



AEMO Workshop: Outage Planning Methodology

July 2018

Purpose and agenda

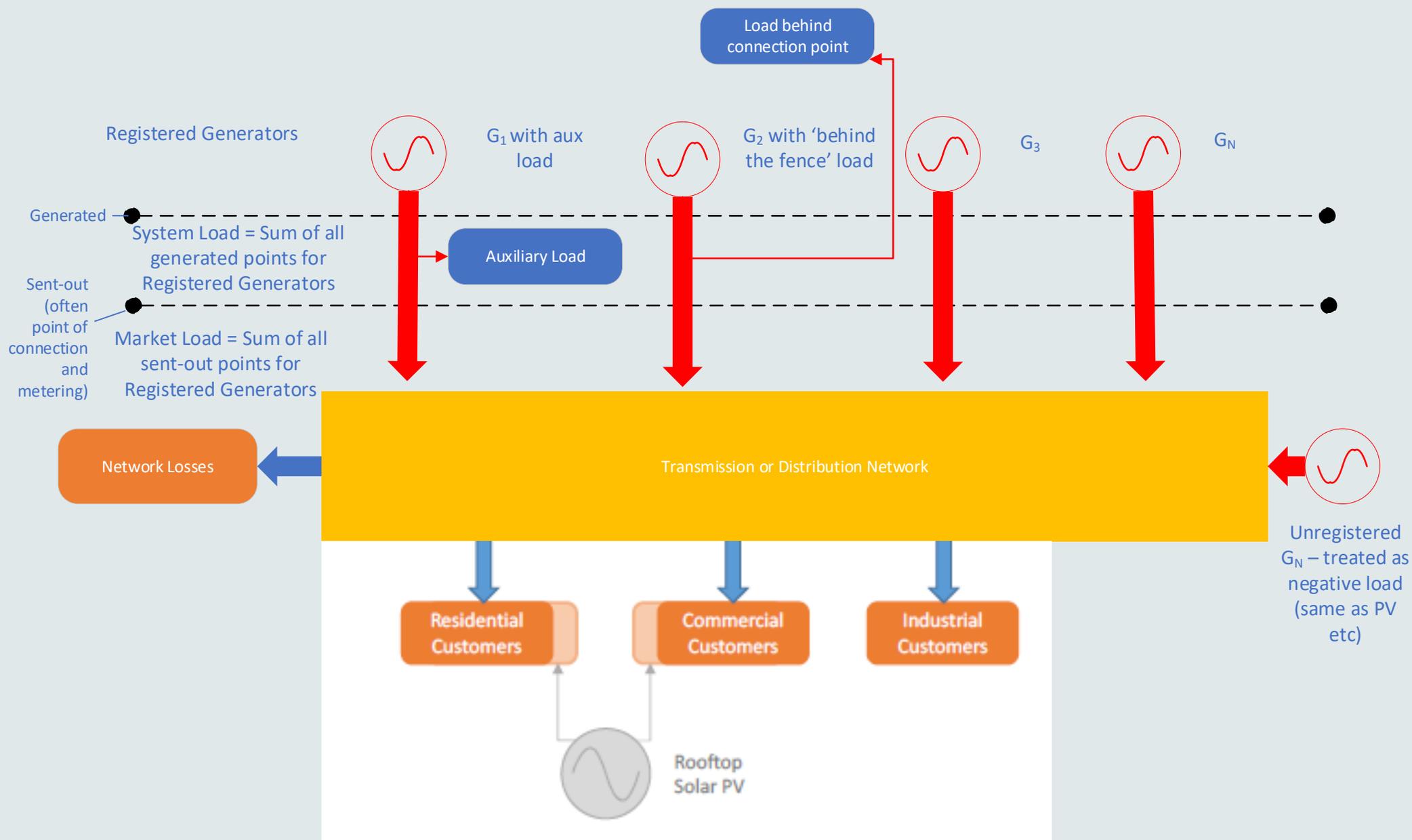
- Purpose
 - Work through methodology of Projected Assessment of System Adequacy (PASA) Planning Margin and use in approval of outages
- Workshop outcomes
 - Methodologies discussed and understood by stakeholders
 - WEM Rule issues and Procedural requirements identified (as required)
- Agenda
 - Historical issues that have impacted everyone relating to outage processes
 - Methodologies
 - Intended approach
- Note: references to System Management mean AEMO

Historic issues that have impacted everyone

- AEMO's methodology to ensure the Facilities remaining in service after outages allow the power system to be operated within the Technical Envelope is unclear
- The Reserve Margin is the capacity remaining after all impacts are taken into account
 - If the Reserve Margin is zero, or not sufficiently positive, the Power System may not be secure
 - In general, AEMO approves outages by ensuring a positive Reserve Margin
- However, there has always been a lack of clarity on the
 - Calculation of the Reserve Margin
 - Capacity included in the Reserve Margin for:
 - Non-Scheduled Generation
 - Demand Side Programmes
 - Application of the Reserve Margin
 - Coordination of Network Outages that unduly impact the operation of a Market Participant's Facility

A bit of background

Generated versus sent-out



AEMO uses both generated and sent-out to operate the Power System

	Load Forecast	Ancillary Services	Portfolio	IPP Dispatch
GENERATED	System Load Forecast	Requirement	Dispatch	Requirement
Conversion to sent-out	Single binomial transformation based on history	No conversion	N/A	AEMO-developed coefficient for each Facility (RTDE coefficients)
SENT-OUT	Market Load Forecast	Dispatch	N/A	Dispatch Instruction

	Outages	PASA Forecast	Reserve Margin	Settlement
GENERATED	Outage submission and assessment	Development	Development and usage	N/A
Conversion to sent-out	AEMO-developed coefficient for each Facility (Coefficient 1)	Single binomial transformation based on history	Coefficient 1	N/A
SENT-OUT	Reported values	Reported values	Reported values	End of interval values

Load Forecasts – three separate methods

- Trading Interval Load Forecast
 - Metrix model includes history, weather patterns, and recent usage
 - Developed using Generated values, published on a Sent-out basis
 - Published daily with Trading Interval resolution for up to seven day horizon
 - Values for remainder of Balancing Horizon updated each interval
- PASA
 - Historical model only, does not include recent weather or usage
 - Six hour resolution for three year horizon
 - Developed using Generated values, published on a Sent-out basis
 - Sense-checked with ESOO
 - Used for ST PASA and MT PASA
 - Note first week of published ST PASA forecast uses ‘high case’ Trading Interval Load Forecast
- ESOO
 - Econometric determination of single yearly peak value over 10 year horizon
 - Based on sent-out data

Trading Interval and PASA Load Forecast approach

- Identify non-temperature dependant loads which operate continuously (Block Loads)
- Remove Block Loads from total SWIS load
- Forecast SWIS temperature-dependant demand using relevant weather information (forecast and historical)
- Forecast Block Loads
- Add Block Load forecast to SWIS forecast demand

Reserve Margin

Outage assessment

- Planned and unplanned outages occur every day
- AEMO can only approve outages where the Facilities remaining in service [WEM Rule 3.19.6]:
 - Are greater than the load forecast for the relevant time period
 - Are capable of meeting the Ancillary Service Requirements
 - Allow AEMO to ensure the power system is operated within the Technical Envelope
- AEMO uses the Reserve Margin to assess these requirements
 - If the Reserve Margin is positive, the requirements are generally met
- Reserve Margin uses the relevant daily peak as “the load forecast for the relevant time period”
 - The daily peak currently occurs between 16:00 and 20:00
- To calculate the Reserve Margin, AEMO must estimate each Facility’s capacity
 - As AEMO can dispatch Scheduled Generators to their maximum sent-out capacity in Standing Data, unless there are indications of unreliability, this value is used
 - Due to their characteristics, estimating the capacity of Non-Scheduled Generators and Demand Side Programmes is not so simple

Intended Reserve Margin calculation

- The capacity of Scheduled Generators, Non-Scheduled Generators and Demand Side Programmes after allowing for outages that AEMO has knowledge of or has been informed of, less
- The mean plus two standard deviation system peak load forecast, varied seasonally, less
- The effects of any generation being constrained due to insufficient transmission capacity remaining in service, calculated as total capacity allowed from a subset of generators, less
- An allowance for that quantity of generation capacity required to operate as an Ancillary Service, to maintain the frequency standards specified in the PSOP: Power System Security, calculated as 70% of the forecast largest capacity unit, less
- An allowance for Ready Reserve, calculated as:
 - 30% of the largest generator,
 - 70% of the second largest generator, and
 - total Load Following Ancillary Services available, less
- An allowance for the availability of Non-Scheduled Generation, varied seasonally by fuel type, less
- An allowance for the availability of Demand Side Programmes

Capacity of Demand Side Programmes (DSP)

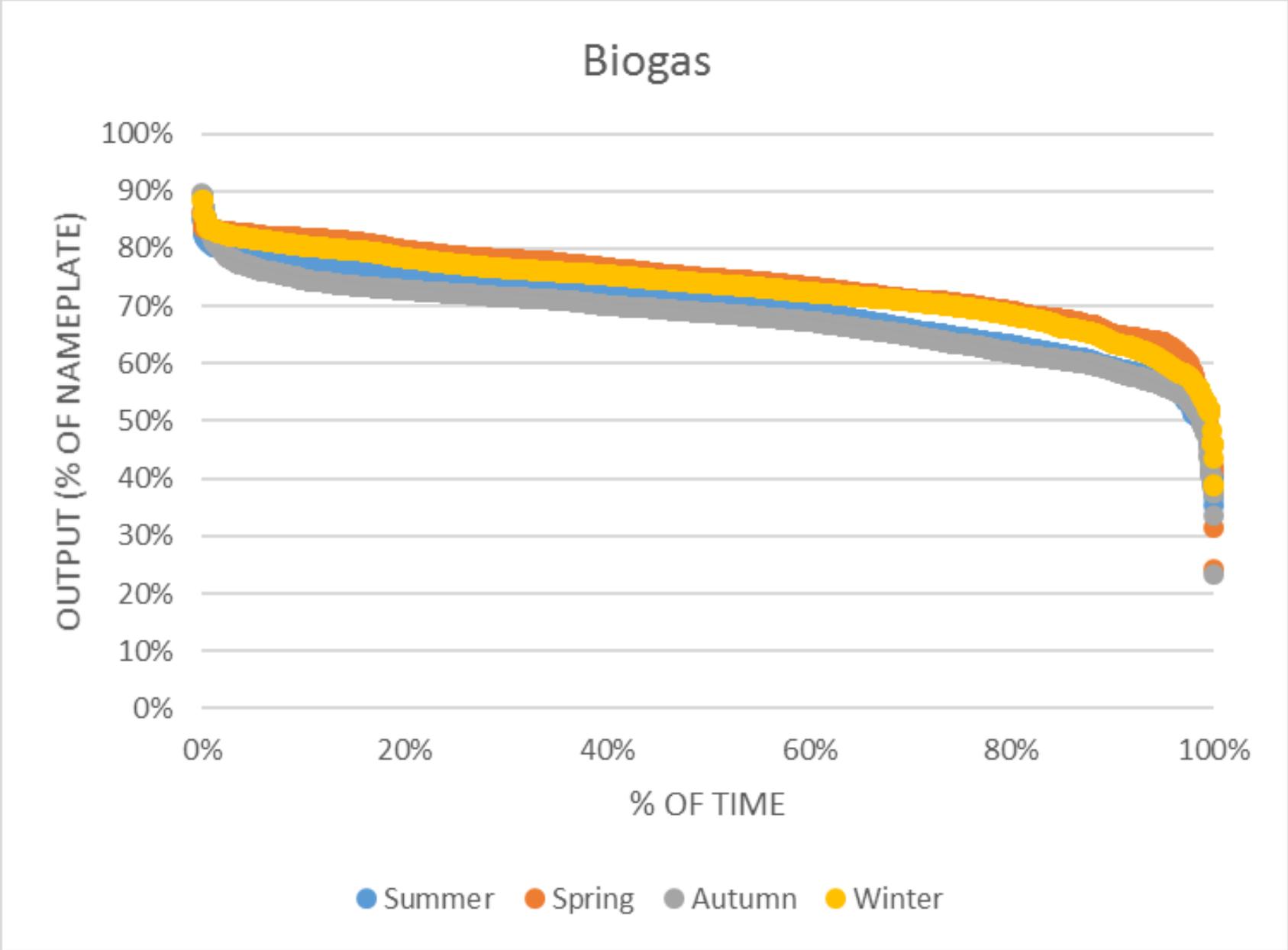
- Historically, AEMO has not included any capacity from DSP in the Reserve Margin
 - This is because it has been difficult to identify whether DSP will be available, especially when lead time is long
- The requirements in the WEM Rules have changed
 - DSPs now have a maximum lead time of 2 hours
 - This is comparable to synchronisation times for many Scheduled Generators
 - Other changes have combined to increase the usability of DSP and AEMO's ability to rely on the capacity
- Therefore, 100% of DSP will be included in the Reserve Margin
- AEMO will assess this inclusion from time to time
- AEMO will include a requirement in the Power System Operating Procedure to publish a methodology for the amount of DSP to be included in the Reserve Margin

Capacity of Non-Scheduled Generation

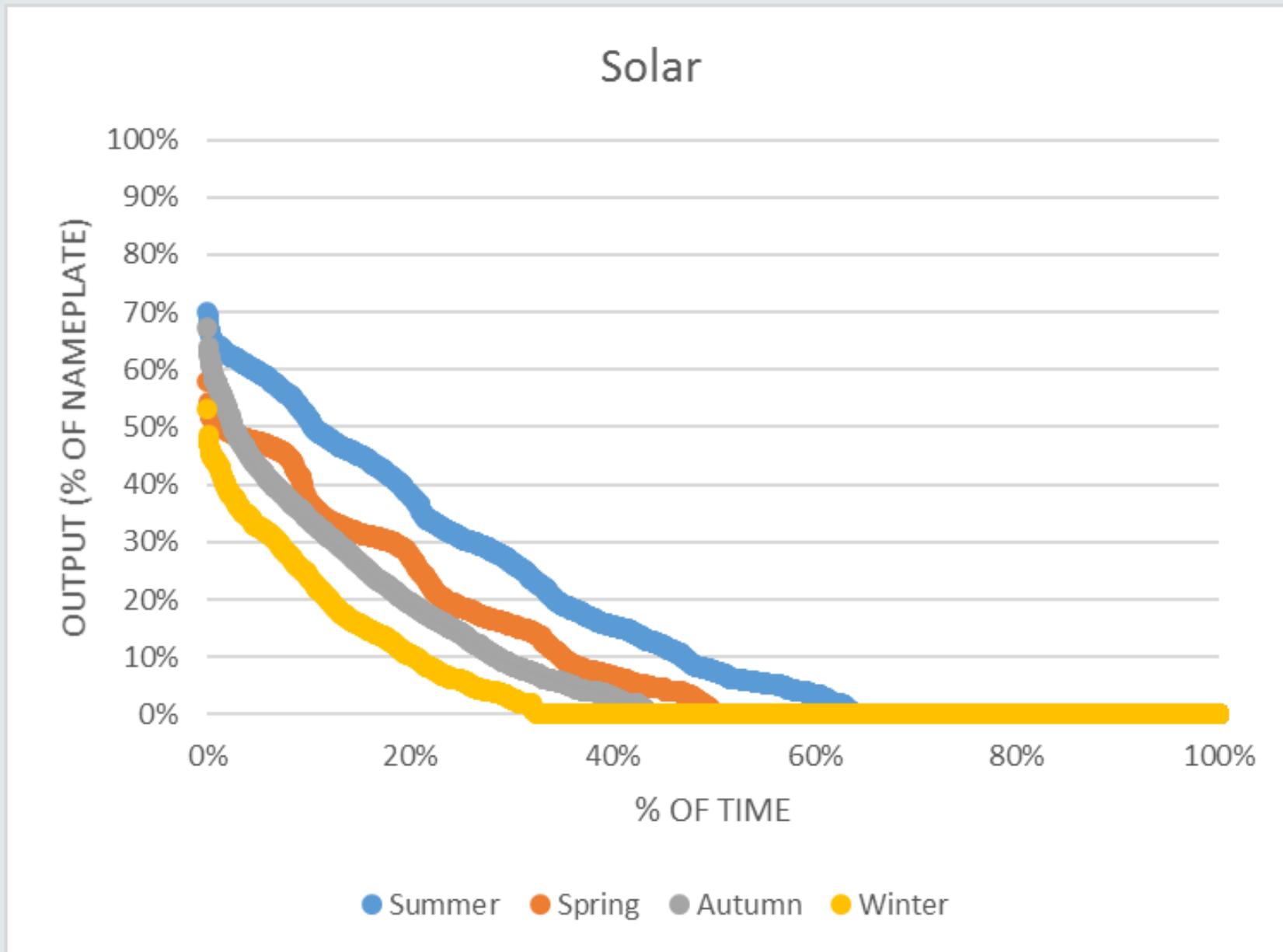
- Availability of Non-Scheduled Generation (NSG) equipment (such as wind turbines) is high – in the range of 95-99%¹
- Historically, AEMO has allowed on average 8 to 16% of nameplate capacity in the Reserve Margin but hasn't detailed the rationale
 - This is the estimated output that will not be met 10% of the time (90% POE)
- AEMO will include a requirement in the Power System Operating Procedure to publish a methodology for the amount of NSG to be included in the Reserve Margin
- The methodology will be required to consider:
 - A NSG availability factor
 - Fuel types, such as solar, wind, biomass
 - Seasonal attributes
- AEMO will determine the NSG availability factor
 - Based on five years of historical Trading Interval data (or the closest approximation if data is unavailable) over peak periods (4-8pm)
 - 90% POE
- The next slides will discuss AEMO's general analysis of NSG availability by season and fuel type
 - AEMO will determine the availability of Facilities on an individual basis

¹ McKinsey, 2008, "How to operate and maintain wind assets", available at:
https://www.mckinsey.com/~media/mckinsey/dotcom/client_service/epng/pdfs/mck%20on%20epng/wind_assets.ashx

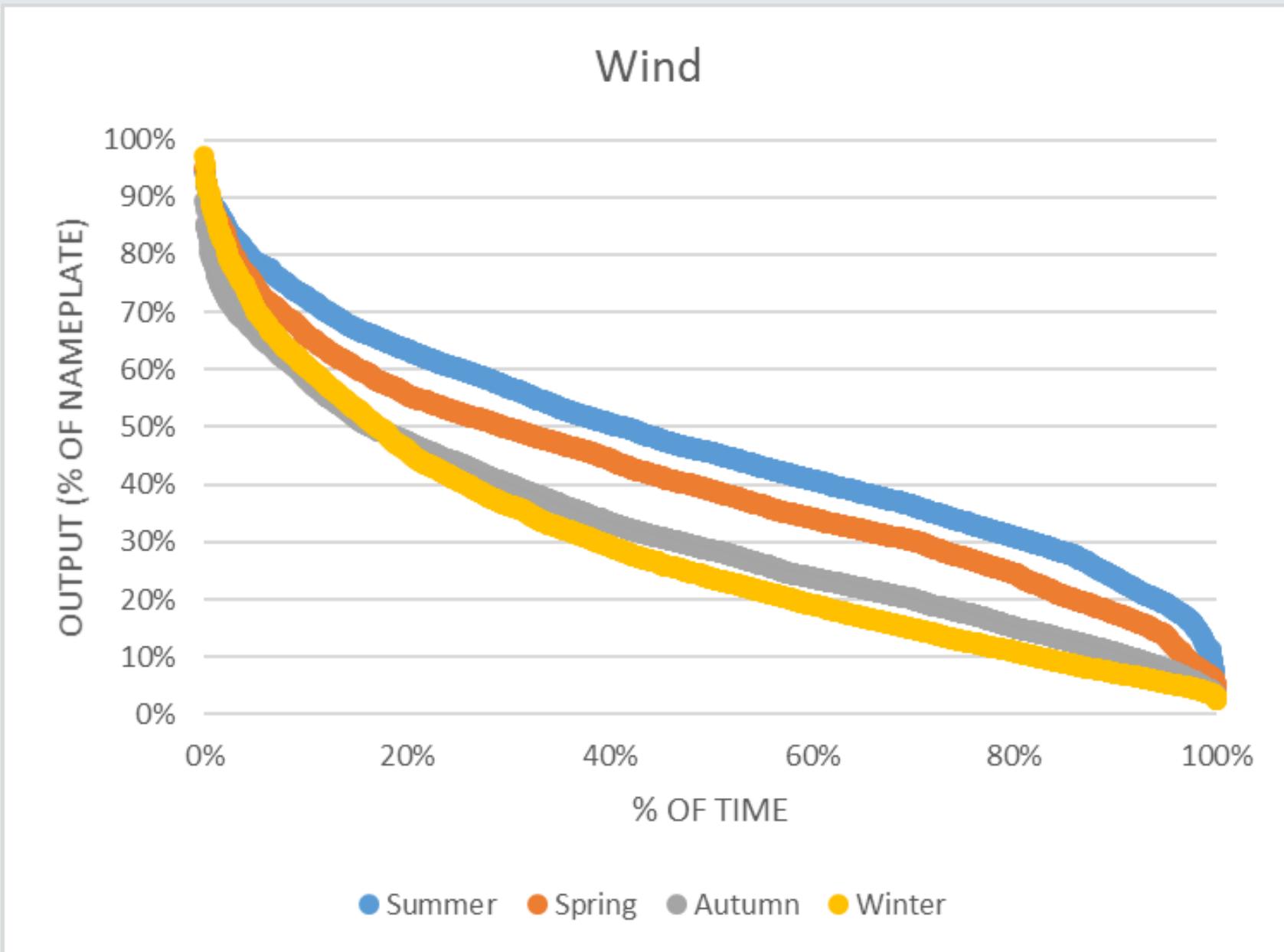
Biogas output duration



Solar output duration (not residential PV)



Wind output duration



Average NSG capacity to include in the Reserve Margin

	90% POE output as % of nameplate capacity		
Season	Wind	Solar	Biogas
Summer	20	0	59
Spring	14	0	65
Autumn	7	0	59
Winter	4	0	64

- New NSGs, including those on the Generator Interim Access (GIA), will be included based on the nearest similar Facility
- GIA network constraints cannot be forecast as this depends on Participant bidding, and therefore will not be included

Transmission constraints

- Up to now there have been relatively few transmission constraints in the SWIS
 - Most limitations affect specific generators and only occur with network outages
 - Forced network outages cannot be forecast
 - With Planned Outages on network equipment, affected Scheduled Generation generally also takes a Planned Outage
- However, GIA will change this
- Many GIA constraints cannot be forecast as the constraints depend on bidding behaviour
- There may be some overlap between capacity included in the Reserve Margin for GIA generators and impacted Scheduled Generators
- AEMO will resolve this conflict by:
 - Identifying network capacity above requirement for Scheduled Generators ('headroom') based on network limitations for GIA Facilities
 - Excluding any GIA NSG capacity allowance that exceeds the headroom
- AEMO will include a requirement in the Power System Operating Procedure to publish a methodology indicating how transmission constraints will be included in PASA

Aggregation of values within each PASA study period

- For each relevant study period in the PASA Horizon, values are aggregated from Trading Intervals
 - For example, the study period for MT PASA is weekly

Value	Value over study period included
Generation and DSM capacity	Lowest
Outages	Highest
Demand forecast	Highest
Transmission constraints	Highest
Ancillary Service and Ready Reserve requirements	Highest

PASA Reporting

- Because of different conversion methodologies from generated to sent-out, reported Reserve Margin differs from one used for outage assessment
- More (or less) information can be published
- What would stakeholders prefer?
 - Generated or sent-out or both?
- What is most valuable to display graphically?
 - Load forecast?
 - Outages?
 - Total available capacity?
 - Reserve Margin?
 - Other?

Outage processes

Coordination of network outages that impact Market Participants

- For any Network Outage that impacts a Market Generator's Facilities, the Network Operator must provide sufficient information to AEMO to demonstrate that it has used best endeavours to inform that Market Generator [WEM Rule 3.18.6(h)].
- Where a Network Outage is likely to unduly impact the operation of a Market Participant's Registered Facilities, AEMO may require coordination to minimise the impact of the Network Outage on the Market Participant Facilities [WEM Rule 3.18.5C]
 - The requirement to coordinate is an obligation on both the Network Operator and the Market Participant
- Circumstances that are 'likely to unduly impact' include where:
 - The Registered Facility's participation in the Balancing Market would be impacted
 - A Facility subject to an Ancillary Services Contract would be unable to provide the contracted services

Intended coordination process

- AEMO will contact both the Market Participant and the Network Operator, providing details of the outage and any other relevant information
- We will ask both parties to respond individually to AEMO with:
 - Evidence that the coordination was undertaken in good faith and that options were provided (eg details of emails, meetings)
 - The outcome of coordination
- The outcome will either be:
 - Both parties agree to the original timing of the outage
 - A Market Generator should indicate whether a Planned Outage will be requested
 - Both parties agree to new timing
 - A Market Generator should indicate whether a Planned Outage will be requested
 - Parties were unable to agree
- If both parties were unable to agree, AEMO has no choice but to assess the original outage

Intended approach

AEMO intends to

- Schedule AEMO Procedure Change Working Group on PASA in late November followed by formal consultation
- Publish methodologies for:
 - Relevant assumptions related to the aggregation of data for the PASA study
 - The peak load forecast where this must include demand patterns over differing resolutions, weather conditions and Block Load assumptions
 - Reserve Margin inclusion of NSG, DSP and transmission constraints based on this presentation
- Implement the approach for rescheduling and coordination of network outages that impact Market Participants
- Update PASA user guide to describe:
 - Fields included and what they represent
 - How the Reserve Margin is reported
- Update PASA tools and reports (ST and MT PASA)