MT and ST PASA – Modelling Concepts and Scenarios

WRIG – 24 June 2021

Agenda

1. Recap Section 3.16 of the WEM Rules
2. Understanding Key Components
   a) ST and MT PASA Market Model Concept
   b) Inputs and Pre-processing
   c) ST and MT Scenarios Modelling
   d) Outputs & Post -Processing
3. Next Steps

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Section 3.16A of the WEM Rules – Projected Assessment of System Adequacy (PASA)

- AEMO will be required to conduct periodic PASA assessments and publish a rolling MT PASA and ST PASA as set out in clause 3.16.1
  - At least each week of the 36 month period from the starting date of the assessment (MT PASA)
  - At least each day of the seven day period from the starting date of the assessment (ST PASA)

- Clause 3.16.2 set out the new PASA objective linking it to Power System Security and Power System Reliability framework.

- Clause 3.16.3 set out the obligation on Rule Participants to provide the information for AEMO to conduct and prepare MT PASA and ST PASA. Details of the information required will be set out in the WEM Procedure.

- Clause 3.16.7 deals with forecasting, specifically the 36-month forecast as the week ahead forecast is covered in the SCED rules under 7.3 (Forecast Operational Demand).

- Clause 3.16.8 sets out the core requirements of the MT and ST PASA report which are linked to the objectives set out in clause 3.16.2.

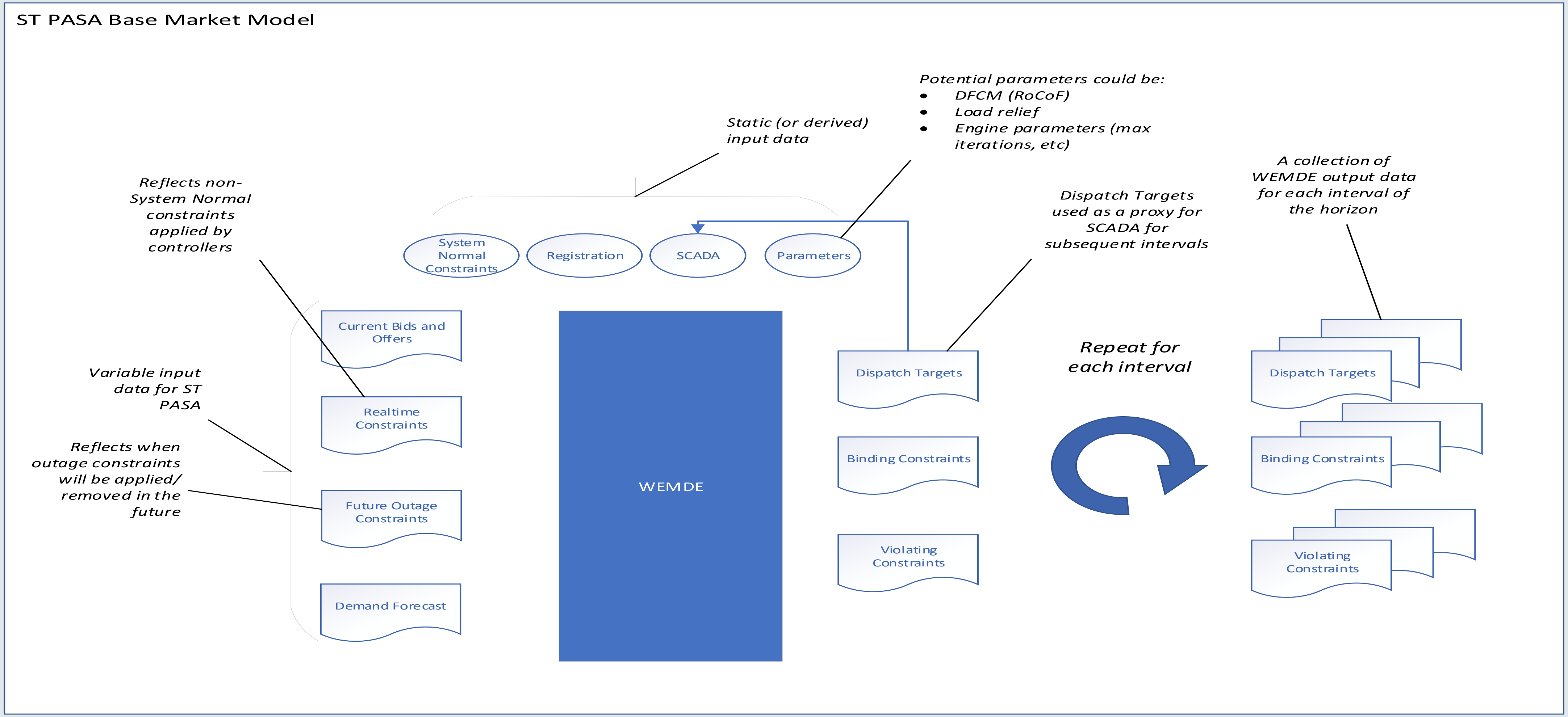
- Clause 3.16.9 enables AEMO to issue an updated MT PASA or ST PASA where there has been a material change.

- Clause 3.16.10 provides head of power for AEMO to develop WEM Procedure which contains the details in respect of the PASA framework.

ST PASA Market Model

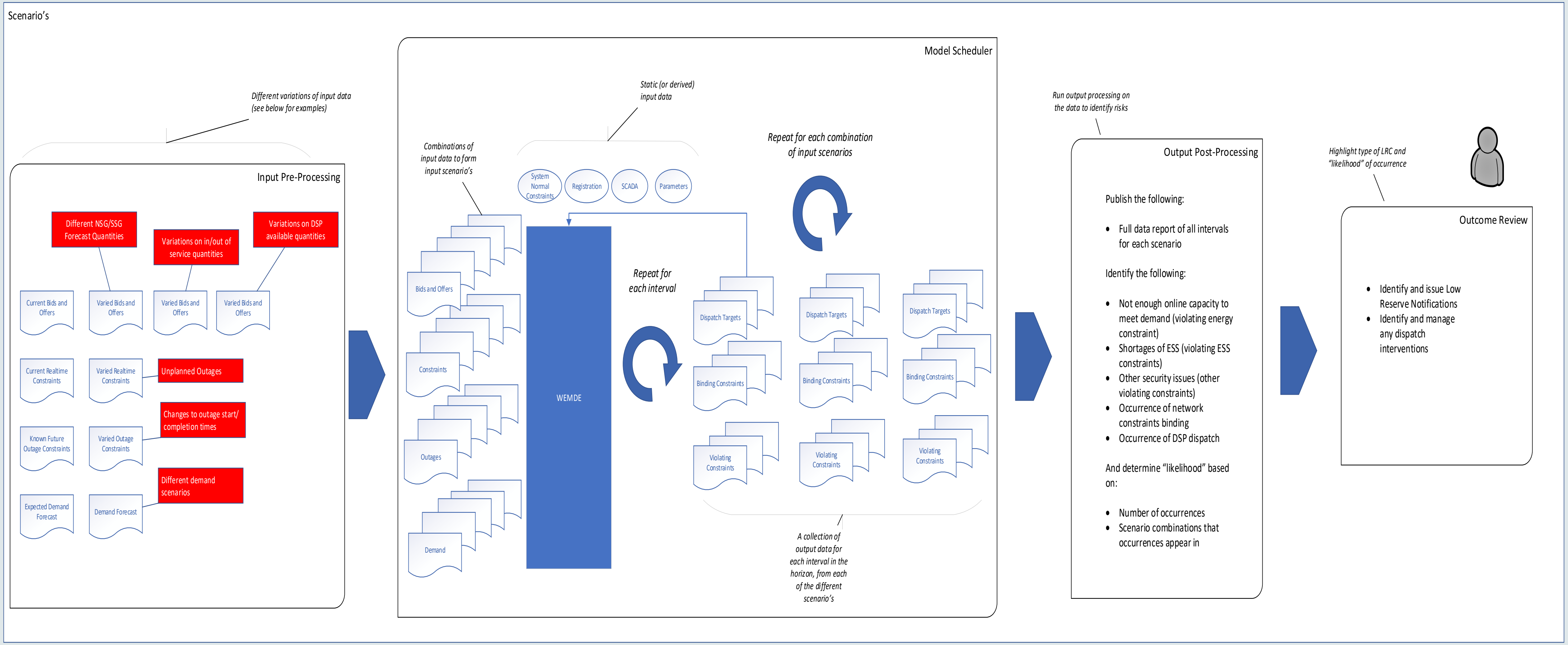
AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

ST PASA Base Market Model



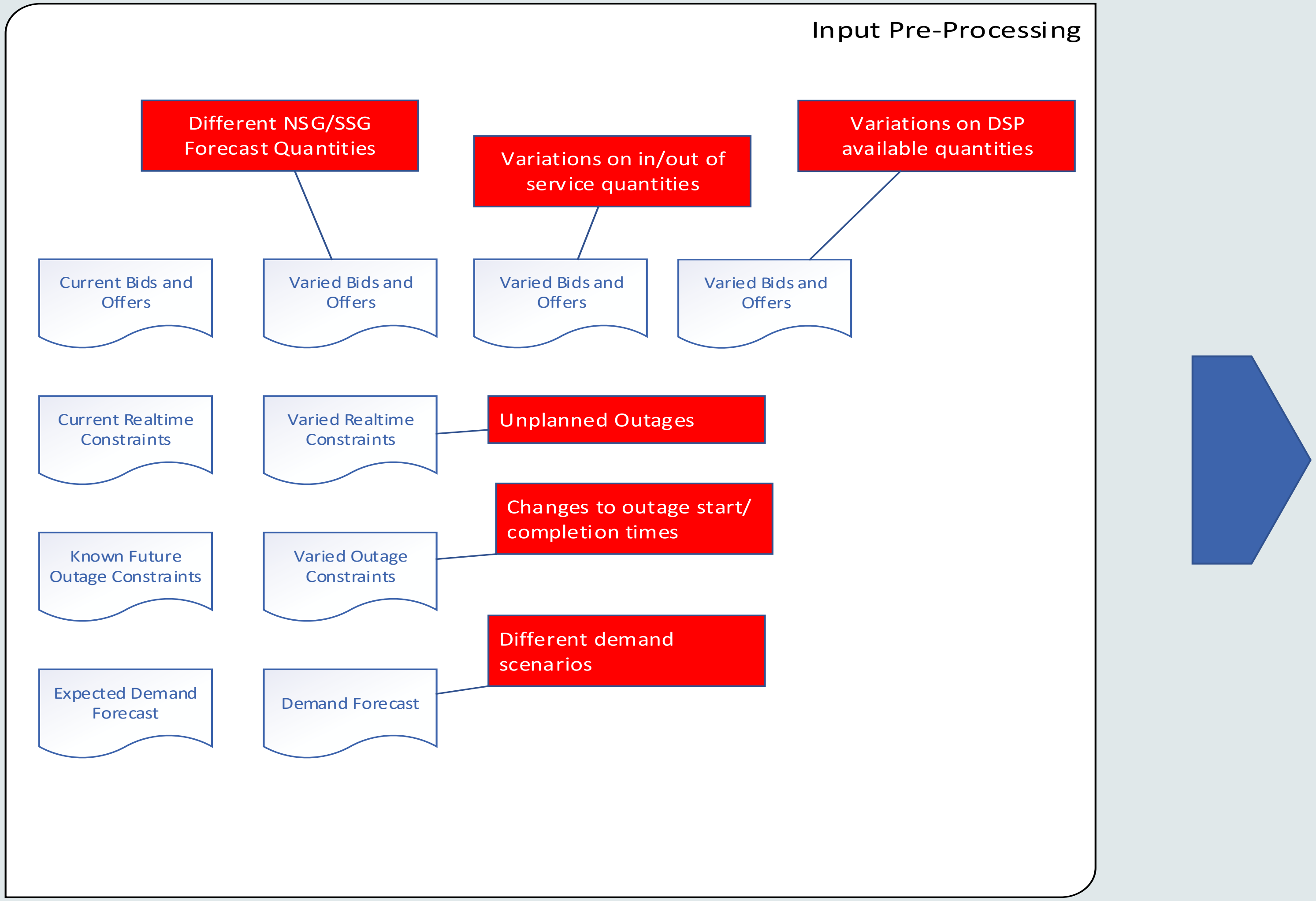
ST PASA Scenario's Modelling

Overview ST PASA Conceptual Diagram



AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Inputs and Pre-processing



ST PASA Input Variations

Input variations considerations

Intermittent (NSG/SSG) variations
- I1 - Base (per offers)
- I2 - Base + statistical error margin (e.g. per Facility, per time of year/ time of day)
- I3 - High output (e.g. 95% capacity)
- I4 - Low output (e.g. 5% capacity)
- I5 - Reserve capacity levels

Availability (In/Out of Service Quantity) variations
- A1 - Base (per offers)
- A2 - Base + adjusting in service quantities for large/key Facilities to zero

Realtime Constraint variations
- RT1 - Base (currently applied realtime constraints)
- RT2 - Base + random forced outages (e.g. based on statistical outage rates)
- RT3 - Base + largest remaining contingencies

Future Outage variations
- O1 - Base (current planned outage start/finish times)
- O2 - Early commencement/late finish variations
- O3 - Base + largest network contingency

DSP available quantity variations
- DSP1 - Base (per offers)
- DSP2 - Base + statistical error margin (e.g. per DSP, per time of year/time of day)
- DSP3 – low availability (5% capacity)

Demand variations
- D1 - Expected demand
- D2 - Expected demand + statistical error margin
- D3 - Expected demand + low PV output
- D4 - Expected demand + high PV output
- D5 - Expected demand + highly variable PV output
- D6 - High demand
- D7 - Low demand
- D8 - POE10 demand

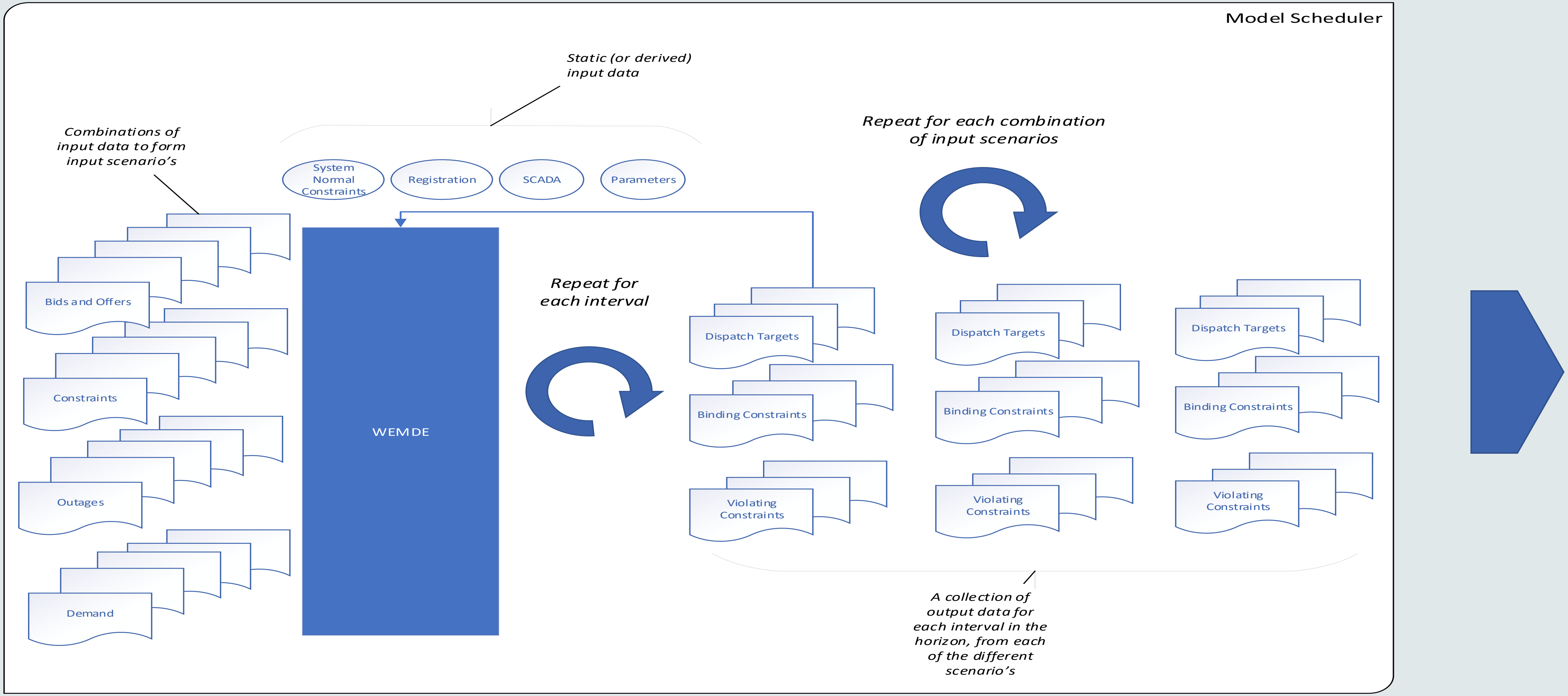
We will define "valid" combinations of these input variations to form the overall list of input "scenario's" for ST PASA

E.g.

- *Base scenario (all base input data) = I1, DSP1, A1, RT1, O1, D1*
- *High capacity risk scenario = I4, DSP3, A2, RT3, O2, D7*
- *Medium capacity risk scenario = I2, DSP2, A1, RT3, O2, D5*

Etc

Scenario's Modelling



Outputs Post Processing

Run output processing on the data to identify risks

Output Post-Processing

Publish the following:

- Full data report of all intervals for each scenario

Identify the following:

- Not enough online capacity to meet demand (violating energy constraint)
- Shortages of ESS (violating ESS constraints)
- Other security issues (other violating constraints)
- Occurrence of network constraints binding
- Occurrence of DSP dispatch

And determine "likelihood" based on:

- Number of occurrences
- Scenario combinations that occurrences appear in

Highlight type of LRC and "likelihood" of occurrence

Outcome Review

- Identify and issue Low Reserve Notifications
- Identify and manage any dispatch interventions

ST PASA: Data Requirements

- Given shorter timeframes, most information is expected to come through offers
- Will need modelling data from participants to support estimating different output scenarios (e.g. wind turbine power curves)
- Variability estimated from historical data
- Risks based on including contingency events (e.g. loss of next largest generator, major transmission outage, loss of major ESS provider, etc)

MT PASA Market Model

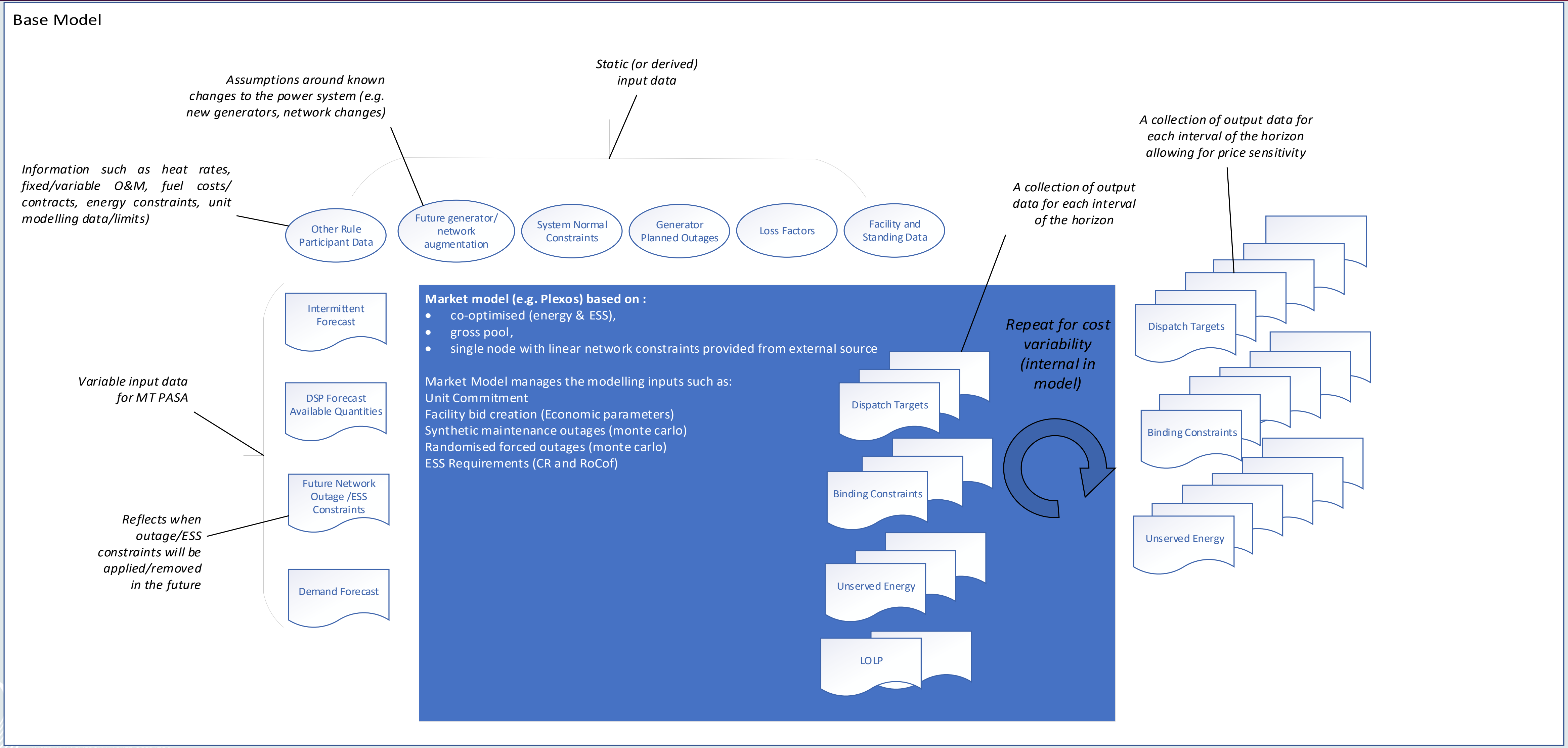
AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

MT PASA Market Model: Key Requirements

- Approximation of single node wholesale electricity market model
- Mixed integer linear programming (MILP) solver to co-optimise energy and essential system services provision for every 30-min interval in the MT PASA horizon (time-sequential)
- Handles linear constraint equations (security-constrained dispatch)
- Determines estimates of unit commitment (time-sequential over specified commitment horizon)
- Randomised generator forced outages
- Uses generator planned outage schedules
- Assesses Power System Security/Reliability risks based on different input scenarios

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

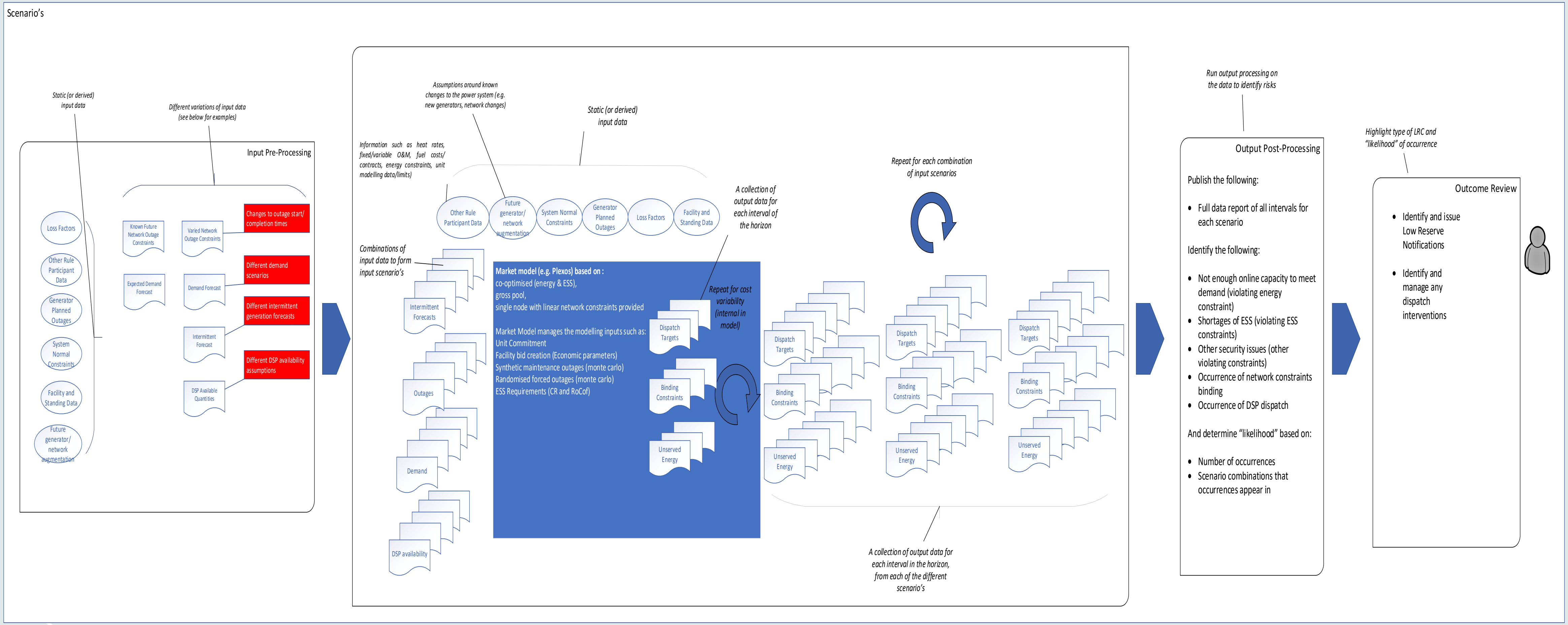
MT PASA Base Market Model



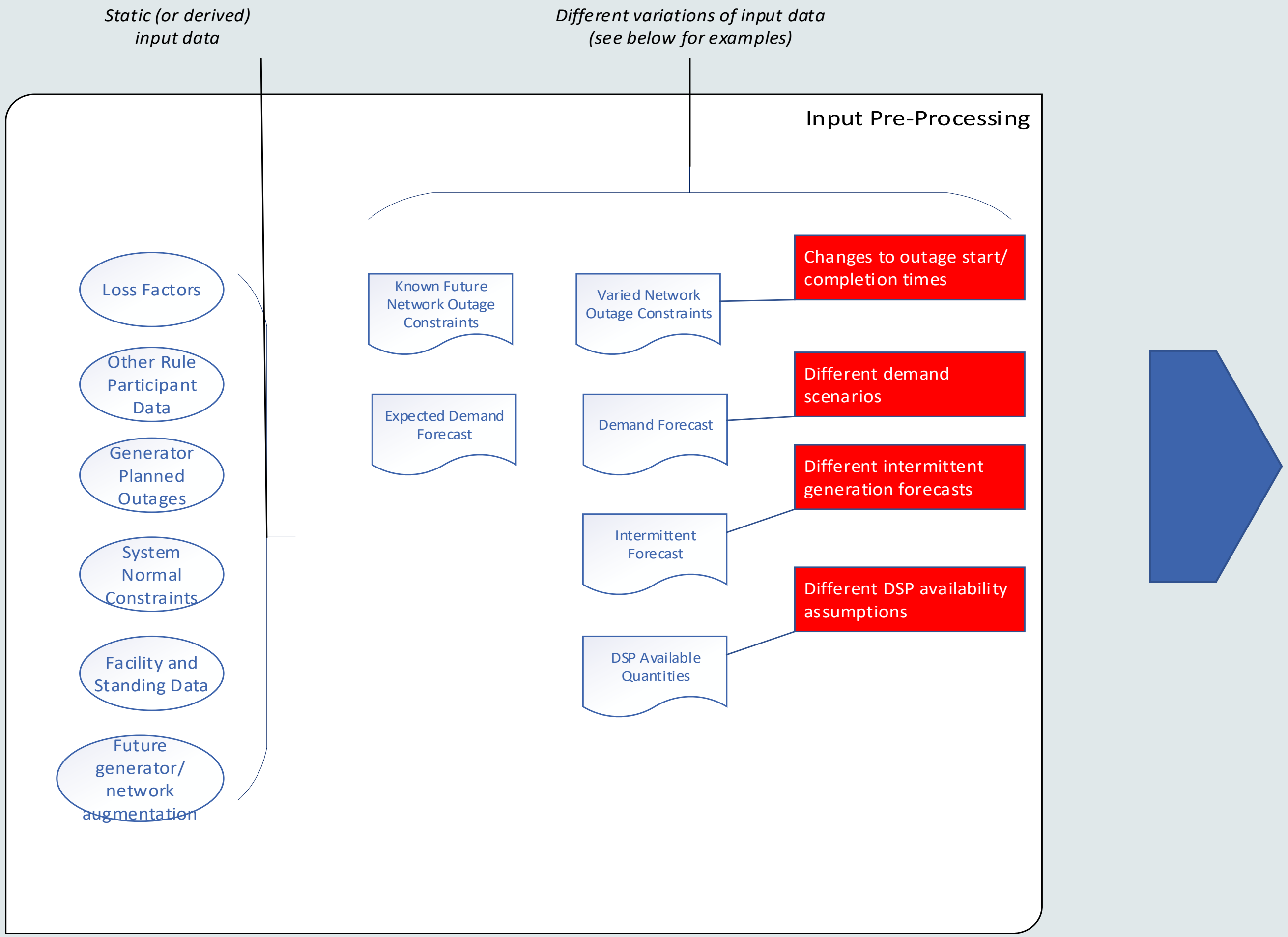
MT PASA Scenario’s Modelling

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Overview MT PASA Conceptual Diagram



Inputs and Pre-processing



MT PASA Input Variations

Input variations considerations:

Intermittent (NSG/SSG) variations:

- I1 – Statistical time of year (e.g. per Facility, per time of year/time of day)
- I2 - High output (e.g. 95% capacity)
- I3 - Low output (e.g. 5% capacity)
- I4 - Reserve capacity levels

DSP available quantity variations:

- DSP1 - Base (per offers)
- DSP2 - Base + statistical error margin (e.g. per DSP, per time of year/time of day)
- DSP3 – low availability (5% capacity)

Future Outage variations:

- O1 - Base (current planned outage start/finish times)
- O2 - Early commencement/late finish variations
- O3 - Base + largest network contingency

Demand variations:

- D1 - Expected demand
- D2 - High demand
- D3 - Low demand
- D4 - POE10 demand
- D5 – POE50 demand

We will define "valid" combinations of these input variations to form the overall list of input "scenario's" for MT PASA

E.g.

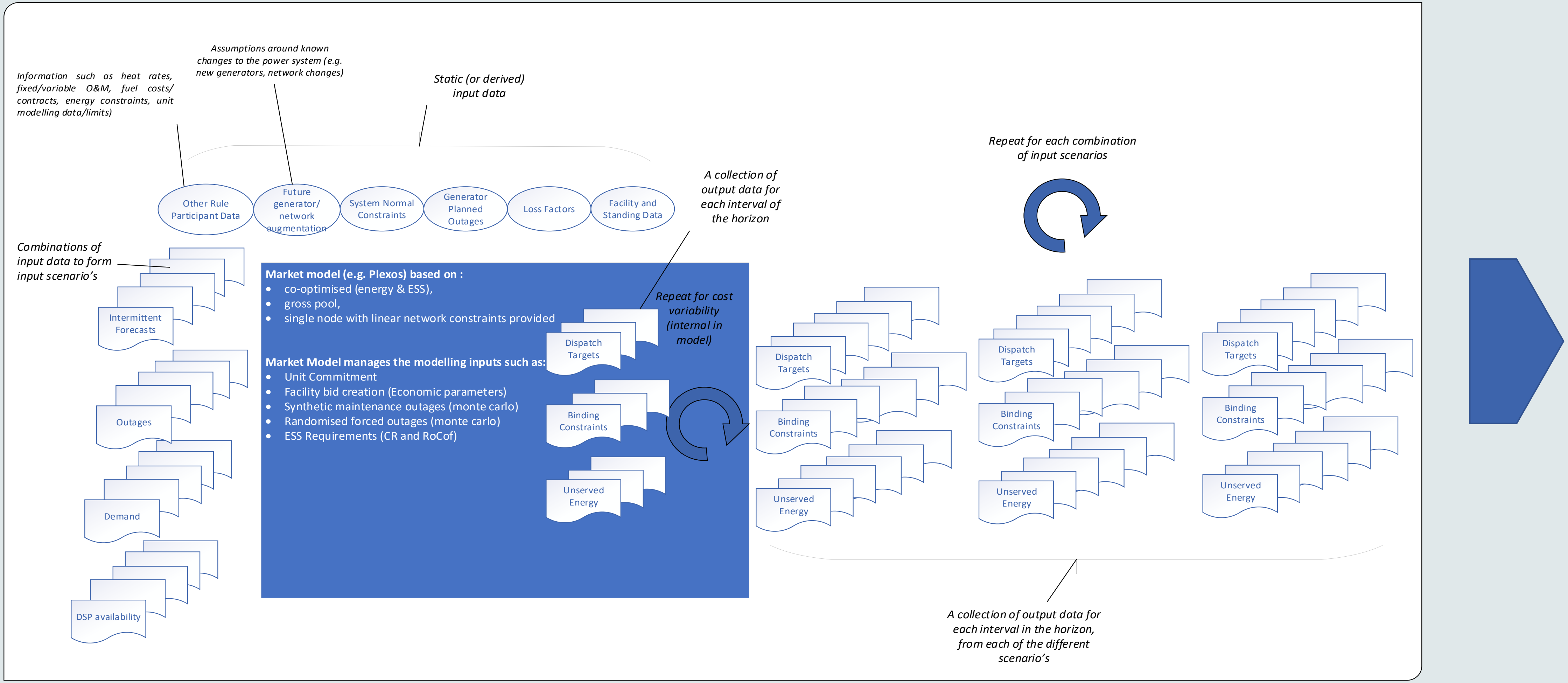
- *Base scenario = I1, DSP1, O1, D1*
- *High capacity risk scenario = I3, DSP3, O3, D4*
- *Medium capacity risk scenario = I4, DSP2, O2, D2*

Etc

AEMO

AUSTRALIAN ENERGY MARKET OPERATOR

Scenario's Modelling



Outputs Post Processing

Run output processing on the data to identify risks

Output Post-Processing

Publish the following:

- Full data report of all intervals for each scenario

Identify the following:

- Not enough online capacity to meet demand (violating energy constraint)
- Shortages of ESS (violating ESS constraints)
- Other security issues (other violating constraints)
- Occurrence of network constraints binding
- Occurrence of DSP dispatch

And determine “likelihood” based on:

- Number of occurrences
- Scenario combinations that occurrences appear in

Highlight type of LRC and “likelihood” of occurrence

Outcome Review

- Identify and issue Low Reserve Notifications
- Identify and manage any dispatch interventions

MT PASA: Data Requirements

- Will need modelling data from participants to support estimating output (e.g. wind turbine power curves)
- May require information from Demand Side Programmes on future demand estimates (e.g. future demand availability reductions)
- Information on future network augmentations and decommissioning
- Information on future generation connections
- Information on future generation retirements

Questions

Next Steps

- We will continue to build on the modelling concepts and scenarios
- Commence drafting the WEM Procedure