Intermittent Generator Forum

Friday 20th March 2020

Welcome and Introduction

Mike Davidson
Manager/Operational Forecasting

Agenda

Time	Duration (min)	Item	Presenter
9.00 am - 9.10 am	10	**Welcome and Introduction**	Mike Davidson
9.10 am - 9.35 am	25	**Actions from previous forum (Feb 2019)**	Jack Fox
9.35 am - 10.20 am	45	**AWEFS/ASEFS forecasting** • Reporting of regional wind and solar forecasts • Expedited dispatch forecast prior to AWEFS/ASEFS • AWEFS/ASEFS forecast model onboarding • ASEFS Dispatch default power curve and updates • Expedited AWEFS PD/STPASA models • Other AWEFS/ASEFS enhancements • Participant education sessions	Jack Fox Jack Fox Petar Pantic Petar Pantic Petar Pantic Petar Pantic Petar Pantic
10.20 am - 11.05 am	45	**Generator compliance requirements** • Availability submissions • Semi-dispatch and linear ramping • AGC response capability • System strength constraints • SCADA provision • Operational communication facilities	Ellise Harmer Ross Gillett Ross Gillett Ross Gillett Ross Gillett Ross Gillett
11.05 am – 11.15 am	10	**Other Business**	Mike Davidson

Forum objectives

- **Inform stakeholders** on AWEFS/ASEFS enhancements since last forum in Feb 2019

- **Remind stakeholders** of their compliance requirements and the impact of non-compliance on power system security and reliability

Actions from previous forum

Jack Fox

Allow new farms to initially register as non-scheduled during commissioning

- **Recap of the issue**:
  - AEMO was to investigate the feasibility of allowing new semi-scheduled wind and solar farms to initially register as non-scheduled units for the duration of commissioning

- **Status**:
  - AEMO has investigated this proposal from a regulatory, technical, procedural and operational perspective and determined that it is infeasible.
  - There is a need to address the root cause (a lack of a forecast model from the date of registration)
  - AEMO is developing an initial dispatch forecasting system, which uses the power curve provided by the participant during registration to create unconstrained forecasts until the AWEFS/ASEFS model is implemented by the vendor
    - → Target date: Quarter 3, 2020

Publishing of pre-dispatch availability next-day

- **Recap of the issue**:
  - Publishing UIGF meets the NER 3.13.4(p)(7) obligation to publish *available capacity*
  - However, to improve market transparency AEMO has received requests to publish the Upper MW Limit and Turbine/Inverter Availability entries submitted by semi-scheduled and non-scheduled generators on a next-day public basis

- **Status**:
  - Following recent instances of widespread high-temperature de-rating/cut out of wind turbines, the AER have been speaking with AEMO seeking further information
  - AEMO have identified the following details for discussion:
    - Tracking information of the availability entry used to create the forecast is not currently published out of AWEFS/ASEFS. **Is the publication of tracking information required?**
    - Submission of updates to availability entries do not have a reason/comment field, so there is no log of the explanation for changes to availability. **Is this information required?**
    - The original request relates to the publishing of availability used to produce the pre-dispatch forecast. The dispatch forecast uses SCADA signals (turbines/inverters available and local limit) to determine plant availability but these SCADA signals are not published. **Should AEMO publish the availability information used to produce dispatch forecasts?**
  - **Please provide any feedback to op.forecasting@aemo.com.au by Fri 3 April**

Providing Possible Power via API

- **Recap of the issue**:
  - Self-forecast providers required to produce an unconstrained forecast at all times
  - Dispatch Self-Forecast Assessment Procedure allows AEMO to use the SCADA Possible Power to assess self-forecast performance during constrained-off intervals
  - A request was received to assess the feasibility of providing Possible Power via an API rather than SCADA

- **Status**:
  - As at 10 March 2020, self-forecasts for 17 DUIDs have passed the initial assessment and are being used in dispatch
  - Of those, only 7 DUIDs are providing SCADA Possible Power to AEMO, and only 2 DUIDs have requested its use in self-forecast assessment
    - For the 2 DUIDs that requested the use of SCADA Possible Power, both passed initial assessment without relying on its use due to the low incidence of constrained-off intervals
    - Of the remaining 15 DUIDs, the use of SCADA Possible Power would have assisted one DUID with a high incidence of constrained-off intervals in passing the initial assessment sooner

Providing Possible Power via API

- AEMO is seeking feedback on the level of support in pursuing changes to accept Possible Power via an API
  - **Please provide any feedback to op.forecasting@aemo.com.au by Fri 3 April**
- **Technical concerns**:
  - Farm should be responsible for providing Possible Power to AEMO, but how would this work with multiple independent self-forecast providers?
- **General concerns**:
  - During constrained-off intervals, are self-forecast providers using Possible Power to assess the performance of their self-forecasts?
  - If the incidence of constrained-off intervals continues to increase, without using Possible Power how will self-forecast providers tune their unconstrained forecast models with the limited number of unconstrained intervals still available?
  - Without tuning their unconstrained forecast models, will self-forecast performance deteriorate over time? Or will self-forecast providers elect to suppress their self-forecast and create an over-reliance on using AWEFS/ASEFS forecasts?
  - AEMO will cover these issues in its review of the self-forecasting process

Additional notification options when forecasts are suppressed

- **Recap of the issue**:
  - Request to provide SMS/Email notification when self-forecasts or AWEFS/ASEFS forecasts are suppressed by AEMO

- **Status**:
  - The INTERMITTENT_FORECAST_TRK table in the EMMS Data Model indicates which forecast was used in dispatch and can be monitored to determine when the forecast source has changed
  - This data is available to the relevant participant immediately after each dispatch run through the Data Interchange, and will need to be shared with their self-forecast providers to ensure effectively monitoring
  - AEMO considers this is the most efficient mechanism for notifying the status of forecasts used in dispatch

Participant markets portal improvements

- **Recap of the issue**:
  - Investigate changes to the <u>Participant markets portal website</u> to improve usability and user experience

- **Status**:
  - Participants can submit availability entries via the markets portal website or programmatically using FTP and aseXML format files. More information is available in the <u>Guide to Intermittent Generation</u>
  - AEMO is investigating changes to the markets portal including data fill-down and auto populate functionality as well as performance improvements that can be included in a future market systems release
  - AEMO is seeking feedback from users on improvements to the availability view/entry screens on the markets portal website
  - **Please provide any feedback to <u>op.forecasting@aemo.com.au</u> by Fri 3 April**

AWEFS/ASEFS forecasting

Jack Fox and Petar Pantic

Separate reporting of SS wind & SS solar (1)

- AEMO released the EMMS Release Schedule and Technical Specification in October 2019, advising participants of the publication of additional fields for the separate reporting of region-aggregate forecasts and targets for each of semi-scheduled wind and semi-scheduled solar

- The new fields have been added to the following EMMS tables as part of the EMMS Data Model 4.29 release:
  - DISPATCHREGIONSUM
  - P5MIN_REGIONSOLUTION
  - PREDISPATCHREGIONSUM
  - PDPASA_REGIONSOLUTION
  - STPASA_REGIONSOLUTION

- AEMO targeting to implement these new fields from end March 2020

Separate reporting of SS wind & SS solar (2)

- The following set of new fields will be published in the Dispatch, Pre-dispatch and 5-min Pre-dispatch Region Solution tables, where:
  - UIGF = Forecast from AWEFS/ASEFS (or for Dispatch, the self-forecast if used)
  - CLEARED = Energy Target from NEMDE
  - COMPLIANCEMW = Energy Target from NEMDE if the Semi-Dispatch Cap is set

Field Name	Description
SS_SOLAR_UIGF	Regional aggregated Unconstrained Intermittent Generation Forecast of Semi-scheduled generation (MW) where the primary fuel source is solar
SS_WIND_UIGF	Regional aggregated Unconstrained Intermittent Generation Forecast of Semi-scheduled generation (MW) where the primary fuel source is wind
SS_SOLAR_CLEARED	Regional aggregated semi-scheduled cleared MW where the primary fuel source is solar
SS_WIND_CLEARED	Regional aggregated semi-scheduled cleared MW where the primary fuel source is wind
SS_SOLAR_COMPLIANCEMW	Regional aggregated Semi-Schedule generator cleared MW where the semi-dispatch cap is enforced, and the primary fuel source is solar
SS_WIND_COMPLIANCEMW	Regional aggregated Semi-Schedule generator cleared MW where the semi-dispatch cap is enforced, and the primary fuel source is wind

Separate reporting of SS wind & SS solar (3)

- The following set of new fields will be published in the PDPASA and STPASA Region Solution tables, where:

  - UIGF = Forecast from AWEFS/ASEFS
  - CAPACITY = Same as UIGF
  - CLEARED = Cleared amount from PASA, where Study Region = Region

Field Name	Description
SS_SOLAR_UIGF	Regional aggregated Unconstrained Intermittent Generation Forecast of Semi-scheduled generation (MW) where the primary fuel source is solar
SS_WIND_UIGF	Regional aggregated Unconstrained Intermittent Generation Forecast of Semi-scheduled generation (MW) where the primary fuel source is wind
SS_SOLAR_CAPACITY	Regional aggregated semi-scheduled UIGF availability where the primary fuel source is solar
SS_WIND_CAPACITY	Regional aggregated semi-scheduled UIGF availability where the primary fuel source is wind
SS_SOLAR_CLEARED	Regional aggregated semi-scheduled cleared MW where the primary fuel source is solar
SS_WIND_CLEARED	Regional aggregated semi-scheduled cleared MW where the primary fuel source is wind

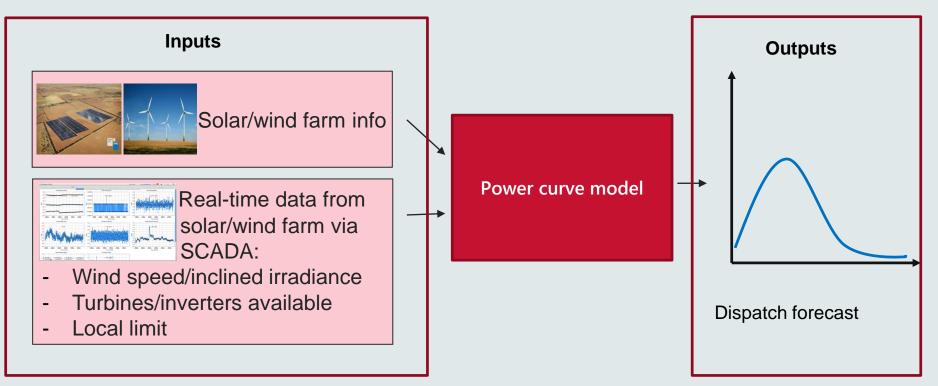# Expedited Dispatch forecast models

- **Issue**:
  - For new wind and solar farms, implementation of AWEFS/ASEFS forecast model could take **up to 3 months**, during which time consecutive semi-dispatch cap intervals could lead to the dispatch target eroding to 0 MW
  - This can be a cause of delays in the commissioning program

- **Solution:**
  - AEMO has introduced a monthly onboarding process for AWEFS/ASEFS forecast models, which has reduced implementation lead-times from 3 months to **3-7 weeks** (depending on whether they meet the cut-off date)
  - AEMO is also planning to implement a **start-up dispatch forecast model**, effective from registration date until the AWEFS/ASEFS forecast model is implemented
    - Target date: Quarter 3, 2020

Start-up Dispatch forecast model

- A **simple** dispatch forecast model that can be used from the date of registration of the wind/solar farm

- High level solution

AWEFS/ASEFS forecast model onboarding

- Developing new or making modifications to existing AWEFS/ASEFS models are now performed on a monthly basis.

- The tentative cut-off date to include these updates in the monthly batch is COB of the first or second Monday of each month.

- Participants must meet requirements pertaining to ECM SCADA signals and EMMS Intermittent Generation Availability to include new model updates in the batch.

- The updates are implemented in our Production systems by the end of that month.

ASEFS Dispatch: default power curve & updates

- ASEFS uses a power curve to forecast output in dispatch during constrained intervals

- ASEFS initially uses a default power curve before it switches over to a site-specific power curve trained to the SCADA data

- This default power curve is normally developed by AEMO however, participants now have the opportunity to provide this as an optional item as part of the ECM submission package

- Solar power curves are updated every quarter (if required)

ASEFS Dispatch: default power curve example

Inclined Irradiance (W/m²)	Solar Farm Output at Point of Connection* [fraction of Nameplate Rating]
0	0
50	0.03
100	0.08
150	0.13
…	…
1300	0.80

- Output data at 50 W/m² increments
- *Assumes the farm is fully available under Standard Temperature Conditions

Expedited AWEFS models: **PD/STPASA**

- AEMO have further expedited developing and implementing AWEFS models

- The implementation of the first stage expedited model enables forecasts in the Pre-dispatch and Short-term PASA timeframes only

- The expedited model is implemented prior to commissioning (Hold Point testing) commencement to prevent delays in the commissioning timeline

- On the registration effective date, participants are required to update their intermittent generation availability in the EMMS Portal. This is to ensure accurate forecasts are produced in these timeframes

Expedited AWEFS models continued:
EMMS portal

Other AWEFS/ASEFS enhancements

- **Feb 2020 change:** to use "replaced" SCADA active power inputs
  - Before change, AWEFS/ASEFS dispatch ignored "replaced" SCADA active power and substituted less accurate weather-based PD forecast
  - Change applies to SCADA active power replaced by farm (remotely replaced) or replaced by AEMO (either manually, or automatically by state-estimator or user-calculation)
  - Change does not apply to other SCADA inputs to AWEFS/ASEFS dispatch, which are still ignored if "replaced"

- **Proposed change:** to reduce blending of PD forecast into dispatch forecast
  - Currently, 7.7% of the PD forecast is blended into the dispatch forecast
  - Blending has resulted in dispatch forecast errors due to inaccurate PD forecasts or misalignment of local limits in dispatch (using SCADA) versus PD (using portal entries)
  - AEMO have engaged its AWEFS/ASEFS vendor to conduct a study to analyse the impacts on dispatch forecast accuracy when reducing the share of PD blending

Participant education sessions

- The Operational Forecasting team offer a 30-45 min education session on AWEFS/ASEFS and participant self-forecasting

- This is intended to assist new semi-scheduled participants or farm operators in understanding wind and solar generation forecasting and how it relates to their obligations under the NER

- Items of discussion include:

  - ECM and implementing the AWEFS/ASEFS forecasting model
  - Model inputs and outputs
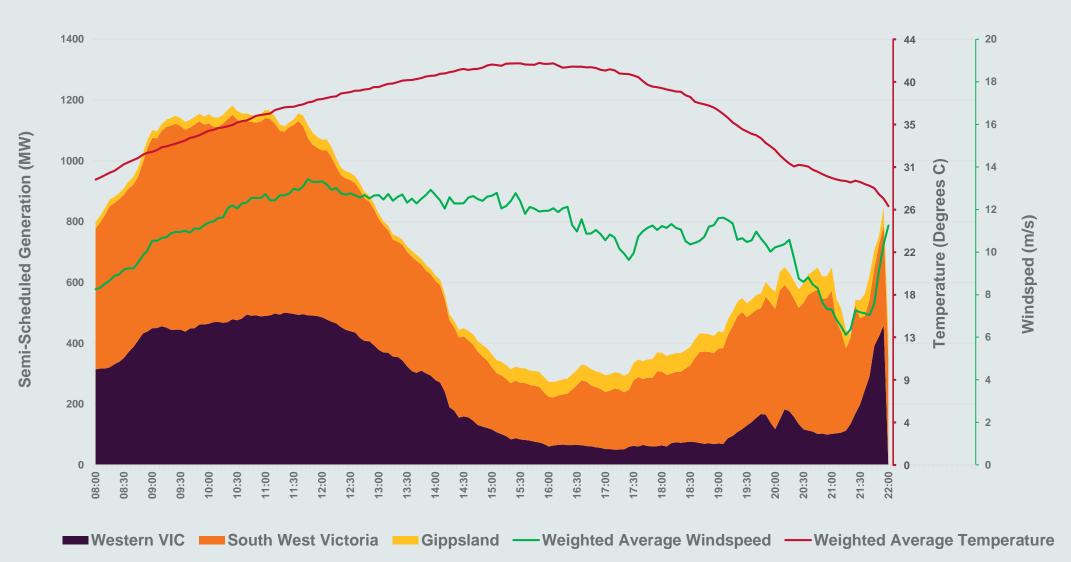 - Intermittent Generation Availability
  - Other queries

Generator compliance requirements

Ellise Harmer and Ross Gillett

Availability submissions (1)

- Accurate forecasts for wind and solar are becoming increasingly important, particularly where reserve margins are low

- There have been a number of days this summer where short-notice high temperature de-rating of intermittent generation has significantly impacted the assessment of system adequacy

- Semi-scheduled generators are obliged under NER 3.7B(b) to reflect changes in *plant availability*

  - Via availability submissions (upper MW limit or turbines/inverters unavailable)

  - Availability used to cap the AWEFS/ASEFS forecasts input to AEMO's Pre-dispatch and PASA processes

- Further, all generators are obliged under NER 4.9.8(e) to maintain a *dispatch offer* they can honour at all times

Availability submissions (2)

Semi-dispatch and linear ramping (1)

- ***What is a dispatch instruction for semi-scheduled?***

  - *dispatch level* (MW)

  - semi-dispatch flag - if set, must cap output to the *dispatch level* (aka semi-dispatch cap) at the end of dispatch interval (a *semi-dispatch interval*)

  - target time to reach the semi-dispatch cap, or the **ramp rate to be followed**

- ***When does a semi-dispatch cap apply?***

  - a *network constraint* would be violated if generation were to exceed the *dispatch level, OR*

  - *dispatch level* is less than its *unconstrained intermittent generation forecast* (eg due to economic withdrawal or marginal dispatch)

- ***How does AEMO issue dispatch instructions?***

  - Market Data Interchange (primary)

  - AGC via SCADA (mandatory if providing regulation FCAS)

Semi-dispatch and linear ramping (2)

Issue: Fast ramping by solar and wind farms at maximum inverter ramp rate has caused actual frequency deviations outside the normal operating band

- **Absent a specified ramp rate in dispatch instruction**, AEMO expects a semi-scheduled generating unit to linearly ramp from its current output to its semi-dispatch cap, subject to energy availability

- In July 2018, AEMO updated its <u>Dispatch operating procedure</u> to reflect this requirement:

> NER 4.9.5(a)(3) also requires *AEMO* to specify a *ramp rate* or a specific target time to reach the outcome specified in the *dispatch instruction*.
>
> Absent a specified *ramp rate*, the *semi-scheduled generating unit* is expected to ramp linearly from its initial *active power* output to its semi-dispatch cap applying at the end of the 5-minute *dispatch interval*, subject to energy availability.
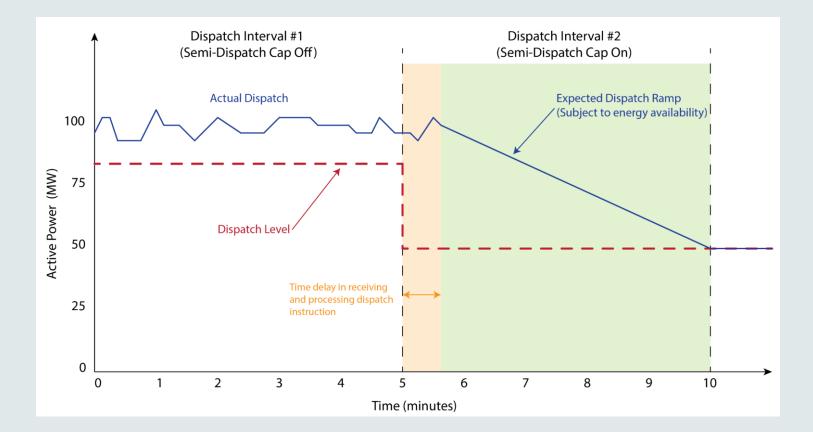>
> This requirement applies to s*emi-scheduled generating units* that have an *active power control system* capable of linear ramping as agreed in the relevant *performance standard*.
>
> When the *semi-dispatch interval* flag is set to 'FALSE' the *semi-scheduled generating unit* is free to generate at any level.

Semi-dispatch and linear ramping (3)

AEMO is proposing to include diagram in Dispatch operating procedure to show the linear ramping requirement and time delays in receiving and processing the dispatch instruction

Please provide any feedback to op.forecasting@aemo.com.au by Fri 3 April

AGC response capability

- AEMO uses its AGC system to issue set-points to generators to:

  - linearly ramp output to energy target, if not providing regulation FCAS

  - regulate output in response to small frequency deviations (within bounds around that linear ramp), if providing regulation FCAS

- **Under NER s5.2.5.14,** the minimum access standard requires a semi-scheduled generating system provide the capability to receive and automatically respond to AGC signals from AEMO delivered at least every 4 seconds (subject to energy source availability)

- Standard applies to all new farms from October 2018, as part of the "Generator technical performance standards" rule change

<u>Issue:</u> Not all new farms have completed testing of their AGC response capability

System strength constraints (1)

- Wind and solar generators may be subject to system strength limits on the maximum number of inverters connected (particularly if connected in weak parts of the grid) to maintain power system security

- System strength MW constraints that cap output not always effective if MW reduction spread across the same number of connected inverters

- AEMO also invokes "inverters connected" constraints in parallel with these

- "Inverters connected" constraints are designed to never bind, because they are not MW-related and hence not part of dispatch optimisation

System strength constraints (2)

Issue: Current process for issuing an inverters connected dispatch instruction is largely manual, with potential for large delays threatening power system security

- Scope to automate this process

    - Constraint naming convention: xxx**STR**xxx**_I**

    - Extract the "inverters connected" limit from the NEMDE dispatch constraint solution by subtracting the swamping value (10,000) from its constraint RHS

    - Upload limit to park controller

- **Please provide any feedback to op.forecasting@aemo.com.au by Fri 3 April**

SCADA provision (1)

- SCADA data transmitted to and from AEMO must comply with the [Power System Data Communication Standard](), to enable AEMO to discharge its market and power system security functions

- NER 4.11.1(a) and S5.2.6: Generators must comply with this standard with respect to the quality, security and reliability of SCADA data, including:

  - Management of planned SCADA outages

  - Response to, and rectification of failed SCADA dispatch data within six hours

- For Intermittent Gens, SCADA dispatch data includes AWEFS/ASEFS inputs:

  - active power, set-point, local limit

  - wind speed, wind turbines generating/available

  - solar irradiance, solar inverters generating/available

SCADA provision (2)

Good quality and reliable SCADA is critical to the ongoing accuracy of AWEFS/ASEFS dispatch forecasts:

Issues:

- If SCADA active power fails > 1 hour:

  - AWEFS/ASEFS reverts to weather-based PD forecast → large dispatch errors

- If SCADA wind speed or solar irradiance fails:

  - AWEFS/ASEFS produces constrained forecasts → reduce cap to zero issue

- If SCADA turbines/inverters available fails:

  - AWEFS/ASEFS forecast based on installed → potential large over-dispatch errors

- If SCADA local limit fails:

  - AWEFS/ASEFS forecast ignores local limit → potential large over-dispatch errors

SCADA provision (3)

Actions:

- AEMO liaises with participant to rectify failed SCADA, or to provide suitable alternative, including AEMO replacing the failed SCADA

- If failed SCADA persists for more than six hours, AEMO notifies the participant requesting they submit a GPS s5.2.6.1 non-compliance notice

- Notice forwarded to the AER

- AEMO may disconnect the farm if prolonged SCADA failure is causing market or security issues

Operational communication facilities

- Under Clause 4.11.3 of the NER, generators are required to establish, maintain and update operational communication facilities and contacts

- In particular, generators are required to:

  - Nominate and regularly update AEMO with contact details for nominated personnel who will receive or provide operational communications for each of its facilities

  - Must provide two independent telephone communication systems. Mobile phones are not sufficient.

  - Telephone communication systems must be in good repair and must investigate faults within 4 hours or as agreed with AEMO of a fault being identified

  - A form of electronic mail facility must be established and maintained

- Good industry practice is to notify AEMO of any changes immediately and review contacts on a regular basis

- **Please send all contact updates to psocontacts@aemo.com.au**

Other Business

Mike Davidson

Thank you for your valued participation !

- AEMO runs Intermittent Gen forums every year

- AEMO will publish forum minutes (see the [Intermittent Generator Forum webpage](#))

- General feedback or questions: email op.forecasting@aemo.com.au

- **AWEFS & ASEFS info**: [Solar and wind energy forecasting webpage](#)

- **Participant Self-Forecasting info**: [Participant Forecasting webpage](#)

Other Resources

- Self-Forecast Registration and Assessment
    - AEMO website – Participant Forecasting
    - Self-Forecast Application Form

- Self-Forecast API Access
    - Guide to AEMO's e-Hub APIs
    - Self-Forecast API details
    - API Documentation Portal

- Public next day forecasting data
    - AEMO NEMWeb: http://www.nemweb.com.au/#next-day-intermittent-ds
- MMS Data Model Report