Reliability Modelling: Review Process & Methodology

Adequacy and Demand Curve Workgroup

Sept 20th, 2017
Reliability Modelling Background

• Per SAM 2.0:

  – AESO is the responsible party for modelling reliability requirements, subject to appropriate governance

  – The resource adequacy criterion and the reliability measure is expected to be a government policy decision

  – Target procurement volume to be based on probabilistic resource adequacy requirement modelling considering supply adequacy impacts of all resources regardless of their capacity market eligibility

• A methodology is required to determine and evaluate the required reserve margin and the amount of capacity to procure
SAM 3.0 Objective: AESO Reliability Model

• Seeking Workgroup recommendation (acceptance) of the methodology and key inputs of the AESO reliability modeling that will determine the amount of capacity required to meet the defined reliability target.

  – Through the review process feedback and acceptance will be sought from the workgroup to validate that the AESO is using:
    • Reasonable assumptions and methodologies
    • Clear transparent process
    • Industry standard practices
Meeting Action: Seek agreement on the objective and intent of achieving WG recommendation (acceptance) on the methodology and key inputs of the AESO reliability modeling, and the process to reach such recommendations.
Suggested Reliability Modeling Review Process

• Sept 20th, 2017
  – Seek input and agree to review process
  – Agree to which aspects of methodology and input to review
    • Feedback to date is to review all inputs

• Oct 11th, 2017
  – AESO provide WG material on intended methodology & inputs

• Oct 18th, 2017 (Full day)
  – Review material for clarity, identify issues and other options
    • WG members can bring one technical support staff if desired
  – Identify follow up actions

• Nov 15th, 2017
  – Revisit follow up action regarding methodology and inputs

• Nov 29th, 2017
  – Recommendation: Reliability methodology and inputs
Reliability Modelling: Methodology
Reliability Modelling Principles and Objectives

• Principles
  – Reliability is a top priority of the AESO
  – Additional priorities for the modeling process include:
    • Reasonable assumptions
    • Clear transparent process
    • Industry standard practices
    • Appropriate oversight and governance

• Objectives
  – Assess physical reliability metrics (frequency, duration and magnitude) to determine the reserve margin and target procurement volume
  – Use Monte Carlo simulations of hourly load and generation to determine tradeoff between capacity and reliability
    • Multiple iterations of output required for convergence
Monte Carlo Simulation

• Monte Carlo simulation performs risk analysis by building models of possible results by substituting a range of values (a probability distribution) for any factor/input that has inherent uncertainty

  – Results are calculated repeatedly, each time using a different set of random values from the probability functions
  – Monte Carlo simulation produces distributions of possible outcome values
  – Monte Carlo simulation may involve thousands or tens of thousands of iterations before it is completed
Why use a Monte Carlo Simulation?

• Supply shortfalls can have many drivers, uncertainty in load, uncertainty in generator availability, energy limited variable resources and intertie/transmission outages

• A deterministic selection of extreme events will not give an accurate representation of the operation of any system during such an event, nor would it be possible to estimate a distribution of when such events could occur

• Since most reliability events are high impact, low probability events, a large number of possible scenarios must be considered to capture uncertainties
Consistency with Industry Guidelines and standards for reliability

• NERC BAL-502-RFC-02 (not currently adopted in Alberta)
  – To establish common criteria, based on “one day in ten year” loss of Load expectation principles, for the analysis, assessment and documentation of Resource Adequacy for Load

• North East Power Coordinating Council – Directory 1
  – Each Planning Coordinator or Resource Planner shall probabilistically evaluate resource adequacy of its Planning Coordinator Area portion of the bulk power system to demonstrate that the loss of load expectation (LOLE) of disconnecting firm load due to resource deficiencies is, on average, no more than 0.1 days per year.
Anticipated Inputs

• Load
  – Hourly
  – Probabilistic (economic- and weather-driven)

• Generation Fleet
  – Installed capacity based on existing and anticipated future units
  – Outages (Maintenance, Planned, De-rate and Forced Outage)
  – Consideration of output profiles from variable/intermittent resources

• Intertie (imports)
  – Expected intertie capacity, availability, and behavior

Inputs and methodology to be discussed in greater detail at the October 18 Working Group meeting; detailed list of inputs shared with WG
Anticipated Output

Hourly supply cushion data

• Reliability metrics
  – Frequency – Loss of Load Expectation (LOLE)
  – Duration – Loss of Load Hours (LOLH)
  – Magnitude – Expected Unserved Energy (EUE)

• Determine the reserve margin and target procurement volume

• Multiple iterations / seeds for convergence

• Will evaluate output:
  – Over a spectrum of reserve margins / capacity volumes
  – By season (as required)
Anticipated Modelling Assumptions

• Transmission System
  – Unconstrained transmission system per SAM 2.0
• Physical reliability metric, not economic
• AESO will use “off-the-shelf” software tool
  – Industry standard
  – Validation project currently underway to determine appropriate tool
Can begin modelling before these are determined but they are required for final reliability model outputs and demand curve calculation

- **Self-supply**
  - The amount of capacity to be procured by the AESO to meet load needs and ensure reliability is dependent on self-supply treatment

- **Eligibility**
  - The unforced capacity (UCAP) methodology and treatment of resources in the reliability model should be consistent to the extent possible

- **Seasonality**
  - Reliability model provides insights into the seasonal reliability issues and seasonal capacity needs

- **Others?**
Meeting Action: Seek agreement on the aspects of methodology and key inputs of the AESO reliability modeling that the workgroup wishes to review.
Next Steps

Timelines of the Adequacy and Demand Curve work group on Reliability Modelling

• Oct 11th, 2017
  – AESO provide WG material on intended methodology & inputs

• Oct 18th, 2017
  – Review Reliability Model methodology and inputs

• Nov 15th, 2017
  – Revisit AESO Reliability Model methodology and inputs

• Nov 29th, 2017
  – Recommendation: Reliability methodology and inputs