Intermittent Generation Forum

Session 2 – Challenges, Learnings, and Perspectives

7 December 2020

Our facilitators

AEMO

Cameron Gibson Williamson

Petar Pantic

Rob Selbie

Jack Fox

Alicia Webb

Mike Davidson

Ellise Harmer

AEMO Control Room

Bill Webb

Global-Roam

Marcelle Gannon

Agenda

Time (ADST)	Duration (min)	Item	Presenter
9.30 am – 9.35 am	5	Welcome and Introduction	Alicia Webb
9.35 am – 9.45 am	10	System Operation Context	Jack Fox
9.45 am – 10.45 am	60	Current challenges and generator compliance requirements	Petar Pantic Ellise Harmer Cameron Gibson-Williamson Rob Selbie
10.45am – 11:10 am	25	Additional Perspectives	Bill Webb (AEMO) Marcelle Gannon (Global-Roam)
11.10am – 11.30 am	20	Questions and discussion	

Forum objectives for Session 2

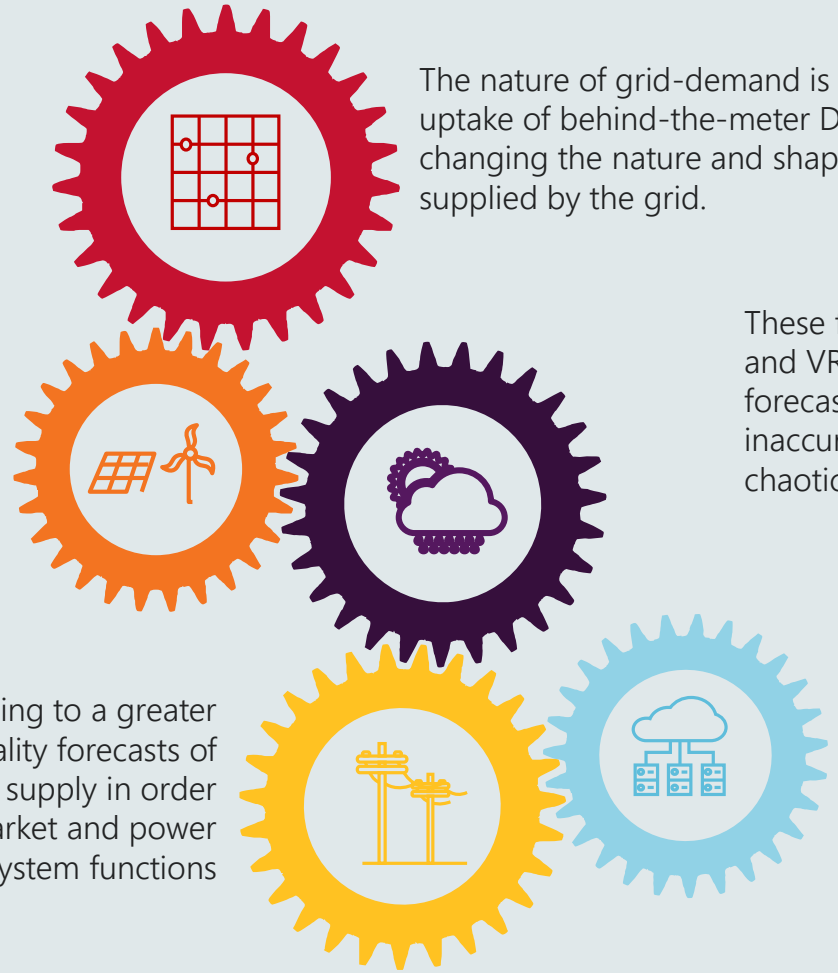
- **Inform stakeholders** of the current and emerging state of variable renewable energy (VRE) in the energy system.
- **Remind stakeholders** of key compliance requirements and how to address common issues.
- **Explain** the impact of non-compliance on generator performance, and power system security and reliability.
- **Provide stakeholders** an additional perspective on the management and operation of VRE generation in the NEM.

System Operation Context

Jack Fox

Operational Forecasting

The energy transition



The nature of grid-demand is rapidly changing due to the uptake of behind-the-meter DER (rooftop PV, batteries, EV etc) changing the nature and shape of demand that must be supplied by the grid.

These forecasts (both demand and VRE) are reliant on weather forecasts which are subject to inaccuracies due to the inherent chaotic nature of the weather

The share of VRE generation where the fuel source is the weather continues to increase rapidly, compounded by the closure of scheduled generators

This is leading to a greater reliance on quality forecasts of demand and VRE supply in order to perform market and power system functions

The increasingly complex and rapidly changing energy system means preparation needs to be made for imposed and disruptive change. Operational Forecasting must be enabled to transform processes, tools and systems to rapidly evolve our existing forecast solutions and create new types of forecasts to meet new demands

The VRE industry

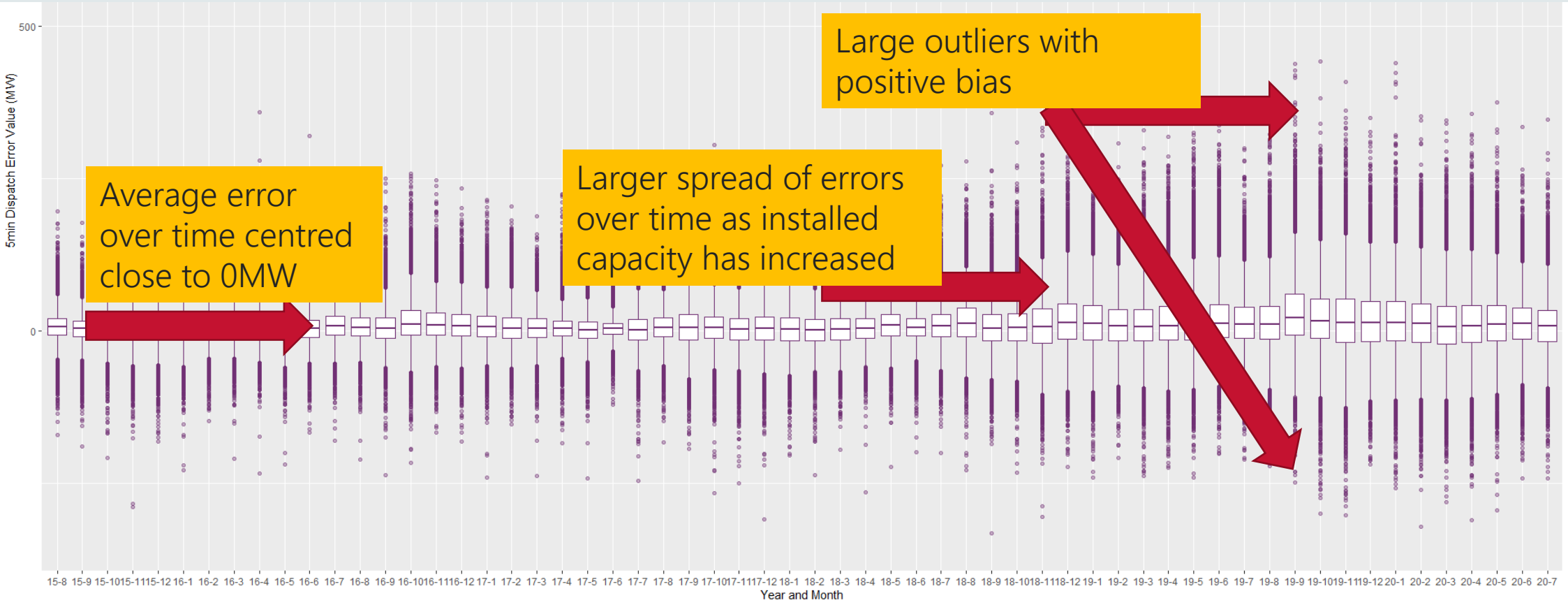
One example of a recent challenge being discussed in the industry

- Semi-scheduled aggregate dispatch error

- Recent discussion includes:
  - Series of Case Studies on Watt Clarity ®
  - AER semi-scheduled proposed rule change

Semi-scheduled aggregate dispatch error

- AEMO analysis of semi-scheduled aggregate dispatch error



Current challenges and generator compliance requirements

Petar Pantic
Ellise Harmer
Cameron Gibson-Williamson
Rob Selbie

Operational Forecasting

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ECM SCADA signals

- Semi-scheduled and non-scheduled generators must have remote monitoring equipment per NER S5.2.6.1.
- This requires the provisioning of all SCADA data marked as mandatory in the ECM.
- The dispatch UIGF depends on real-time measurements via ECM SCADA signals.

ECM SCADA issues

- If SCADA signals are not healthy, this will impact the accuracy of the dispatch forecast and hence, dispatch targets.

- Large deviations between unit output and targets can impact power system security, and contribute to higher Causer Pays Factors for your portfolio which results in higher FCAS charges.

- To minimise these impacts, any SCADA issues should be rectified as soon as they are identified[1].

- Examples of SCADA signal issues include:
  - ‘Bad’ quality SCADA signals.
  - Not reflecting actual farm conditions or farm availability.
  - Incorrectly configured.

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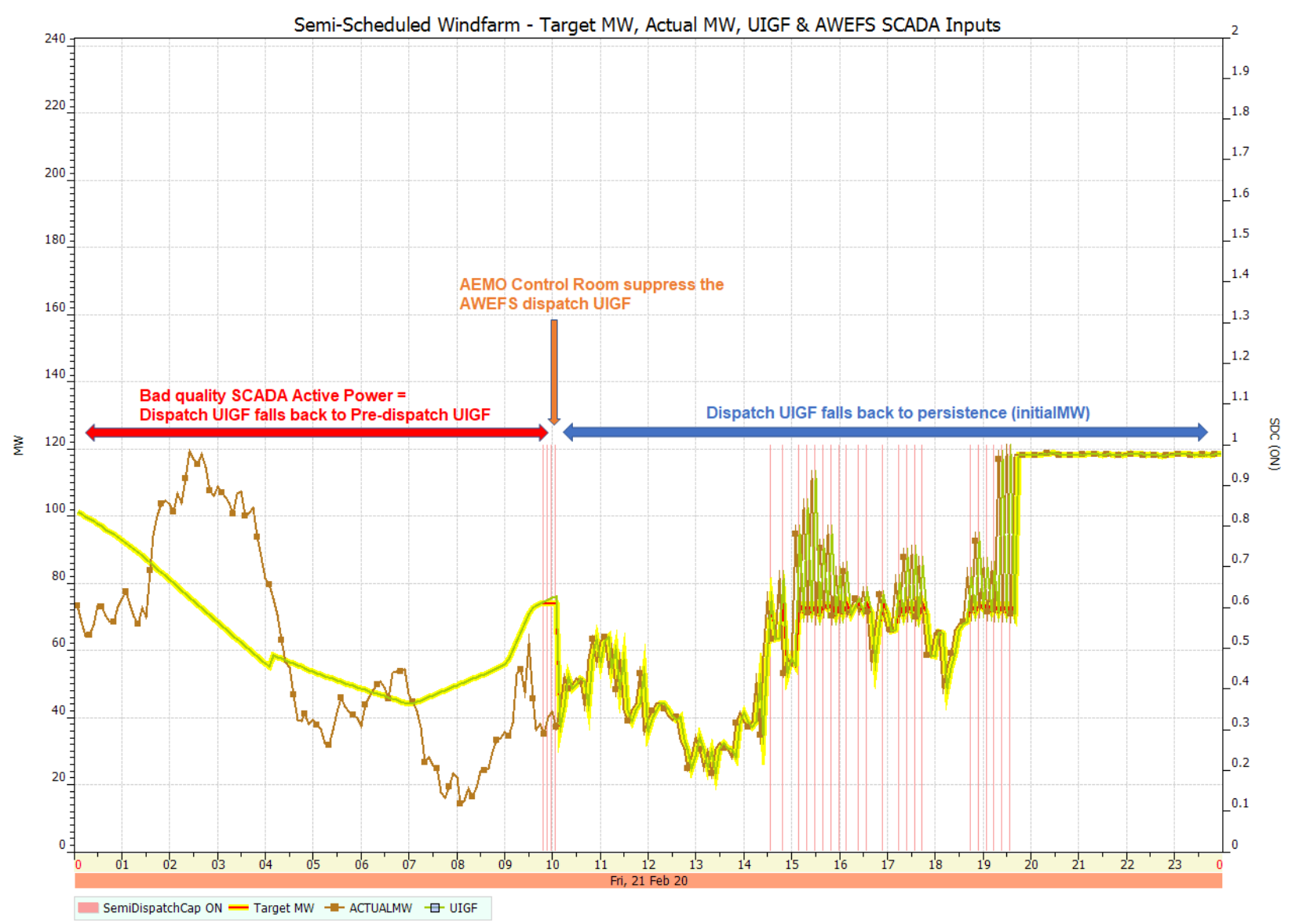
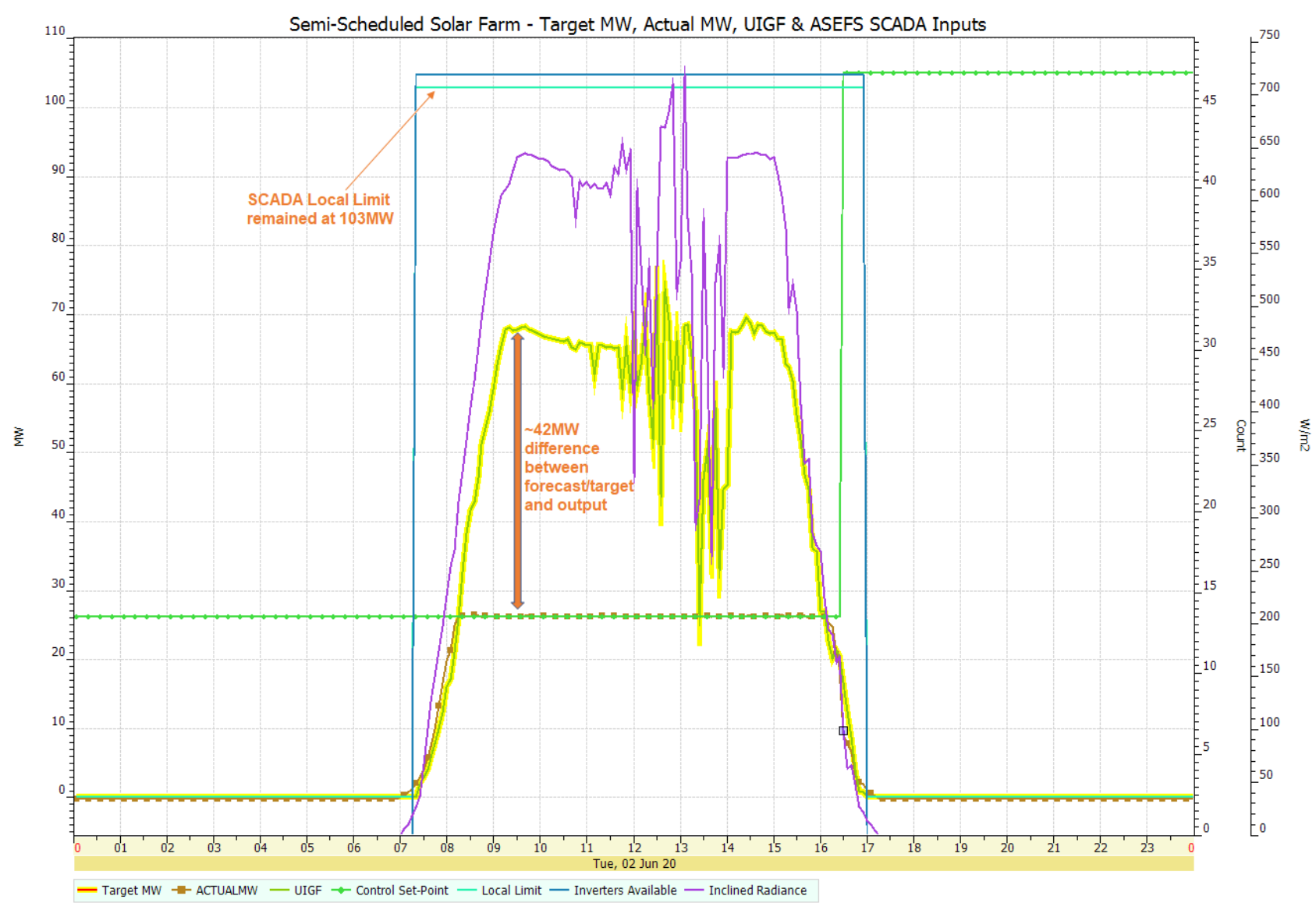
[1]AEMO Standard for Power System Data Communications:
https://www.aemo.com.au/-/media/Files/Electricity/NEM/Network_Connections/Transmission-and-Distribution/AEMO-Standard-for-Power-System-Data-Communications.pdf

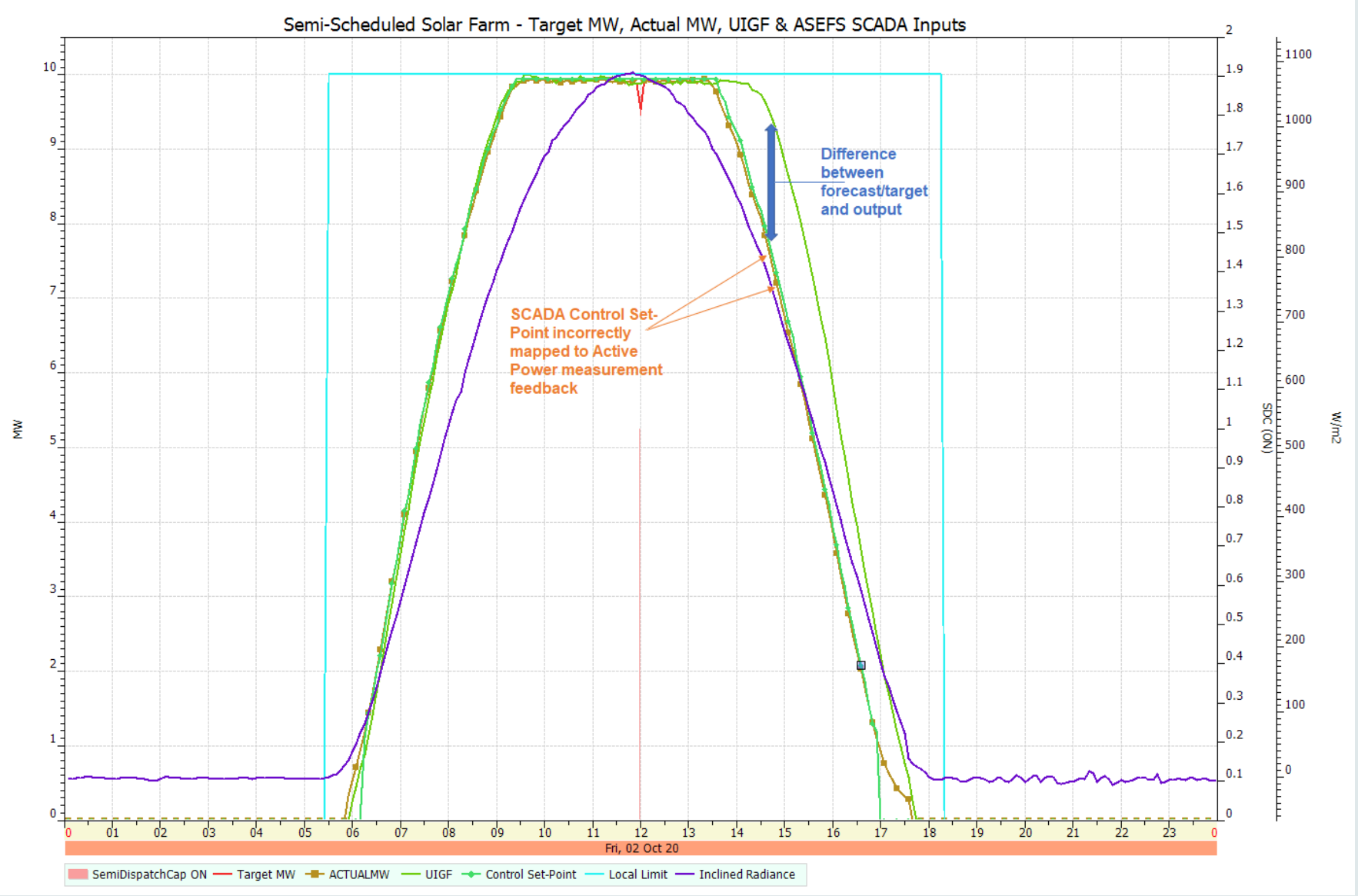
Example – Bad quality SCADA



Example – SCADA not reflecting actual farm availability



Example – SCADA incorrectly configured



Managing your plant – model development process

- AEMO schedules monthly updates to AWEFS/ASEFS forecasting models to develop new forecasting models or progress updating existing models.

- These updates include a multi-staged approach to achieve developing the full forecasting model:
  - For wind farms, a three-stage approach is required.
  - For solar farms, a two-stage approach is required.

- From the generator registration effective date, participants must meet the model requirements by the monthly cut-off date to be included in the scheduled monthly model update.

- The monthly cut-off date is typically scheduled on COB of the first or second Tuesday of the month.

Managing your plant – model requirements for the model development process

1. Ensure compliance with ECM SCADA signals[1] as per NER 4.11.1
   - Received as 'Good' quality, correctly configured, reflecting site-conditions.
   - Reflects EMMS portal availability.
   - Sufficient operational data is available (>2 days worth of data).

2. Updating and accurately reflecting intermittent generation availability (EMMS Portal) as per NER 3.7B(b)
   - Reflects SCADA Local Limit and SCADA Elements Available
   - Both Pre-Production and Production availabilities are required to be updated.

Failure to meet the above requirements by the cut-off date will result in at least a one month delay in implementing the forecasting model. This can contribute to delays in the commissioning program and reduce farm revenue.

Network limits impacting unit availability

- AEMO has received queries about how network limits should be communicated to AEMO to ensure these are reflected in the unit's forecasts.
- Network limits, such as runback schemes or outages, can impact a unit's availability and therefore, their capability to export power.
- Transmission limits are reflected in the Network Outage Scheduler (NOS) which consequently gets managed in AEMO's central dispatch process via constraints.
- Distribution limits, however, are not managed via NOS nor AEMO constraints unless the runback is a physical network security issue and AEMO has been notified of this.

Network limits impacting unit availability

- In all other instances, distribution limits should be managed via the SCADA Local Limit to ensure the dispatch UIGF is limited to the runback/outage level. Furthermore, these limits should also be reflected in the EMMS Portal to ensure the Pre-dispatch/ST PASA UIGF is also limited.

- If the SCADA Local Limit is unavailable, participants can update their bids or, as a last resort, contact the AEMO Control Room to request a quick constraint be invoked to the reduced capacity level.

- The Guide to Intermittent Generation has been updated to clarify this requirement, and the SCADA Local Limit ECM definition will be updated to clarify this requirement at the next ECM Consultation.

Network limits impacting unit availability

Availability submission guidelines

Upper MW Limit submission

The Upper MW Limit for a unit (DUID) is the lower of its plant availability and all technical limits on the capacity of its connection assets to export energy, and excludes limits on the transmission and distribution network that are managed by AEMO through the central dispatch process (eg. via constraints).

Read this guide along with documents on the Solar and Wind Energy Forecasting web page.

Participants must liaise with the Network Service Provider to determine if these limits have been communicated to and managed by AEMO through the central dispatch process to ensure appropriate action is taken thereafter.

Reference: AEMO Guide to Intermittent Generation

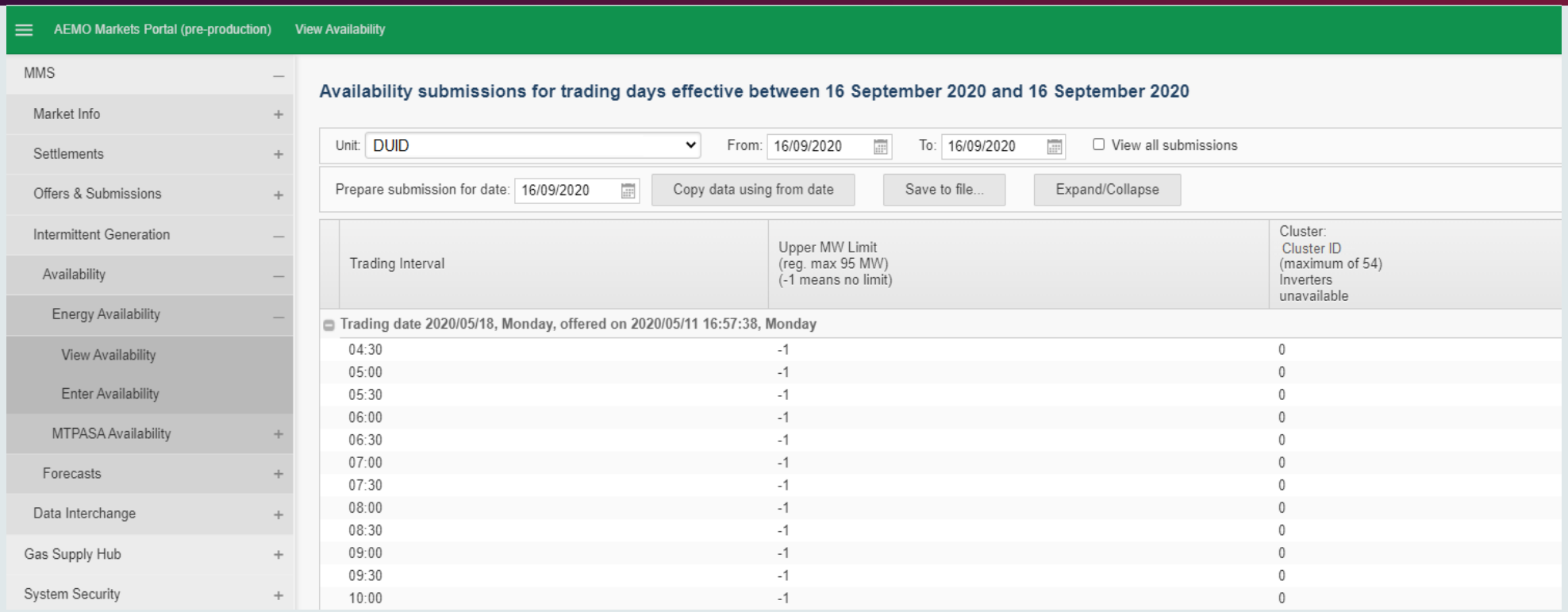
Requirement to submit plant availability

- As mentioned previously, semi-scheduled and some non-scheduled intermittent generators must submit plant availability as per Clause 3.7B(b) in the NER.

- The plant availability is an input to the forecasting model when preparing the UIGF in the Pre-Dispatch and STPASA timeframes.

- Participants must ensure their plant availability is consistent with availability reflected in SCADA Local Limit and SCADA Elements Available.

Requirement to submit plant availability



Participants must update availability for every expected or actual change in plant availability, unless the change in plant availability has already been communicated to AEMO via another mechanisms (e.g. limits modelled in constraints).

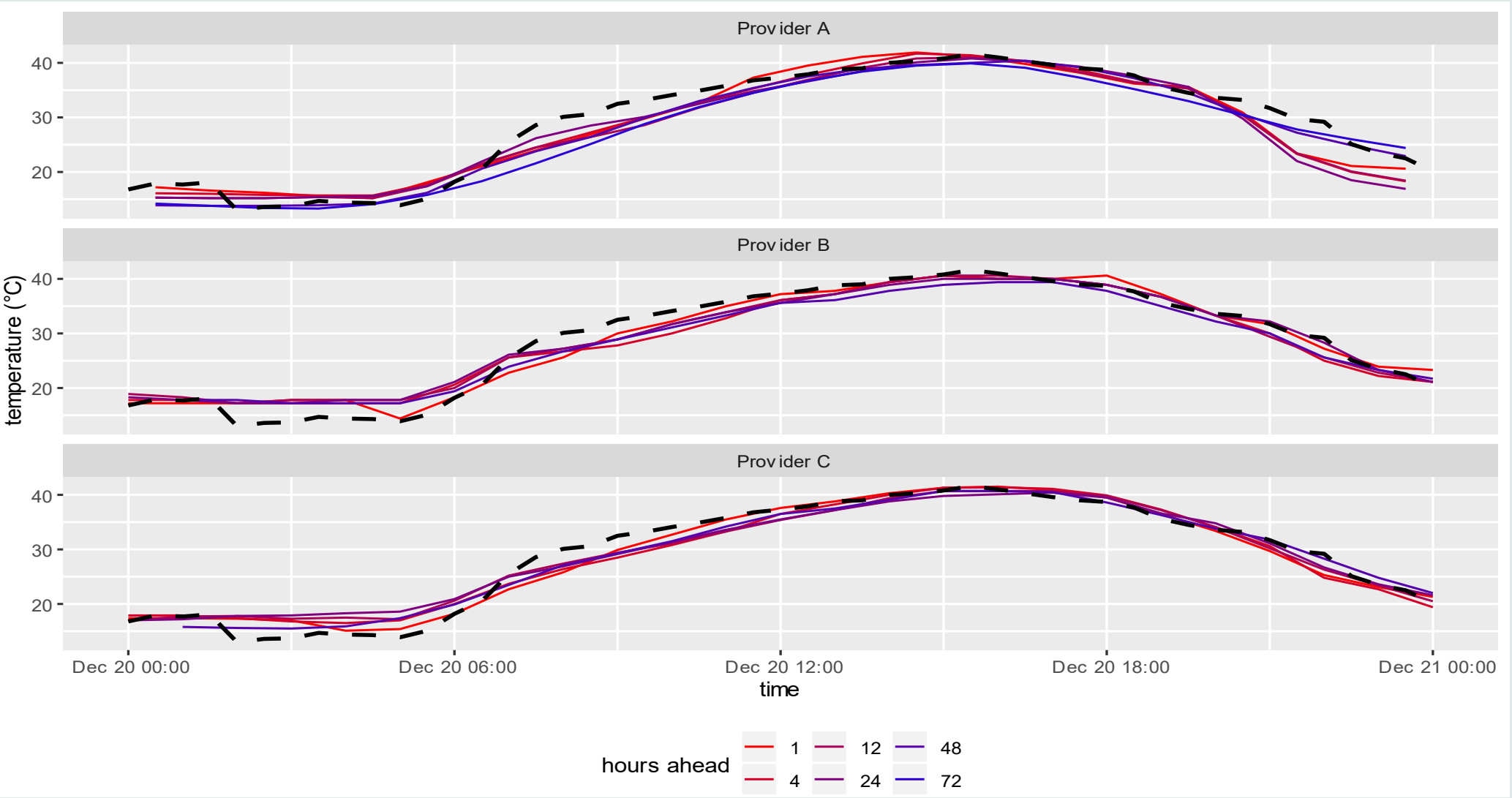
Note: Updating plant availability has an effect only on Pre-dispatch and PASA forecasts. Dispatch forecasts and targets must be managed via SCADA Local Limit and energy offers, respectively.

Requirement to submit plant availability

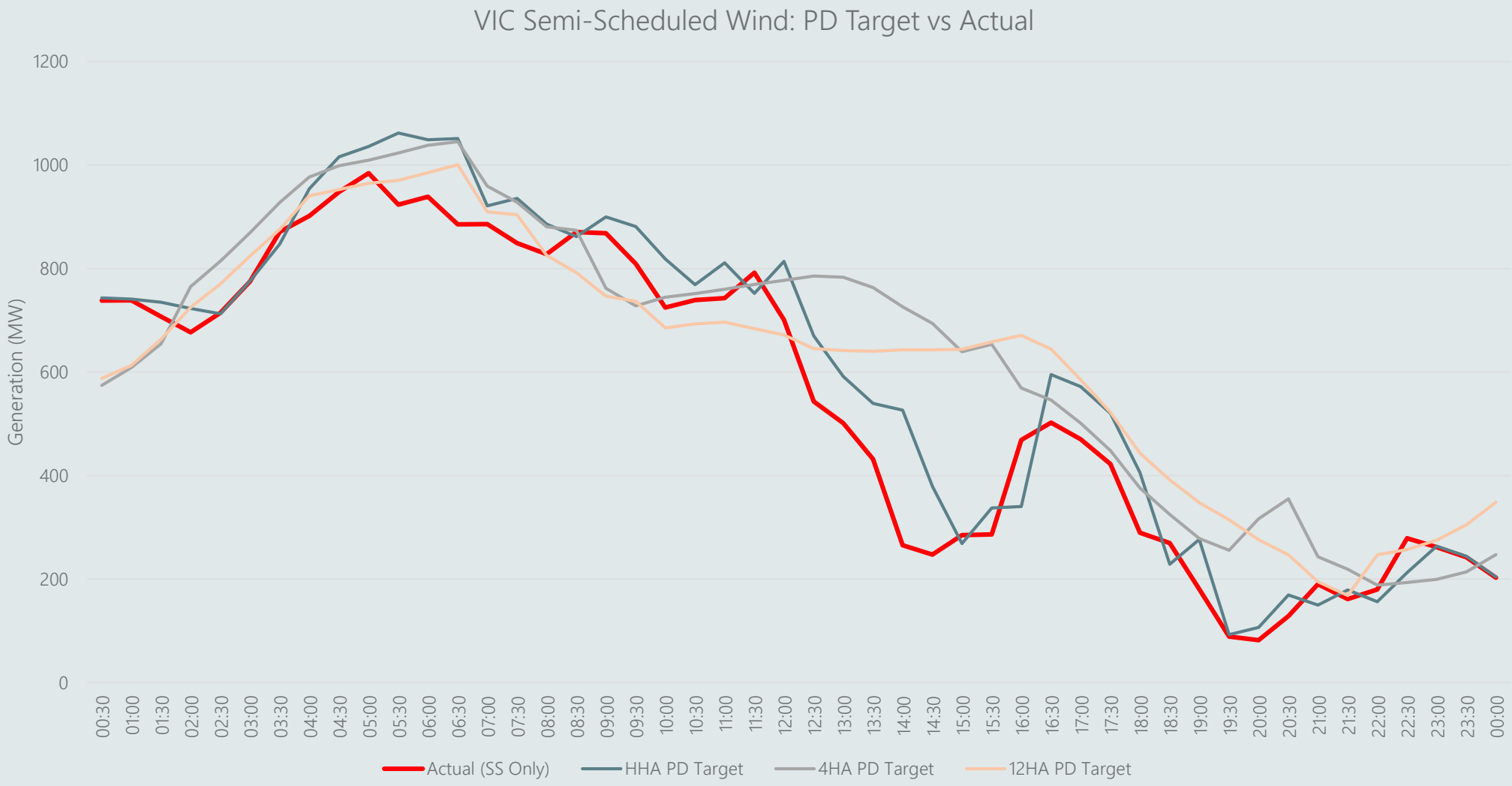
Examples of instances where availability changes should be submitted to AEMO include, but not limited to:

- an unplanned or planned outage of the generator or its elements.
- environmental conditions such as high ambient temperatures causing de-rating effects on turbines, modules, and inverters, in addition to high wind speeds causing de-rating or cut-out effects on turbines.
- GPS requirements and/or changes in commissioning hold point levels.
- transformer outages or provision of reactive power.
- network limits not modelled in constraints.
- changes in number of elements available to generate.

High-temperature turbine cut-out



The impact of availability submissions



High-temperature or high-wind cut-out

- Temperatures can reasonably be assessed as posing a risk of high temperature de-rating or cut-out from 3 days-ahead.
- Instances of high wind de-rating can be forecast within a few-hours ahead.
- Once high-wind or high-temperature de-rating has commenced, near-term availability (half-hour ahead to a few hours-ahead) can reasonably be updated depending on local conditions.
- A number of weather forecast providers can provide forecasts and situational awareness tools to assist with extreme temperature and wind forecasting.

NEM Local Temperature Alerts for Generators

- The process for informing generators of forecast elevated temperatures has been updated ahead of summer 2020-21.
- Representative weather stations for generation clusters in the NEM:
  - 16 zones where generation clusters are located
  - A weather station for each zone has been selected
- Local Temperature Alert Levels have been determined for each zone.
- Market notices to signal more local risk of high temperature derating and cut-out:
  - Issued each business day if forecast temperatures exceed any Local Temperature Alert Levels
  - Cover five days including the current day

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NEM Local Temperature Alerts for Generators

NEM Local Temperature Alerts for NSW, QLD, SA from 30 Nov 2020 to 04 Dec 2020

AEMO ELECTRICITY MARKET NOTICE

AEMO's weather service provider has issued forecast temperatures equal to or greater than the NEM Local Temperature Alert Levels for listed weather stations below.

NSW
Mudgee Ap (39+ Deg C): 1st Dec

QLD
Dalby Ap (37+ Deg C): 30th Nov, 1st Dec, 2nd Dec

SA
Port Augusta Ap (39+ Deg C): 30th Nov

The NEM Local Temperature Alert Levels are:

Launceston Ti Tree Bend: 33 Deg C, Dalby Airport: 37 Deg C, for all other selected weather stations: 39 Deg C.

AEMO requests Market Participants to:

1. review the weather forecast in the local area where their generating units / MNSP converter stations are located and,

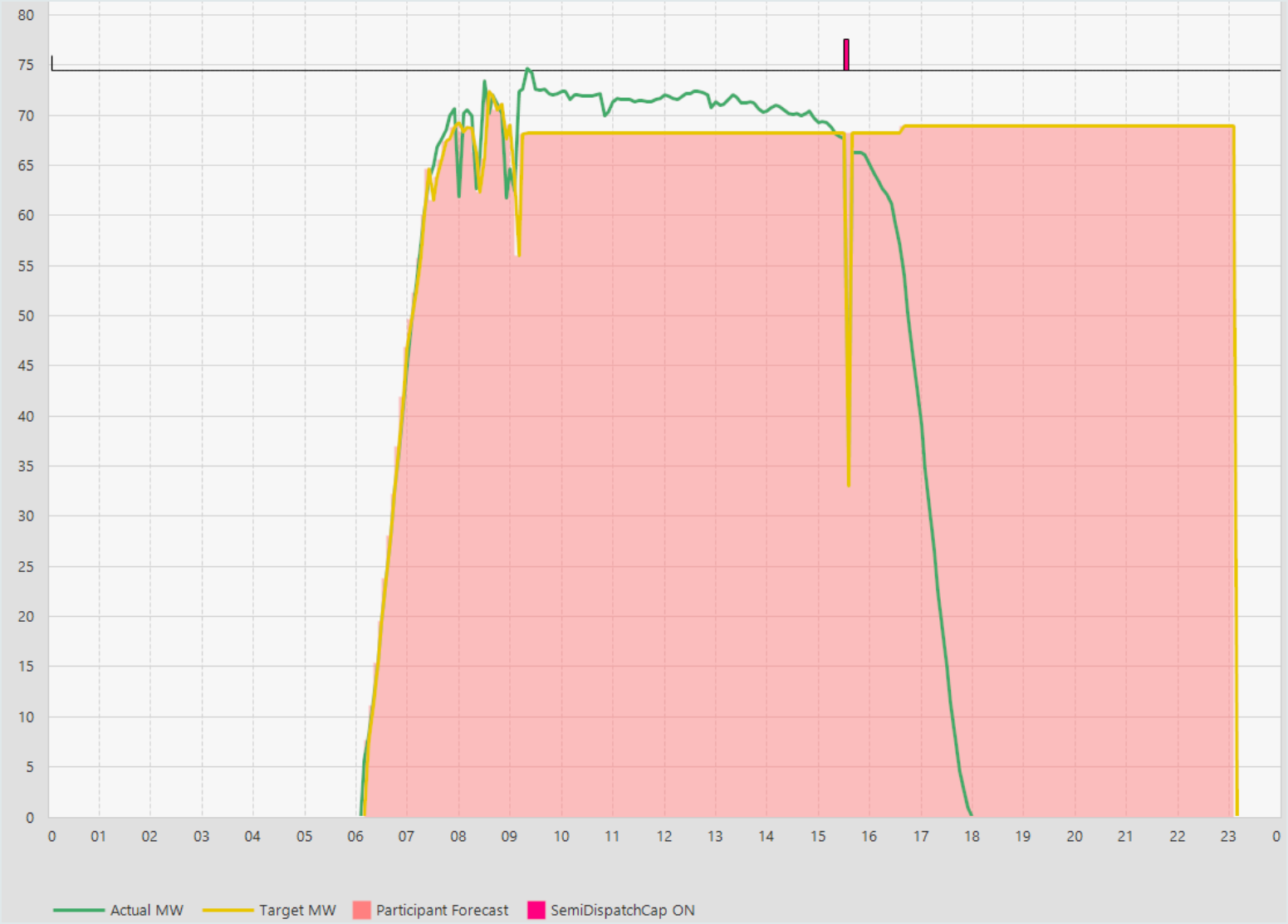
2. if required, update the available capacity in their dispatch offers or availability submissions consistent with the forecast temperatures.

AEMO Operations Planning

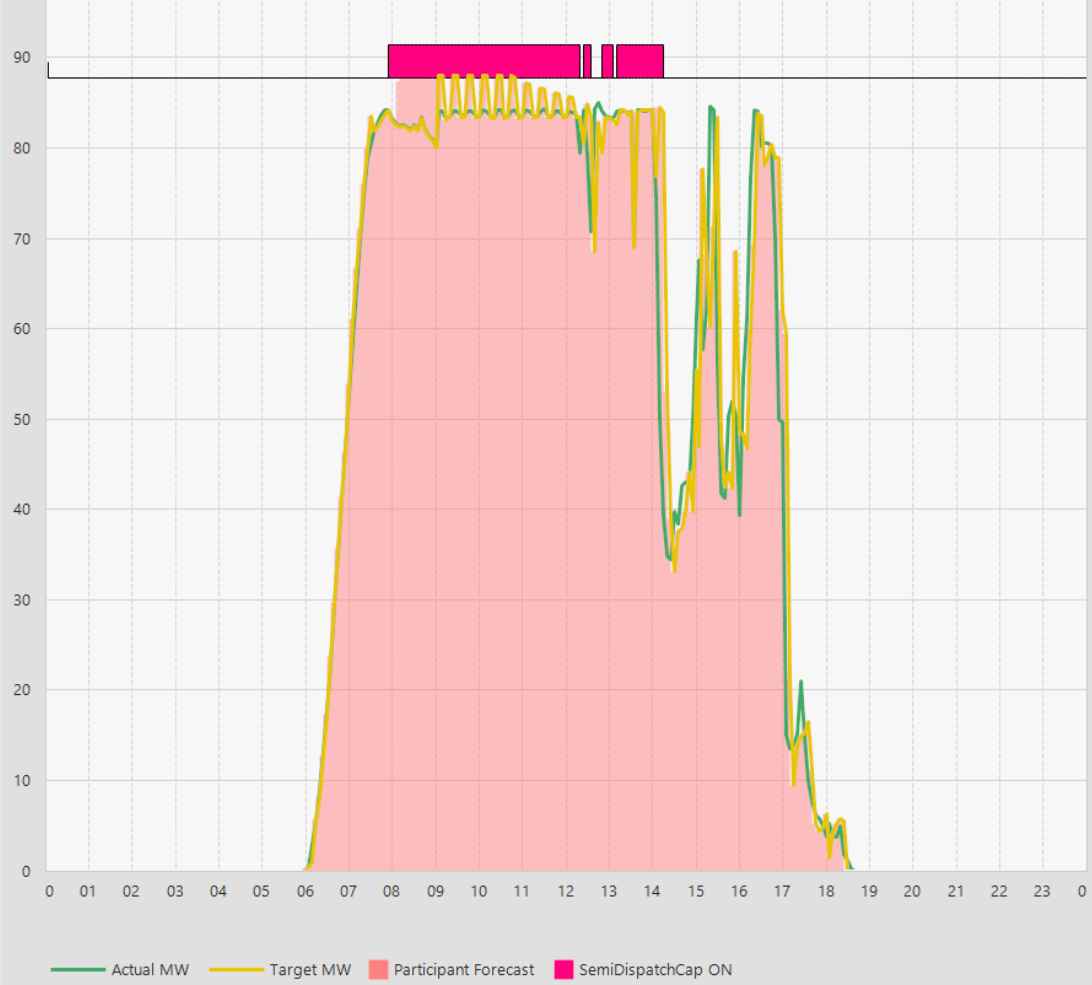
Further information is available at:
https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/forecasting-and-reliability/projected-assessment-of-system-adequacy/nem-local-temperature-alerts

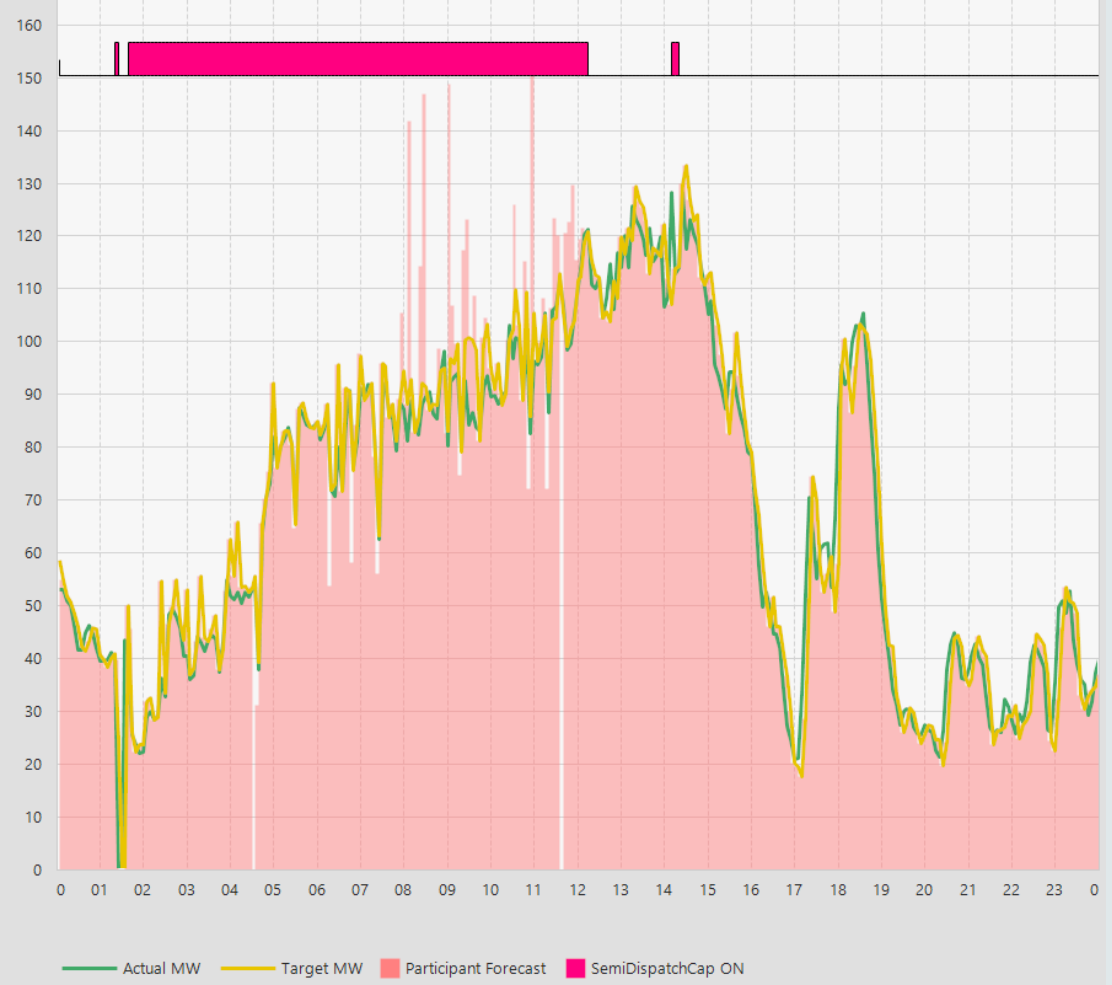
Self-forecasting operational issues

- There have been incidents where participants have submitted highly erroneous or erratic self-forecasts.
- These erroneous forecasts can contribute to increased causer pays factors, operational issues and threaten system security.



Self-forecasting operational issues





Self-forecasting operational issues

- Issues contributing to erroneous self-forecasts have involved:
  - untested self-forecast software releases or unstable models
  - issues with forecast inputs such as inverter faults and failed SCADA telemetry
  - incorrect forecast behavior during constrained intervals
  - failed self-forecast reliability, with submissions sometimes stopping for extended periods.

- On multiple occasions, AEMO control room has had to suppress the self-forecast when dispatch is impacted. When this happens it may take up to a week before the self-forecast can be reassessed and potentially unsuppressed.

- AEMO recommends self-forecast providers to **closely monitor** real-time forecast performance against the actuals, and **proactively suppress** the self-forecast themselves if performance degrades significantly (e.g. due to bad SCADA data).

Additional Perspectives

Bill Webb – AEMO Control Room

Marcelle Gannon – Global-Roam

Key Changes – Control Room Perspective

- Intermittent Gen
  - Weather as a fuel source.
  - Timing of significant weather changes.
  - Turbine/Inverter cut-out.

- Massive growth in number of generators
  - Handful of centralised large power stations per region → 30+ distributed smaller generating systems per region and growing.
  - Communication.

- Generator connections in weaker parts of the network
  - System Strength

- SCADA
  - Less reliable and sometimes down for longer.
  - Time consuming – following up with participants.
  - Manual intervention by control room – Hand dressing → increased risk.

Managing the Technical Envelope

- System Strength
  - Rapidly evolving issues and procedures.
  - Control Room reliant on off-line studies.

- Current System Strength Hotspots
  - Vic/NSW outer grid.
  - North Qld.
  - Tasmania.

- Network outages -> limits on multiple intermittent Gens
  - Challenge to monitor and manage.
  - Planned outage pre-requisites E.G. RCTS Bus outage.
    - 12 Vic Gen limits (MW and/or inverter limits)
    - 8 NSW Gen limits (MW and/or inverter limits)
    - 6 other NSP pre-requisites (SVC, control schemes, network config)
  - Affected Gens sometimes reduce in the last DI before outage start.
  - Ramping constraints - 30 minutes max.

- Voltage Control
  - Increasing need to use intermittent Gens

Communication

- Massive increase in number of Gens
  - Volume of operational comms

- Keeping contact details current – high churn rate
- Sometimes delays in contacting via phone (after hours)
- Timeliness to implement AEMO instructions – voltage control, disconnect

- Complex lines of communication
  - AEMO vs TNSP/DNSP.
  - Planned outages vs unplanned events.

- Increase in Participant inquiries
  - Target not as expected.
  - End time of network limit (e.g. due to network outage).
  - Participant queries – Intermittent Gen Portal (i.e. EMMS Markets Portal).

Questions and Discussion

Further information

AEMO Standard for Power System Data Communications – Sets out the standards with which Data Communication Providers must comply when transmitting data (SCADA) to and from AEMO.

https://www.aemo.com.au/-/media/Files/Electricity/NEM/Network_Connections/Transmission-and-Distribution/AEMO-Standard-for-Power-System-Data-Communications.pdf

Ancillary Services Causer Pays Contribution Factors – Causer pays factors and supporting data.

https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/system-operations/ancillary-services/ancillary-services-causer-pays-contribution-factors

Dispatch – Dispatch procedure providing instructions and guidelines covering market operations in relation to the operation of the power system.

https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Power_System_Ops/Procedures/SO_OP_3705---Dispatch.pdf

Energy Conversion Model (ECM) Guidelines – Current AWEFS and ASEFS ECM Guidelines.

https://www.aemo.com.au/energy-systems/electricity/national-electricity-market-nem/system-operations/dispatch-information/policy-and-process-documentation#forecasting

Further information

Guide to Data Requirements for AWEFS and ASEFS - Supplementary Wind and Solar ECM material.

https://aemo.com.au/-/media/files/electricity/nem/security_and_reliability/dispatch/policy_and_process/guide-to-data-requirements-for-awefs-and-asefs.pdf

Guide to Intermittent Generation - Information regarding submitting intermittent generation availability to AEMO.

https://aemo.com.au/-/media/files/electricity/nem/it-systems-and-change/guide-to-intermittent-generation.pdf

NEM Local temperature alerts – Information on high temperature alerts in the NEM:

https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/forecasting-and-reliability/projected-assessment-of-system-adequacy/nem-local-temperature-alerts

Participant Self-forecasting - Information and registration of semi-scheduled generators providing their own (self) dispatch forecast.

https://www.aemo.com.au/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/operational-forecasting/solar-and-wind-energy-forecasting/participant-forecasting

Primary Frequency Response (PFR) – Information about the PFR requirement for scheduled and semi-scheduled generators.

https://aemo.com.au/en/initiatives/major-programs/primary-frequency-response

Contact information

- AEMO Operational Forecasting

op.forecasting@aemo.com.au

- AEMO Support Hub

https://aemo.com.au/en/contact-us