AESO Load Forecast Update

Adequacy and Demand Curve Determination Working Group

August 9, 2017

Past AESO Long-term Load Forecasts

- AESO acknowledges past load outlooks have over-forecast demand

- Forecasts represented the outlook at the time and expected trends using third-party (Conference Board) economic forecasts

- Known Oilsands projects were a major driver of nearer-term growth

  - 2008/2009 – financial meltdown and economic downturn

    - Oilsands outlook evolved as smaller SAGD projects became the norm

  - Mid-2014 to present – oil prices slide from ~$100/bbl to $50/bbl

    - Oilsands outlook evolved again to smaller, incremental expansions

Load Forecast Evolution

- AESO is focused on continual improvement and recognizes challenges with past forecasts

- AESO load forecasting requirements have also evolved

  - Reliable substation-level hourly load forecasts required

    - To support transmission planning, conduct congestion assessments, and account for embedded PV and other distribution-level impacts

  - Capacity Market / Resource Adequacy load forecast required

    - Will be a key factor in determining the size of the capacity market

    - Precise requirements still being determined

    - Other capacity markets can be examined to help provide direction

Load forecast review

Summary of Brattle's load forecast survey

Capacity markets reviewed

- PJM

- ISO-NE

- NYISO

- MISO

- UK (National Grid)

High level process and governance summary

- Process:
  - All Capacity Markets publish an annual forecast that is used for procurement
    - Some jurisdictions do a mid-year update
  - Internal staff produce the forecast
- Governance:
  - Stakeholders are engaged for feedback on methodology
  - Work groups/committees/technical panels (hereafter committees) approve methodology
    - Committees consist of ISO staff/executives, and/or stakeholders, external experts
  - No Capacity Markets required approval of either methodology or forecast values from a regulator like the AUC

Summary of approval of methodology by ISO surveyed

- PJM
  - Markets and Reliability Committee
- ISO-NE
  - Load Forecasting Committee
- NYISO
  - Executive Committee
- MISO
  - Loss of Load Expectation Working Group (reports to Resource Adequacy Subcommittee)
- National Grid
  - Panel of Technical Experts

Approach

- Most ISO's forecast load at the total and zone level, using econometric regressions

- Some ISO's utilize their annual energy forecasts and input them into peak load forecast models

- Some ISO's utilize data inputs from their stakeholders (TFOs LSEs etc.)

- All econometric models utilize some form of:
  - Calendar variables (holidays, day of week, month, DST)
  - Temperature variables (many different ways to model)
  - Economic data (GDP, Employment, some combination index)
  - Adjustments (e.g. DER, known projects or retirements)

Approach

- All ISO's surveyed utilize some form of probabilistic approach within the Resource Adequacy (RA) study

- In most cases, the ISO reports the 50th percentile peaks from the RA study as the load forecast

  – Weather normalized historic peaks are provided for context for the 50th percentile forecast

  – ISO's also typically report the 90th and 10th percentile peaks from the study for context

- Probabilistic ranges are generated by historic temperature patterns

  – Other ISO's sometimes utilize different DER and Economic scenarios to generate more variation in the RA study

What is delivered?

- Non-coincident and coincident (multiple zones in a footprint) monthly peaks and annual energy are reported

  - Other ISO's then adjust for distributed generation (gross and net forecast)

- Forecast (and sometimes data files) reported with the RA study (input into RA study) or in separate forecast document

- PJM releases a "Load Forecast Report" with it's capacity market forecast also explaining the economic assumptions it retains from their economic vendor

New AESO Load Forecasting Tool

New AESO load forecasting tool

Background

- Recognizing evolving business needs, the AESO kicked off a project in 2016 to find and implement a new load forecasting tool
  - Reliable substation-level hourly load forecasts
  - Flexibility to accommodate capacity market requirements including alignment of capacity market load forecast with transmission planning forecast
- SAS Energy Forecasting was chosen through a competitive process
- SAS LTLF (Long-term load forecast) tool completed implementation in May 2017
  - AESO still assessing and refining substation and area-level models and results

New AESO load forecasting tool

SAS LTLF

- Capabilities
  - Substation, planning area, planning region, and AIL-level hourly load forecasts, all reconcilable
  - Probabilistic (e.g. P10/P90) or deterministic forecasting
  - Inputs include: historical load data, weather variables, calendar variables, economic data
  - Economic scenario modelling
  - Post modelling adjustments (e.g. for known retirements)
  - Significantly less time to generate new load forecast compared to past processes – means more up-to-date information included in forecast
- Future Capabilities
  - PV and EV adjustments
- Initial results
  - At AIL level, results are similar to 2017 LTO Reference Case load growth (pre- energy efficiency adjustment)

Thank You

New AESO load forecasting tool - Additional details

SAS LTLF

- Uses a generalized linear model framework
- The new tool utilizes a exhaustive diagnose process
  - 4 different model structures are tested while running:
    - Many combinations of calendar and temperature effects are iterated through and chosen based on certain criteria (e.g. reduce hourly MAPE)
  - Model(s) accuracy assed during defined in-sample hold-out period to ensure model stability (comparing forecasted values to actuals)
  - Winning model structure identified and used for forecast

New AESO load forecasting tool – Additional details

- Capable of probabilistic forecasts based on historic profiles
  - Currently working to integrate 30 years of historic temperature profiles, yielding a distribution of 30 observations per hour of the forecast (distribution defines the likelihood of forecast values)
- Multiple economic scenarios and variables can be tested in tandem
  - Allows for easy economic uncertainty testing and comparisons
- Hourly modelling allows the AESO to use the most recent data while achieving high levels of statistical significance
- Flexibility to eliminate outliers based on user defined criteria
- Data quality checks ensure that historic data is representative