MARCH 26, 2025

Reliability Outlook Alignment

Resource Planning | Planning Conservation Resource Adequacy

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Territory Acknowledgement

The IESO acknowledges the land we are delivering today's webinar from is the traditional territory of many nations including the Mississaugas of the Credit, the Anishnabeg, the Chippewa, the Haudenosaunee and the Wendat peoples and is now home to many diverse First Nations, Inuit and Métis peoples. We also acknowledge that Toronto is covered by Treaty 13 with the Mississaugas of the Credit First Nation.

As we have attendees from across Ontario, the IESO would also like to acknowledge all of the traditional territories across the province, which includes those of the Algonquin, Anishnawbe, Cree, Oji-Cree, Huron-Wendat, Haudenosaunee and Métis peoples.

MRP Readiness

- The IESO is continuing to move forward with launching the renewed market on May 1, 2025
- Thank you to those Market Participants (MP) who have participated in End-to-End Testing
- MPs are reminded to review the MRP Readiness Plan for Market Renewal Launch, and ensure all required steps are completed
- Please contact IESOCustomerRelations@ieso.ca with any questions

Today's Discussion

- This information session will provide an overview of the changes made to the Reliability Outlook report and Methodology, including the addition of a planned scenario, the shift from deterministic to probabilistic forecasting, hydroelectric and wind probabilistic distributions, and adequacy threshold import assumptions
- This session will also explore the impacts of these changes to the IESO's Adequacy Report
- While this is an information session, we welcome your feedback and will take it into consideration for future planning

Agenda

1. Background
2. Weather Modelling
3. Demand Scenarios
4. Supply Assumptions
5. Adequacy Assessment
6. Adequacy Report

Background

- IESO publishes multiple documents such as the Reliability Outlook (RO), Adequacy Report and the Annual Planning Outlook (APO)
- In response to internal and external stakeholder feedback, including in response to a recommendation from the Market Surveillance Panel, the IESO has made changes to the Reliability Outlook to better align products

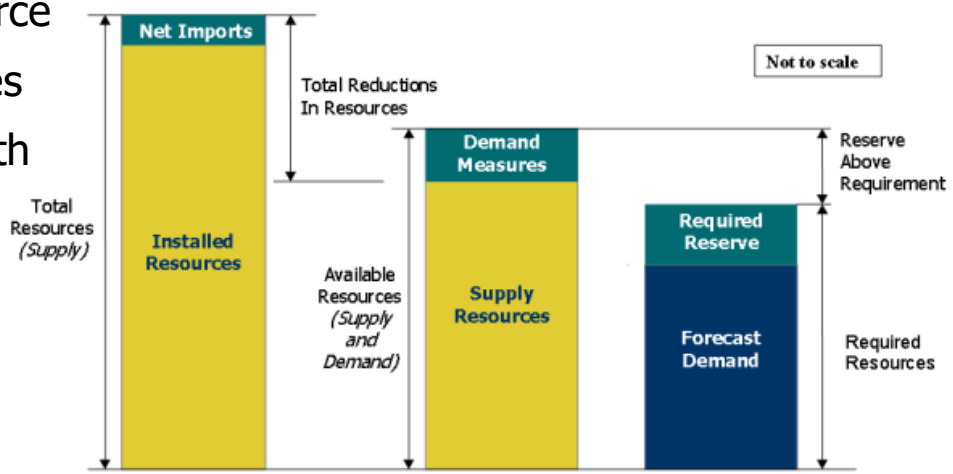
Product Alignment

Adequacy Report	Reliability Outlook	Annual Planning Outlook
• A report on information on Ontario's electricity requirements through 34 days out. The resources offered, forecasted and bid are included for the hours of today and the next day. The report identifies the capacity and energy excesses/shortfalls in all hours.	• A report used for outage management for generators and transmitters for the next 18-months. The Reliability Outlook (RO) is used as input for regulatory requirements for NERC and NPCC.	• A 20+year forward looking report used to inform long-term investment decisions and resource acquisition activity.

While alignment is being sought between products, differences in assumptions and methodology are required as the products serve different purposes and span different time horizons

The Reliability Outlook

- Currently, the Reliability Outlook (RO) uses a deterministic approach in calculating resource adequacy for outage management purposes based on the extreme weather scenario with up to 2,000 MW of import reliance throughout the year
- The metric for determining resource adequacy is called Reserve Above Requirement (RAR)



Demand Forecast (Past) – Weather Scenarios

- Uses 31 years of weather history to generate demand forecasts
- The methodology pre-selects historic weather data to generate Normal (50/50) and Extreme (maximum) demand forecasts
- Limitations:
  - Simplified treatment of embedded wind and solar, which are weather-dependent but not fully aligned with the forecast
  - Load Forecast Uncertainty (LFU) in the Load and Capacity model is based on a fixed calculation method
- Each week includes a Normal weekly peak, a measure of uncertainty (LFU) and an Extreme peak. Each weekly normal peak is assumed to be normally distributed

Demand Forecast (New) – Weather Simulations

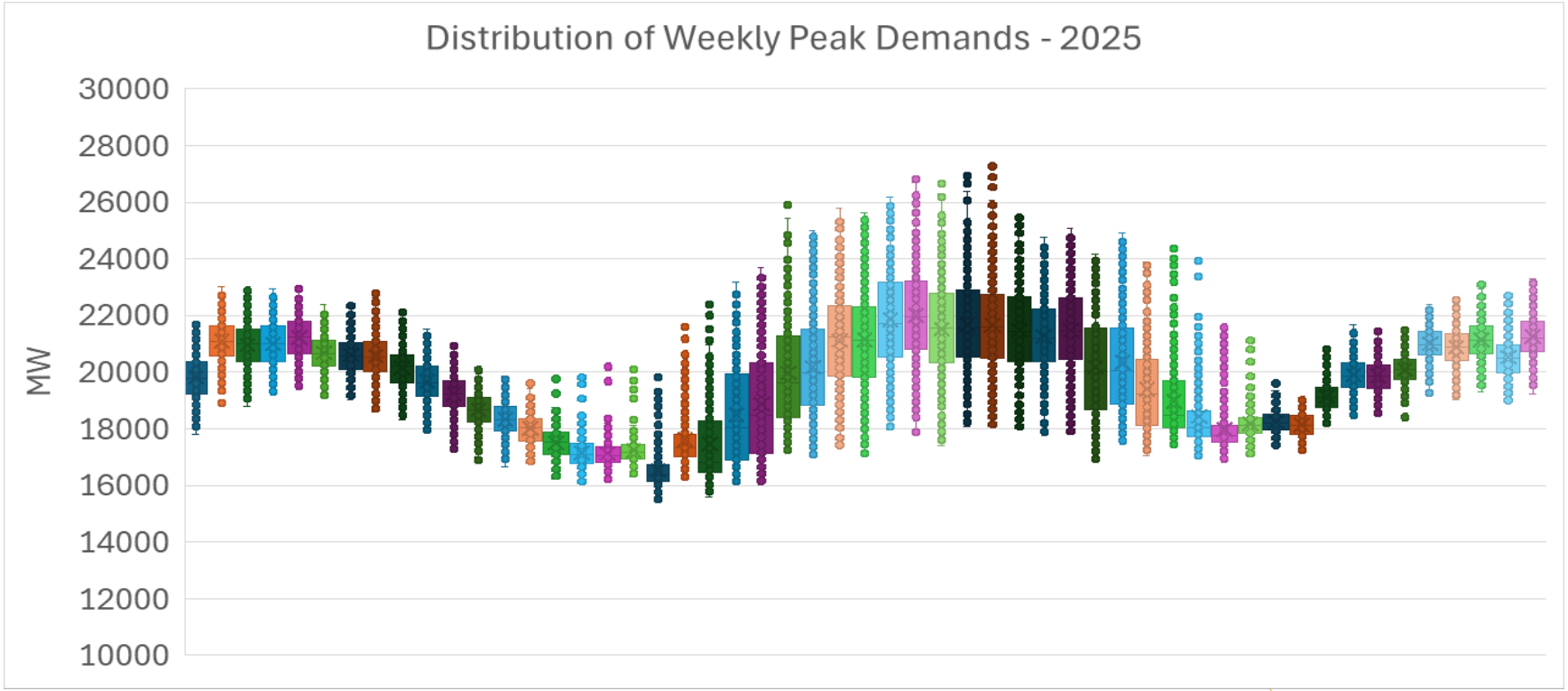
Enhanced Methodology:

- Uses 31 years of weather history, now incorporating previously unavailable Global Horizontal Irradiance (GHI)
- Runs all historical weather through the demand, embedded solar and embedded wind models
- Generates 465 outputs for each model. Slices of the outputs represent different probabilistic outcomes

Key Benefits:

- Stronger linkage between weather, demand and embedded solar and wind
- Weekly peaks now modelled probabilistically, with most weeks a Weibull distribution
- Supports probabilistic analysis of system and zonal levels for demand, embedded solar and embedded wind

Weather Creates a Demand Distribution



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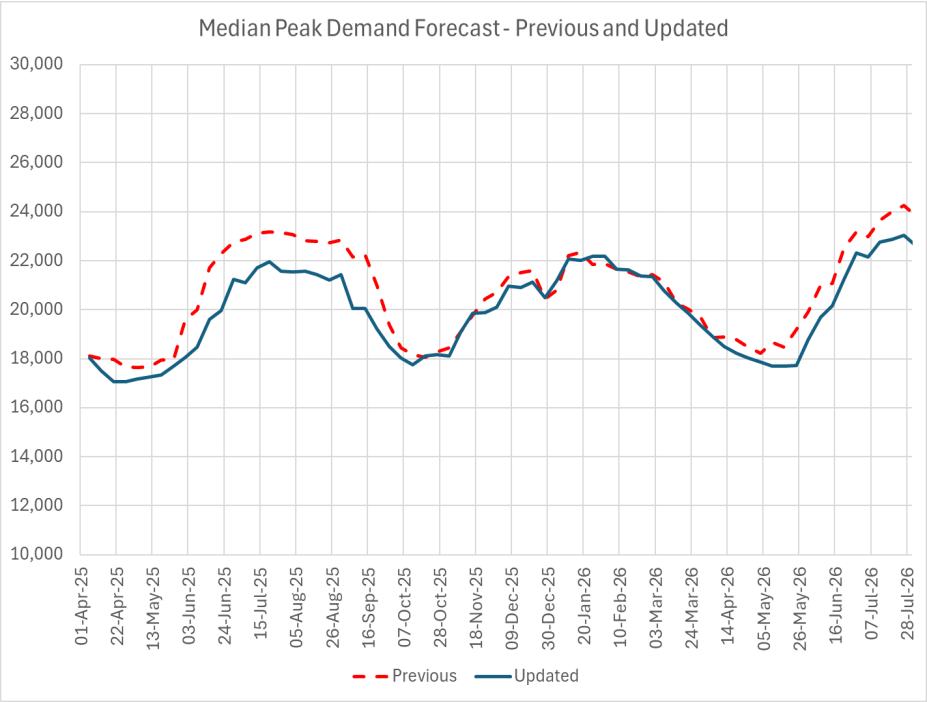
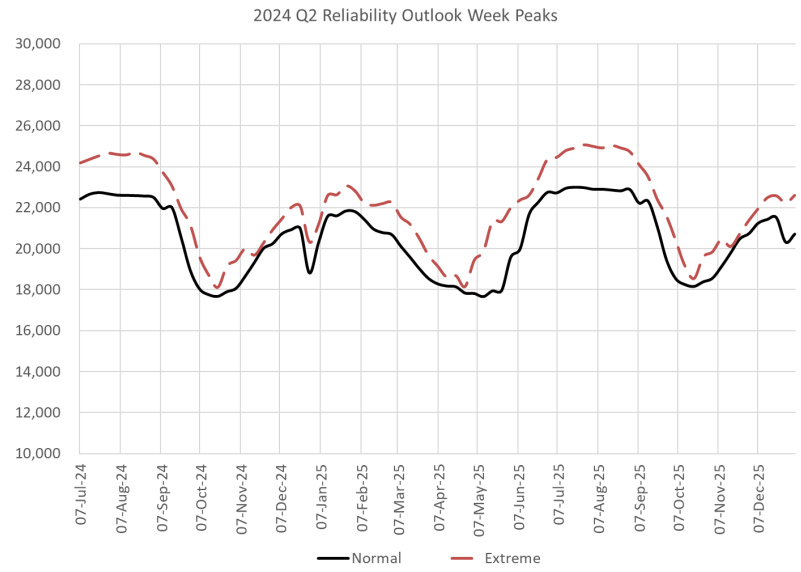
Demand Forecast Changes – Median Comparison

- Comparing the median forecasts of the two methodologies is not a direct "like for like" comparison
- Past Approach: Weather Scenarios were based on a Monthly Normalization approach, which was then adjusted the weekly forecasts
- New Approach: Weather Simulations allows for Weekly Normalization, aligning better with the Load and Capacity modelling
- Key Impact: Monthly Normalization results in higher peaks, particularly in the summer

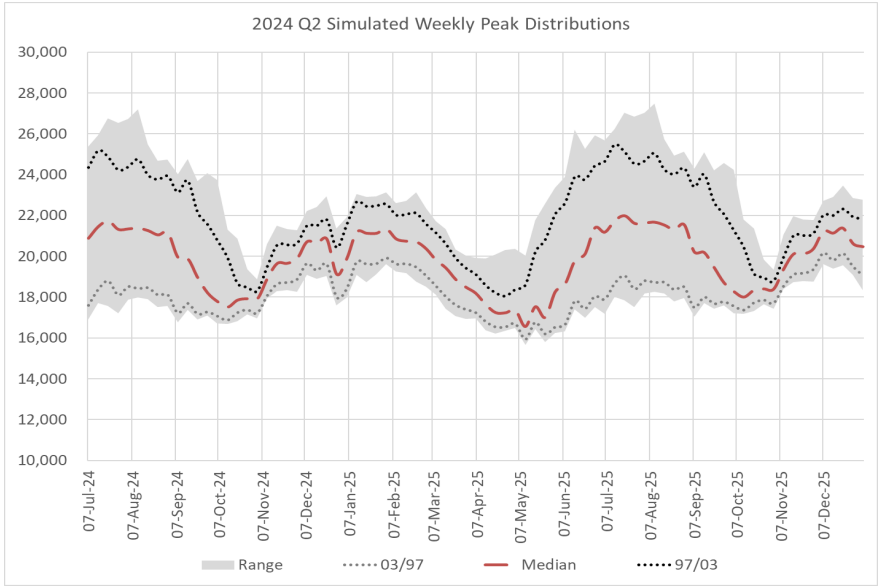


Demand Forecasting Changes

Weather Scenarios – Normal & Extreme



Weather Simulations - Distribution



The Weather Simulations approach provides a greater range.

Demand Scenarios - Uncertainty

- In recent years there has been an increase of large loads wanting to connect to the IESO controlled grid
- Some of these loads are submitting System Impact Assessments (SIAs) and requesting short (<18 month) connections, which is within the RO timeframe
- Others may have submitted SIAs but are approaching their in-service dates and are still not committed or "firm"
- To account for this, a planned scenario and a firm scenario were created:
- The planned scenario demand forecast includes loads that are less certain to reach commercial operation in this forecast period but are large enough to warrant considering their impact on grid operations
- The firm scenario demand forecast includes future loads with a high probability of reaching commercial operation in this forecast period

Supply Assumptions - Wind and Hydro

- Wind and hydroelectric resources are now also being modelled as probabilistic distributions instead of using a median value for each week to capture a broad range of risks, including tail ends of low and high hydroelectric and wind conditions
- The wind and hydroelectric distributions are calculated for each month, and each week within the month receives the same distribution parameters

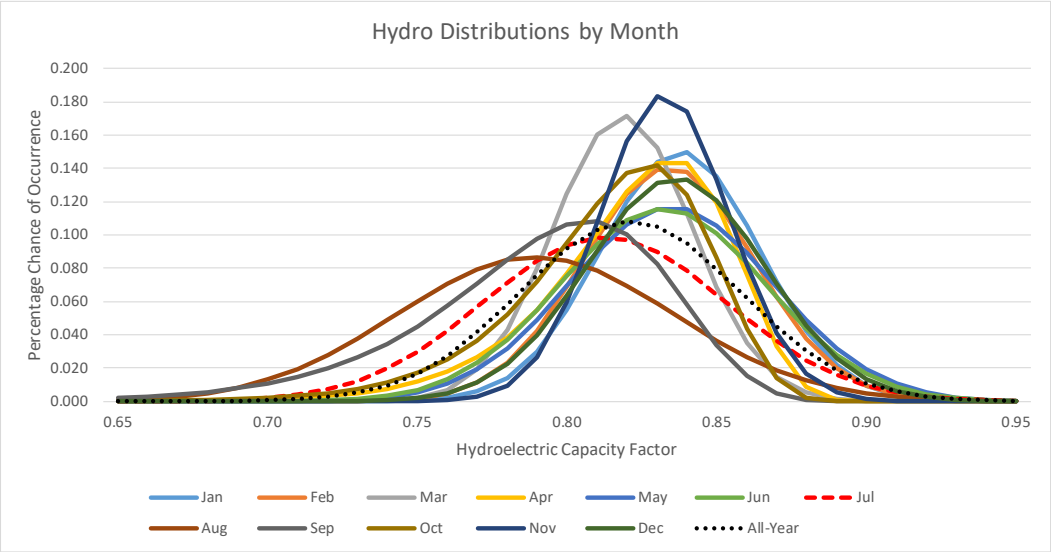
Hydroelectric Distribution – Past vs. New Approach

Past Approach:

- Hydroelectric generation was modelled using the monthly median of production plus operating reserve scheduled
- In Extreme Weather scenarios, the driest year in the dataset (2012) was selected, and about 800 MW was subtracted deterministically for summer months

New Approach:

- Hydroelectric generation is now modelled as a Normal distribution per month to account for the risk of low water conditions, without applying additional penalties



Wind Distribution – Past vs. New Approach

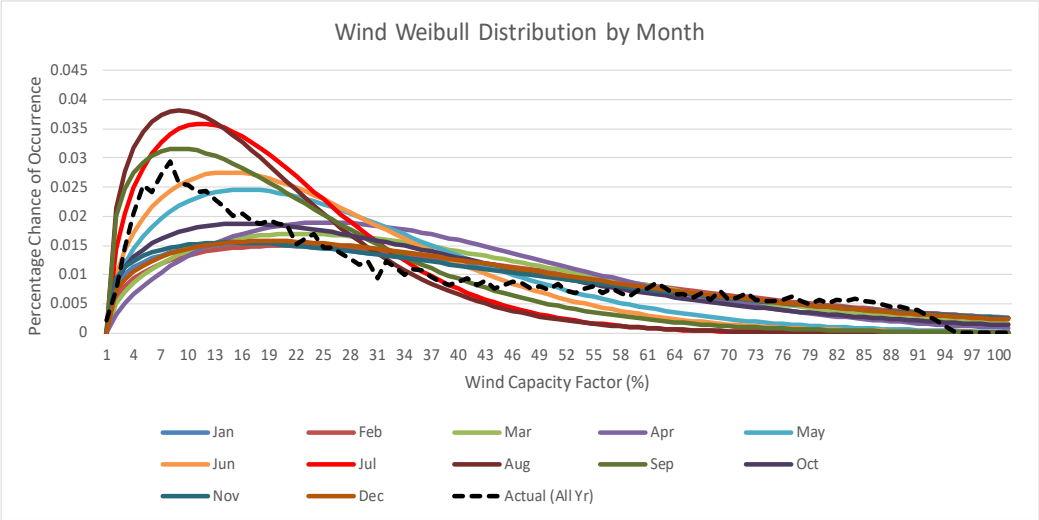
Past Approach:

- Wind was modelled using the median of historical output and foregone energy by month

Limitation: This approach did not account for the possibility of low wind conditions

New Approach:

- Wind is now modelled using a Weibull distribution in all months, allowing for a more accurate representation of low wind conditions



Adequacy Assessment - LOLe Allocation

- As the Planning Coordinator, the IESO evaluates resource adequacy for the bulk system such that the Loss of Load Expectation (LOLe) is on-average no more than 0.1 days per year, as defined by Northeast Power Coordinating Council (NPCC) Directory #1

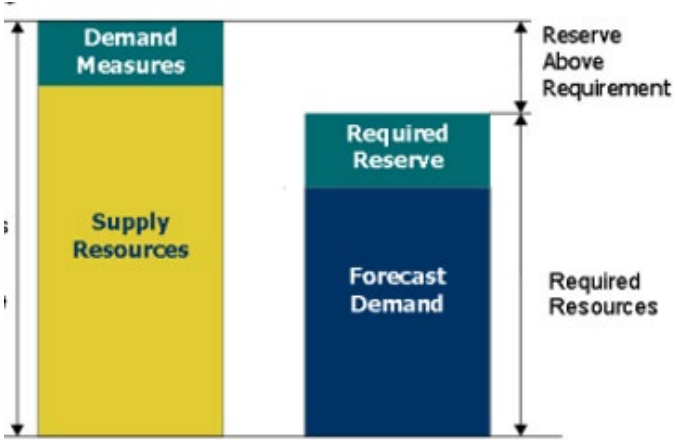
LOLe can therefore be seasonally allocated within the model:

- Winter (November to April)
- Summer (May to October)
- The LOLe allocation ensures adherence to the NPCC standard and that the Reserve Above Requirement (RAR) is reflective of risk assessments performed in Reliability Outlooks prior to these changes being applied this quarter

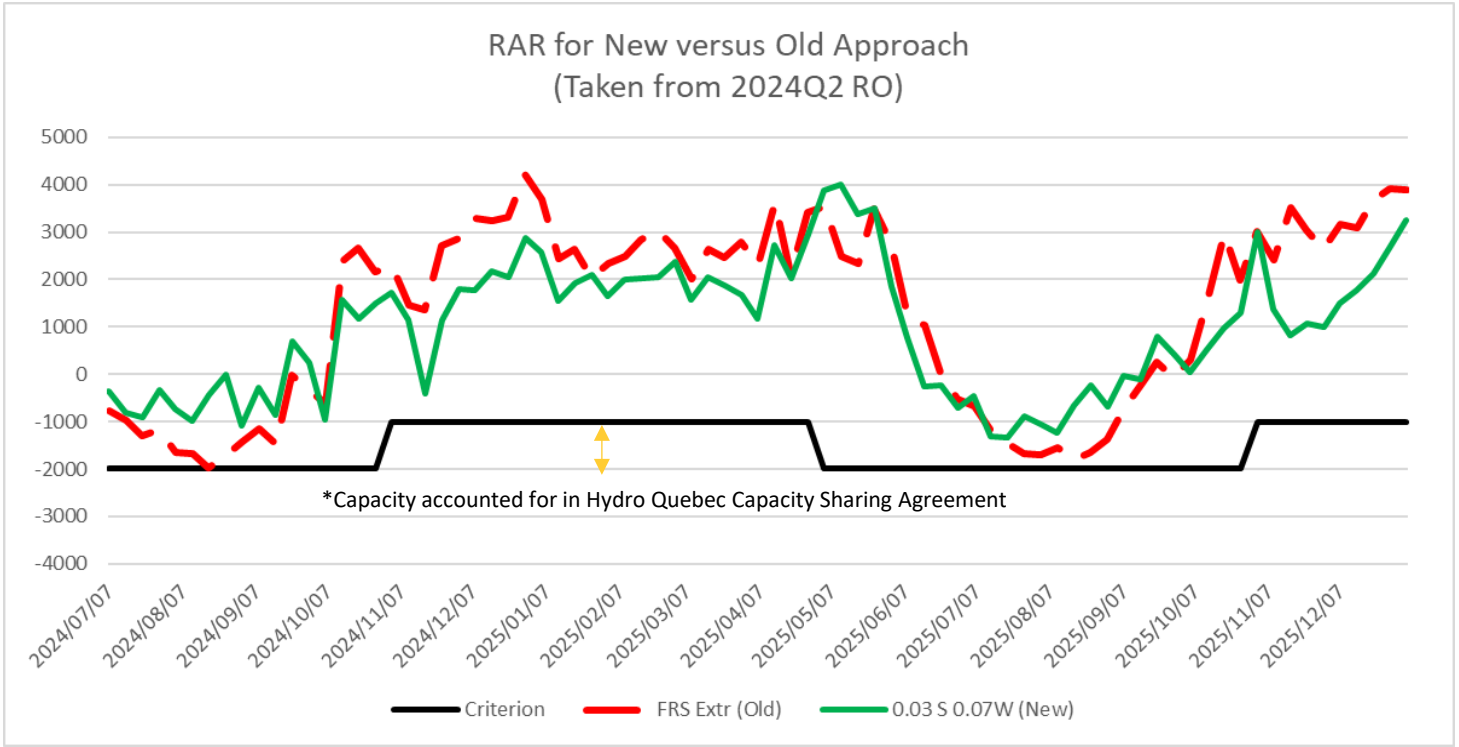
LOLe Seasonal Allocation - New

- The new approach is to spread the annual 0.1 days/year LOLe by having it as 30% of total in the summer (May to October) and 70% in the Winter (November to April)

  - Allocating more risk to a season leads to higher RAR for that season as lower required reserves are needed
  - In converse, a lower seasonal risk leads to lower RAR for that season as higher required reserves are needed
  - Each week has uniform risk compared to the other weeks of same season yet varies between winter and summer



RAR Outcomes: Closer Look



Reserve Above Requirement – Expected Weather

- The L&C model iteratively samples a subset of the weather demand data, which consists of 31 historical years, and 15 shifts resulting in 465 possible 8,760 hourly weather data sets
- Each of the 465 sets allows for a peak demand distribution to be created from 465 data points. Discrete data points are converted to a continuous probability distribution function representing various demands given weather volatility
- When L&C solves for its loss of load metric, it will implicitly choose various distributions (not necessarily based on normal or extreme), and therefore the outcome is an "expected" weather profile to meet reliability requirements

Impacts on Outage Management

- The new approach is expected to reduce RAR in the winter and increase RAR slightly in the summer. This should make it slightly easier to approve outages in the summer
- Although the winter RAR is decreasing, current system conditions do not indicate a need to reschedule outages due to resource adequacy concerns in the winter months

Outage Management Threshold

Previous Approach:

- Up to 2,000 MW of imports was allowed year-round for outage management in extreme weather scenarios, based on experience and intertie capability

New Approach:

- Resource adequacy assessment now considers more than just extreme weather events, with considerations for market manuals. Import reliance ranges from 0 to 2,000 MW
- With the Hydro Quebec (HQ) capacity agreement, HQ has indicated a need for firm capacity from Ontario in winter; to reflect this in the adequacy analysis, winter import reliance is reduced from 2,000 MW to 1,000 MW (Nov 1–Apr 30)

Adequacy Report Changes

- Previously, the adequacy report used the extreme weather Ontario demand (firm scenario) beyond day 10 to calculate adequacy margins. With the update in forecasting methodology, the extreme (97/03) weather demand will now be utilized for the same coverage period. The impact of this change on the adequacy assessment is expected to be minimal
- Echoing the RO's import reliance adjustment in the winter months, the adequacy report will also drop the expected imports in the winter months (Nov 1 – April 30) from 2,000 MW down to 1,000 MW

Summary of Methodology Changes

- These new changes will bring resource adequacy products closer in-line with each other
- Overall, the new methodology is more robust and consider a wider range of risks. The results are similar to the previous approach and should result in minimal changes for outage management
- Since the proposed approach evaluates a broader range of demand and generator risk, it will move away from two weather (Normal and Extreme) scenarios.
- There will continue to be a Firm and Planned scenario that now consider “all-weather” simulations and generator risks through probabilistic assessment. The former Firm, Extreme weather scenario will be replaced by the Firm, "expected" scenario as the outage management criterion

Next Steps

- All documents associated with this engagement can be found on the Reliability Outlook webpage
- If you have any questions on the information shared today, please contact IESO Engagement at engagement@ieso.ca

Thank You

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