~e

The ~~public version~~EAAP will be published as a section in the ESOO and will be available to all Market Participants and will include the following items for each of the Scenarios on regional basis:

- Monthly USE for the study period in GWh; and
- USE for the first 12 months and for the second 12 months in the study period in GWh. Monthly energy generation for the study period in GWh will be provided on a NEM-wide basis.

AEMO will make available an estimate of the total energy production of each participant's~~'~~ scheduled ~~generating unit Scheduled Generator or Integrated Resource System~~production unit per month for the period of the EAAP, on request following publication.

~~The second version will include the following items for each of the Scenarios:~~

- ~~Monthly generation contribution in GWh from the scheduled generating unit or hydro power scheme for the study period; and~~
- ~~Monthly generation contribution in GWh for the first 12 months and for the second 12 months in the study period.~~

~~3.11.~~3.10. Arrangements for managing the confidentiality of information submitted to AEMO

Subject to the requirement to *publish* the *EAAP*, ~~that is, the public version described in section 4.10 of this document,~~ the *GELF* information submitted by the *Scheduled* ~~*Generators*~~ *production units* for the purposes of the *EAAP* will be treated as *confidential information* in accordance with the *Rules*. AEMO may publish technology or regional aggregates of submitted GELF information, where such aggregates protect the confidentiality of individual GELF submissions.

~~4. Schedule 1: Development of POE DEMAND TRACES FOR THE EAAP~~

~~The demand traces used in the *EAAP* represent operational demand, and therefore reflect the demand met by *scheduled, semi- scheduled* and large *non-scheduled generation* in the NEM[8].~~

~~A half-hourly resolution is used in the *EAAP* probabilistic simulations. These traces are generated using the same method employed to produce demand traces for publications such as ISP, the *ESOO* and *medium term* PASA[9].~~

~~The method involves adjusting historical demand patterns to match forecast *energy* and maximum demand projections to determine *10%* and *50% POE demand traces* for the *study period*. Where appropriate, *90% POE demand traces* are also developed using the same method. The historical years used in deriving the demand traces reflect those used in the MT PASA.~~

~~A 10% POE maximum demand projection takes into consideration both the probability of extreme temperatures and day of the week. It is expected to be exceeded, on average, no more than once every 10 years. That is, for any given year, there is a 10% probability that a 10% POE projected maximum demand will be exceeded. Similarly, 50% POE projected demands are expected to be exceeded no more, on average, than one year in every two.~~

~~[8] For details on operational demand please refer to demand definitions at https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/system-operations/dispatch-information~~

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5. Schedule 2: Inter-regional loss model and marginal loss factors used for the EAAP

The *demand traces* used by AEMO will be derived on the basis of "sent-out". The estimated auxiliary load is automatically calculated during the modelling as a fixed percentage of "as generated power". The generator auxiliary information supplied to the model is based on AEMO's latest modelling assumptions[10], which are published on the AEMO website. The overall auxiliary load is therefore dependent on the particular dispatch outcome in each simulation as all generator types have varying levels of auxiliary load.

The *EAAP* simulations will ensure that the *regional* scheduled maximum demands include a proportion of the *inter-regional losses* calculated using loss equations. AEMO proposes that for each *interconnector*, there will be a proportion of the *inter-regional losses* set per *region*.

Marginal loss factors are used in determining pricing and dispatch order in the *EAAP* simulations, but are not used to adjust physical demand. The *Marginal loss factors* applied in the *EAAP* studies for the first year will also be applied for the second year of studies.

The *inter-regional loss* models, *inter-regional loss* proportions and *marginal loss factors* for the *EAAP* studies will be sourced from the latest version of the AEMO document "List of Regional Boundaries and Marginal Loss Factors"[11].

[10] The latest information on AEMO's modelling of generator auxiliary load can be found at https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/forecasting-and-reliability/nem-electricity-statement-of-opportunities-esoo

[11] The *AEMO* document "List of Regional Boundaries and Marginal Loss Factors" can be accessed at: https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Security-and-reliability/Loss-factor-and-regional-boundaries

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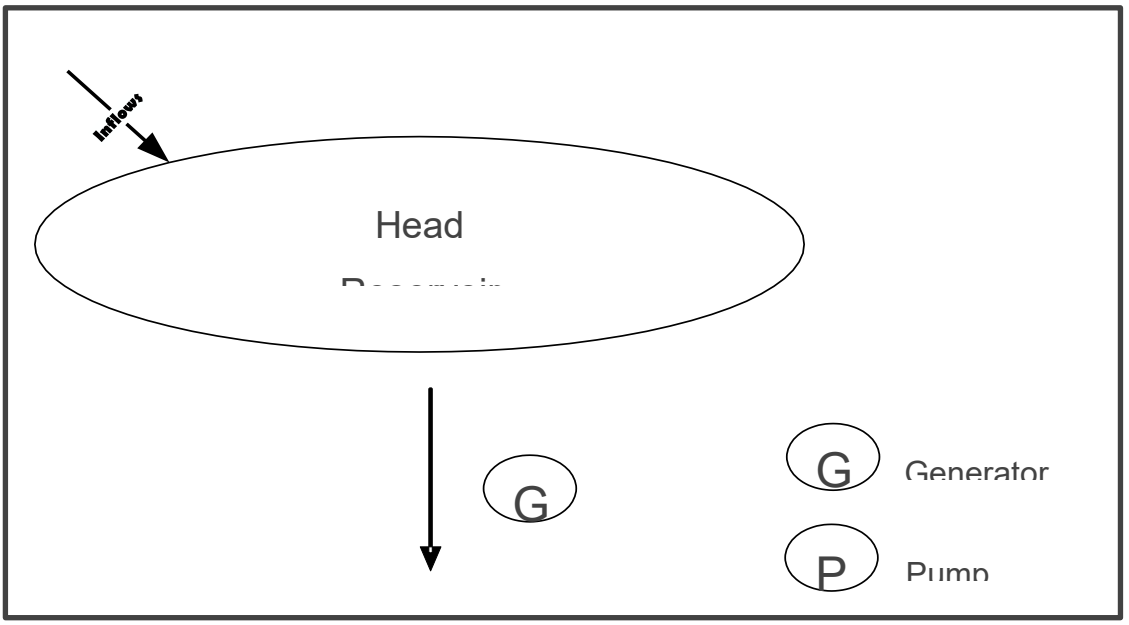
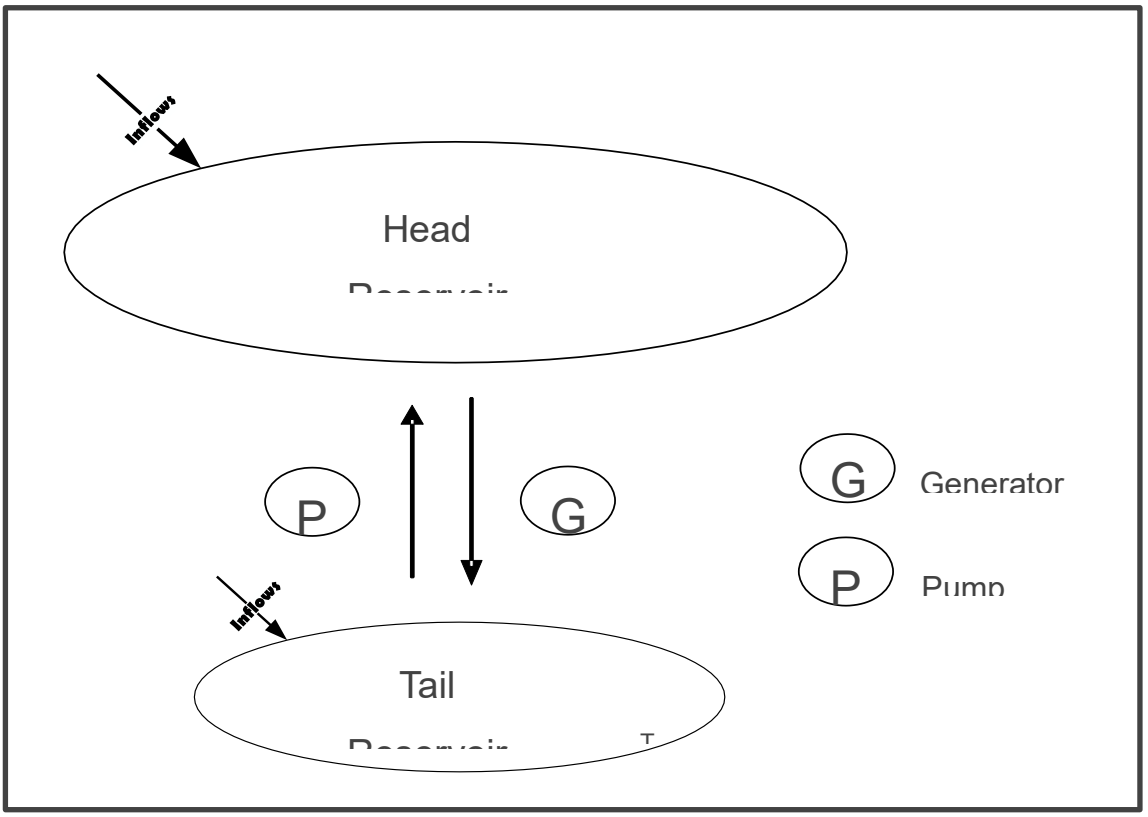
6. Schedule 3: Examples of *Hydro Power Scheme* modelling for EAAP

6.1. Sample Model 1 – Run of river Hydro Power Station



6.2. Sample Model 2 – Basic Pump Storage Hydro Power Schemes



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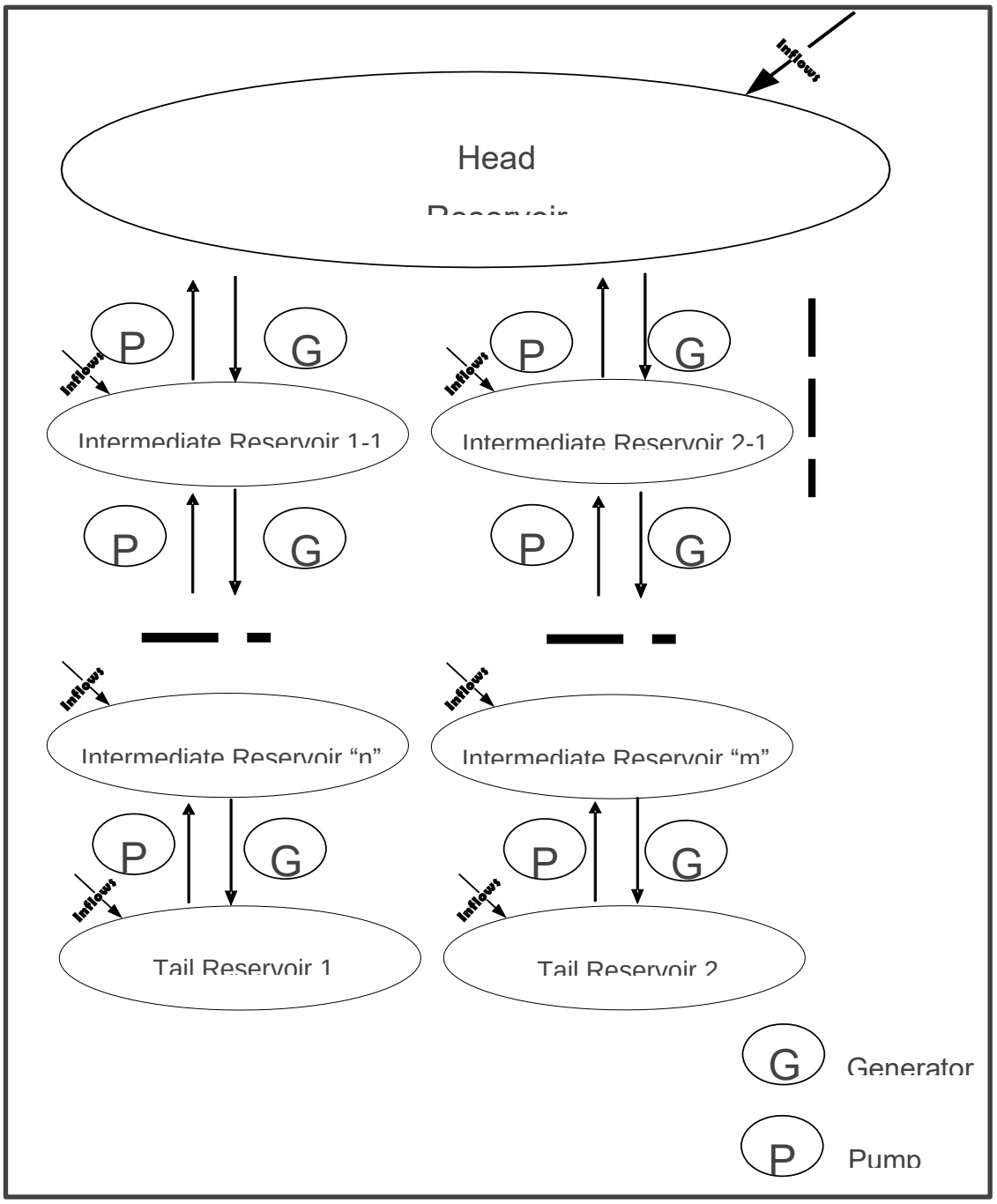
6.3. Sample Model 3 – Complex Pump Storage Hydro Power Schemes



6.4. Sample Model 4 – Aggregated Complex Pump Storage Hydro Power Schemes

A suitable combination of physical hydro *power stations* so that complex *hydro power schemes* can be approximated by one of the three models presented above.

6.5. Sample Model 5 – Hydro Power Schemes with specific generation profiles

Hydro power schemes may be modelled by means of different hourly *generation* profiles for the *study period* to suit various *Scenarios*. This will be an option made available to *Scheduled Generators* to submit variable *GELF parameters* for *hydro power schemes*.

Version release history

Version	Effective date	Summary of changes
1.8	24 April 2023	Final report, implementing updates as per the Reliability Forecasting Guideline and Methodology Consultation
Draft 1.7		Draft for consultation update, including changes which are effective from 3 June 2024 under the National Electricity Amendment (Integrating energy storage systems into the NEM) Rule 2021 No. 13
Final 1.6	7/9/2020	AEMO Forecasting
Draft 1.5	25/5/2020	AEMO Forecasting – Philip Travill
Final 1.4	21/10/2016	AEMO Supply Planning – Rimjhim Kapoor
Draft 1.3	9/9/2016	AEMO Supply Planning – Rimjhim Kapoor
Draft 1.2	2/6/2016	AEMO Supply Planning – Rimjhim Kapoor
Final 1.1	14/1/2013	AEMO – Monica Burkett and Pablo Uribe Gomez
Final 1.0	30/6/2009	EAAP WG
Draft 0.2	12/5/2009	EAAP WG
Draft 0.1	27/2/2009	EAAP WG