ST PASA REPLACEMENT PROJECT: INDUSTRY WORKSHOP

Friday, 28 February 2020

Intelligent Energy Systems

SW Advisory

Topics

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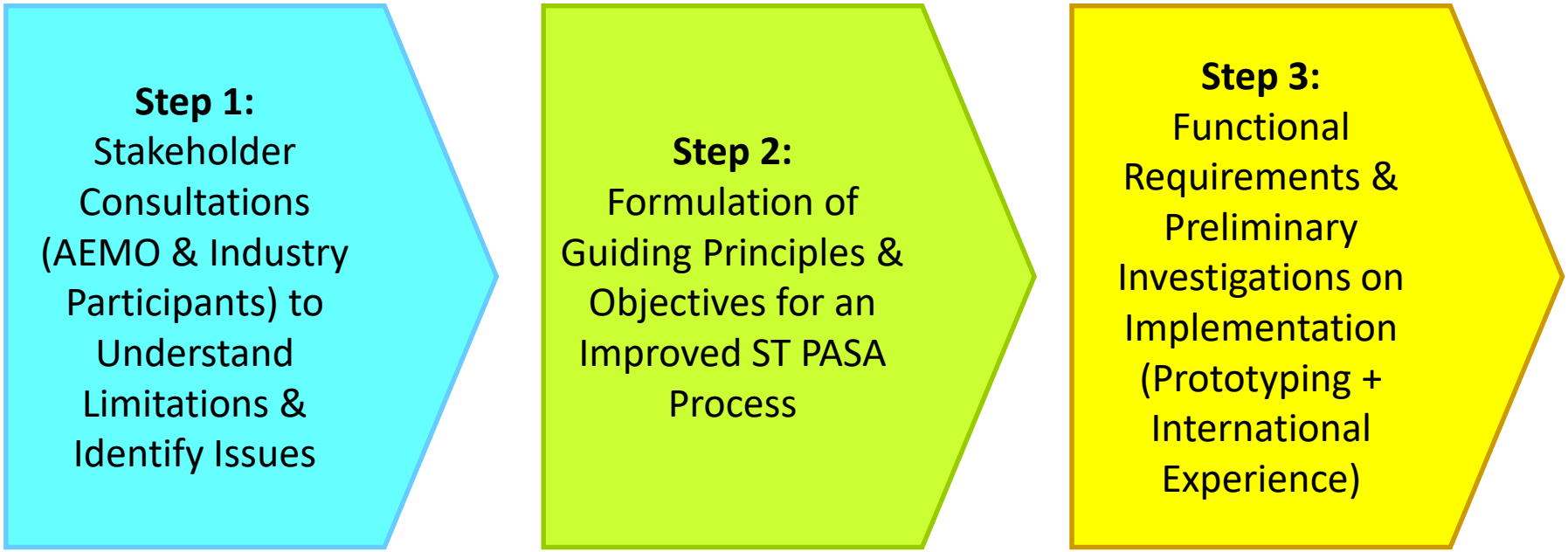
1/. PROJECT INTRODUCTION & WORKSHOP FOCUS

Project Objectives

- For AEMO to meet & maintain future regulatory obligations & satisfy industry needs, as the energy sector undergoes a transition, AEMO has commenced a project to consider a replacement for the ST PASA system
- AEMO has subsequently contracted Intelligent Energy Systems (IES) & SW Advisory (SWA) to assist in developing the functional requirements for an ST PASA replacement

Approach & Workshop Focus



2/. ST PASA OBJECTIVES

ST PASA Objectives

In order of importance the replacement ST PASA should have the following objectives:

1. ST PASA should provide sufficient and timely information about system security and reliability issues to AEMO and the industry such that
   I. **market participants** can respond to the likely market need and thus reduce the need for AEMO to intervene in the market
   II. AEMO can use different operational levers e.g. rescheduling a network outage, intervening via directions or activating RERT **to maintain system reliability and security** cases where market participants do not respond adequately to the situation

2. ST PASA should provide a mechanism to assist AEMO, when required, to develop a RERT schedule at least expected cost

Future Proof Design Principle

ST PASA process needs to be matched to the future requirements of Australia's power system – say with a vision to the year 2030, including:

- Technology mix characterised by high levels of Variable Renewable Energy (VRE)
- High levels of penetration of battery energy storage systems (BESS)
- Increased levels of distributed energy resources (DER)
- Higher penetration of end use appliances that are responsive to prices and demand (DR)
- Be designed to accommodate a wider range of credible threats to power system operations

3/. COMMON THEMES FROM STAKEHOLDER INTERVIEWS

Common Themes from Interviews

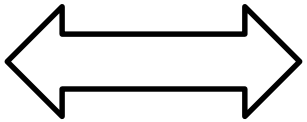
Common issues & themes were raised during the consultations including:

- Theme 1: Critical Decision Points
- Theme 2: Current ST PASA Issues Identified
- Theme 3: Time Horizon & Update Periodicity
- Theme 4: Merging 7 Day Pre-Dispatch with ST PASA
- Theme 5: ST PASA Model Detail
- Theme 6: Information Provision
- Theme 7: Credible Contingencies

3.1. CRITICAL DECISION POINTS

Critical Decision Points

Decision-Making over a 7-day Horizon is informed by ST-PASA & 7-Day PD



AEMO

- Reserve assessment
- Issuing LOR market notices
- Gas supply / gas supply guarantee
- Network outage recalls
- Request to provide Generator outage recall information
- Market interventions
- Use of RERT

Market Participants

- Commit / De-commit decisions
- Small hydro storage management
- Battery storage management
- Infer expected prices
- Fuel management
- Maintenance management
- Staffing levels of power stations (restarting)
- Management of demand resources
- Embedded generation
- FCAS
- Others …

3.2. IDENTIFIED ISSUES WITH CURRENT ST PASA

Current ST PASA: Issues Identified (1/4)

- Accuracy & meaning of results in general
- Accuracy & resolution of forecasts: demand, wind & solar
- Weather random variables not adequately captured within modelling of reliability & security risks:
  - High temperature simultaneously affecting unit ratings / transmission line ratings
  - Wind speeds and impacts on multiple turbines
  - Variable cloud cover impacts on PV outputs
  - Dust storms, bushfires, cyclones, floods etc.
- Optimisation of battery storages problematic – e.g. not reflecting cycles within a day
- Energy limited resources are not modelled adequately

Current ST PASA: Issues Identified (2/4)

- ST PASA regional model does not adequately reflect physical reality:
  - Loss of network elements not intersecting with regional boundary
  - Does not adequately model intra-regional constraints nor system post network contingencies
  - Network and load shedding not consistent with physical reality
  - Can make it difficult to interpret what the results mean
  - Does not model system strength issues
- Inadequate treatment of intermediate plant
- Treatment of resource availability:
  - ST PASA availability is not the same as offered max available:
    - Max available is commercial availability
    - PASA availability is technical capability with a 24 hour recall
  - Available generation capacity does not mean that there is adequate fuel supplies
  - Different availabilities can cause problems with AEMO interventions and use of RERT
  - Modelling capacity alone doesn't reflect energy limitations
  - Use of 24 hour recall doesn't fit all resources – e.g. some have 36 hour recalls or lead time / limitations of some demand resources

Current ST PASA: Issues Identified (3/4)

- Inconsistencies between ST PASA and 7-DAY PD
- Lack of transparency in preparation of inputs & classification of credible contingencies
- Providing information on what would happen following an intra-regional transmission related credible contingency
- Large volume of potential constraints – don't have resources to analyse the sheer volume of information
- No pricing information provided with the ST PASA
- Would like to get more clarity on shortfalls:
  - better quality and more timely information,
  - what were the binding constraints (network, FCAS etc.) and
  - management of discretionary generation

Current ST PASA: Issues Identified (4/4)

- Power system security issues not modelled under all conditions – e.g. minimum demands
- Not all required power system services are modelled in ST PASA framework:
  - FCAS not included – so some security / reliability issues may be missed – which is important as VRE levels rise
  - Inertia, synchronous units within some regions, or adequate levels of ramping capability
- Issues around not modelling the impacts of concurrent small events

3.3. Time Horizon & Update Periodicity

Time Horizon & Update Periodicity

- Stakeholders split between those that were happy with 7 days ahead and those that would like a longer period of time of say 10-14 days ahead
  - Often this was linked back to the decisions that the participants need to make based on the technology within their portfolio
  - While 14 days would cater to all participants:
    - Some concerns raised that if the model is extended to 14 days then the information might not be accurate / reliable & may encourage AEMO to intervene more in the market
    - Concern raised about “good faith” rebidding rules applying for 14 days
- Other participants were more interested in increasing the update periodicity of both ST PASA and PD PASA

3.4. Merging 7 Day Pre-Dispatch with ST PASA

Merging of 7-Day Ahead Pre-Dispatch with ST PASA

- Most Market Participants monitor both PD/ST PASA and 7-Day Ahead pre-dispatch and use results from both processes to inform their decisions:
  - ST PASA was "AEMO's view" of reliability and whether intervention would be triggered
  - 7-Day Ahead provides "Market View" of the future
- All stakeholders we spoke to were favorably disposed to merging 7 Day Ahead Pre-dispatch with ST PASA, although the main issue for generators was that they were not keen on the "good faith" rebidding rules being applied for the extended period of time
- Issues raised if 7 day pre-dispatch and ST PASA were to be merged:
  - 'Good Faith' bidding issues would have to be addressed for periods past the current pre-dispatch horizon - a middle ground should be sought
  - Different definitions of availability used by ST PASA (technical availability) and 7 Day Pre-dispatch (commercial availability) would have to be harmonised, perhaps PD availabilities for base case and ST PASA availabilities for reliability scenarios
  - Set of services necessary to run the power system should be included to assess system adequacy
  - Outputs of prices would be useful
  - Could be used for system strength and gas management
  - Minimum demands issues need to be modelled

3.5. ST PASA Model Detail

ST PASA Model Detail (1/3)

- Widely agreed that as a general principle, the more the ST PASA model could reflect physical reality, the better the outcome
- Consider inclusion of modelling FCAS capability
- Consider reflecting demand response in forecasts
  - Includes: interruptible load, involuntary load shedding and price sensitivity of demands
- Consider modelling network at the connection point level
  - Including connection point level forecasts of demand, wind generation, solar generation etc.
- Consider how to reflect different recall times for network and generation outages depending on how far into the future they are rather than just a constant 24 hour recall time and incorporate recall costs
- Consider ability to model network constraints that could impact on generation and loads including post contingency network constraints
- Consider use of probabilistic approaches for linked events such as high wind speeds leading to wind turbines disconnecting, bushfires affecting multiple transmission lines etc.

ST PASA Model Detail (2/3)

- Consider reflecting gas flow constraints that could affect multiple units
- Consider improvements to forecasts of demand and behind the meter solar & wind
- Consider assessments of generator availability for different time horizons (rather than only the 24 hour recall time for all horizons)
- Consider the disaggregation of wind, PV & demand forecasts
- Consider modelling of distributed energy response (DER) and wholesale demand response
- Include price sensitivities into demand forecasts to reflect non centrally managed or non-market participant demand responses
- Improve modelling of energy limited plant and energy storage systems
  - Consider use of intertemporal optimization
- Consider automatic generation of thermal constraints for network model, particularly for post contingency scenarios to enable quick and easy modelling and analysis of possible contingencies

ST PASA Model Detail (3/3)

- Consider reflecting system strength constraints which impact wind & solar generation
- Consider whether more information on whether RERT should be triggered
- Needs to address future ramp rate issues

3.6. Information Provision

Information Provision (1/2)

- Would like reports on all key input random variables & how their variability is modelled, including:
  - Demand
  - VRE generation
  - Interconnections
  - Dispatchable generation
  - Demand management
  - Generation outages
  - Pain sharing of load shedding
- Prices would be useful
- A goal should be to provide outputs that describe physical reality – avoiding the need to interpret results
- Better information on security constraints that are binding (both inter-regional and intra-regional)

Information Provision (2/2)

- Providing more useful indicators to participants such as graduated warning bells (based on the same underlying information but summarised in different ways):
  - A traffic light system to provide simplified indication of whether reliability is at risk
  - An index as a measure of risk to the system reliability
  - Summary level distributions
  - Complete set of modelling results with interpretable physical meanings)
- This would cater to varying levels of sophistication / resources across the different categories of market participant

3.7. Credible Contingencies

Credible Contingencies – Definitions

- **Credible contingencies**: these are events that AEMO considers to be reasonably possible, a non insignificant probability of occurring, such as a loss of a generator, single load or single transmission line.
- **Non-credible contingencies**: these are events that that AEMO considers to be not reasonably possible, an insignificant probability of occurring, such as the simultaneous loss of multiple generators, or the loss of interconnection with a neighbouring region as a result of the loss of multiple transmission circuits. AEMO may reclassify a non-credible event to a credible event based on its published power system security guidelines. These guidelines define two scenarios that AEMO has considered for reclassification, being the presence of bushfires and lightning near transmission assets (although AEMO may reclassify it in light of other identified threats).
- **Protected event**, which is essentially a classification to deal with "non-credible events" that have non infinitesimal probabilities of it occurring but very high consequences if they occur.
  - *'Formerly, events like the loss of interconnection between two regions may have resulted in controlled load shedding. However, changing power system conditions resulting from changes in the generation mix means that there may be higher rates of change of frequency (RoCoF) levels following such an event. The higher RoCoF means that the current equipment which facilitates load shedding may no longer be able to act fast enough to arrest the fall in frequency following this kind of event. This means that there is an increased risk that such an event could more easily trigger a major blackout (a black system event). based on the classification above which has been reclassified because there is no longer an infinitesimal probability of it occurring'*

Credible Contingencies

- These classifications don't fully address some of the issues raised by participants
- What should be the basis for determining whether a contingency is credible or not? Should it be based on probability and potential consequences? *The basis for determining credible contingencies should evolve with the nature of contingencies and should provide enough flexibility for AEMO to operate the power system securely. Should be based on a cost benefit analysis.*
- There is an issue of normal operations versus contingences such as cloud cover suddenly affecting a lot of PV generation. Is this a contingency or normal operations which requires larger amounts of FCAS? Is a potentially very high temperature in an area with a material probability of occurring and consequently causing a number of wind turbines to shut down a credible contingency or normal operations which requires larger amounts of FCAS?
- Credible contingencies should include events like cyclones and bushfires that can affect multiple elements of the power system

4/. DISCUSSION / FEEDBACK:

HAVE WE MISSED ANY IMPORTANT ISSUES?

Thank You