DECEMBER 14, 2020

Reliability Standards Review Update

David Richardson, Ph.D, Senior Planner, Resource Adequacy
Bashir Bhana, P.Eng., Manager, Resource Adequacy
David Devereaux, Senior Manager, Resource & Plan Assessments

ieso
Connecting Today. Powering Tomorrow.

Agenda

1. Background
2. Summary of feedback from previous session
3. Non-firm imports: proposed methodology
4. Next steps

Background

- In August 2020, IESO held a stakeholder engagement session focused on reliability standards
- IESO proposed two changes:
  1. Removal of the additional contingency allowance in the Reliability Outlook
  2. Inclusion of non-firm imports in resource adequacy assessments
- A list of considerations for a potential non-firm import methodology was proposed

Summary of Stakeholder Feedback

- Three key themes from the feedback received after the last session:
  1. Non-firm import impact on outage management
  2. Consideration of climate change uncertainty in adequacy assessments
  3. The desire for more data and transparency from the IESO

Summary of Stakeholder Feedback (cont.)

- Consensus on removal of the additional contingency allowance proposal
- General support for inclusion of non-firm imports
- Good recommendations were provided in regards to the non-firm import methodology, which have been incorporated
  - Areas of concern
  - Number of years of data

Non-firm Import Methodology Proposal

- At the last engagement session, six considerations were proposed for assessing an appropriate non-firm import capacity assumption
- Data and an analytic approach for each of these considerations is provided here
- These approaches provide the basis for a methodology to determine the amount of non-firm imports to be included in resource adequacy assessments

Non-firm Imports: Considerations

1. Excess capacity available in neighbouring areas (planning criteria)
2. Excess supply available in neighbouring areas in real-time (timing of each area's peak demand)
3. Sufficient intertie capability
4. Imports likely to flow under tight supply conditions/prices
5. Deliverable within Ontario
6. Ability to manage non-discretionary outages (regulatory requirements)

Proposed Methodology

1. Determine a numeric capacity value for each of the six considerations
2. The most limiting value of the six considerations will be selected as the non-firm import capacity assumption

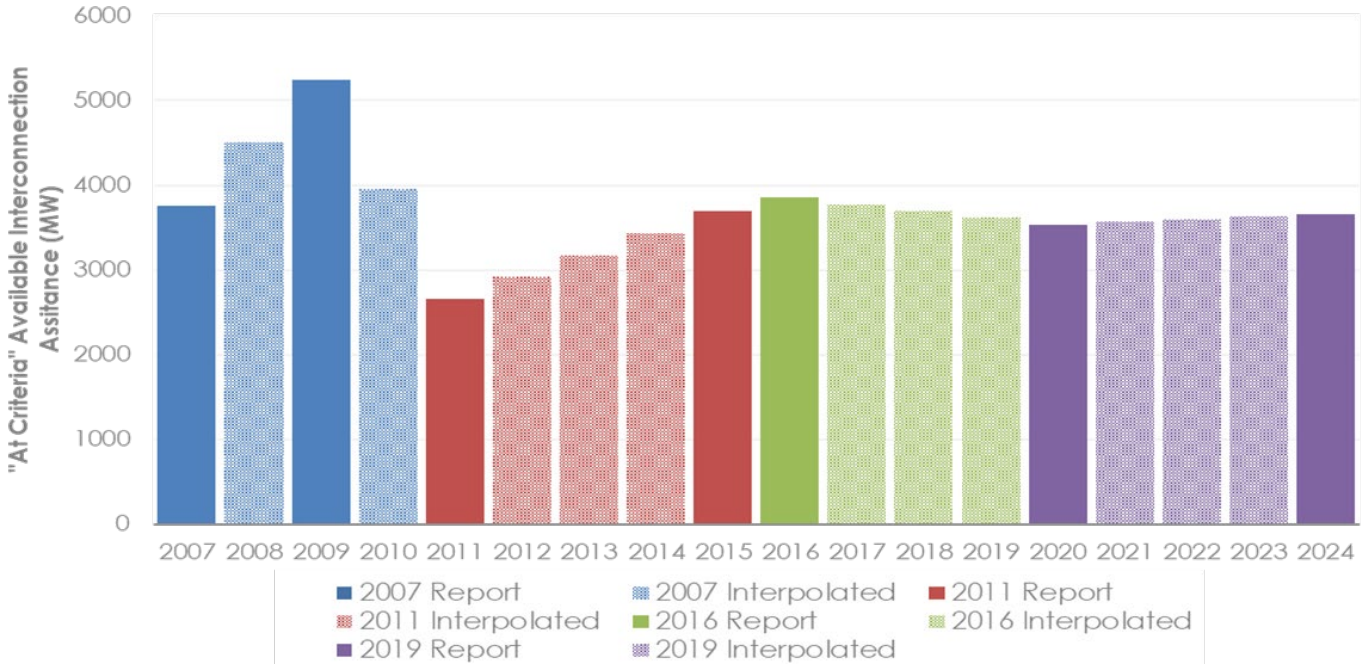
1. Excess capacity available in neighbouring areas

- The best assessment of the future available import capacity for resource adequacy is the NPCC "*Review of Interconnection Assistance Reliability Benefits"* report
  - Probabilistic assessment of NPCC, PJM and MISO assessment areas
  - Forward looking (most recent study assessed 2020 and 2024)
- These studies consistently show the available non-firm import capacity for Ontario is well over 2,500 MW

NPCC Study Details

- GE-MARS model that includes Ontario, Quebec, Maritimes, New England, New York, PJM & MISO
- Determine capacity benefit for Ontario by connecting to neighbours
- Reduces neighbouring jurisdiction reserve margins such that they are at the 0.1 day/year LOLE criteria

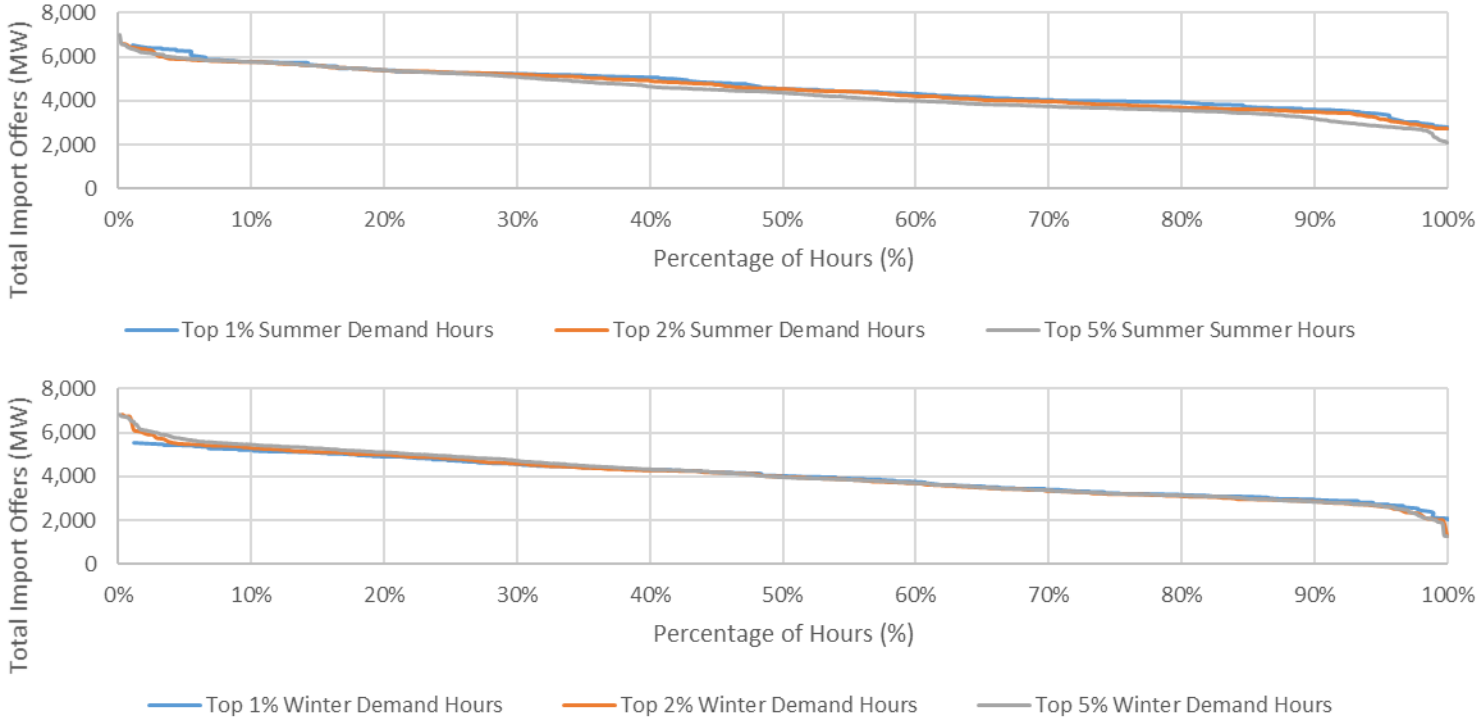
Available Import Capacity – NPCC Studies



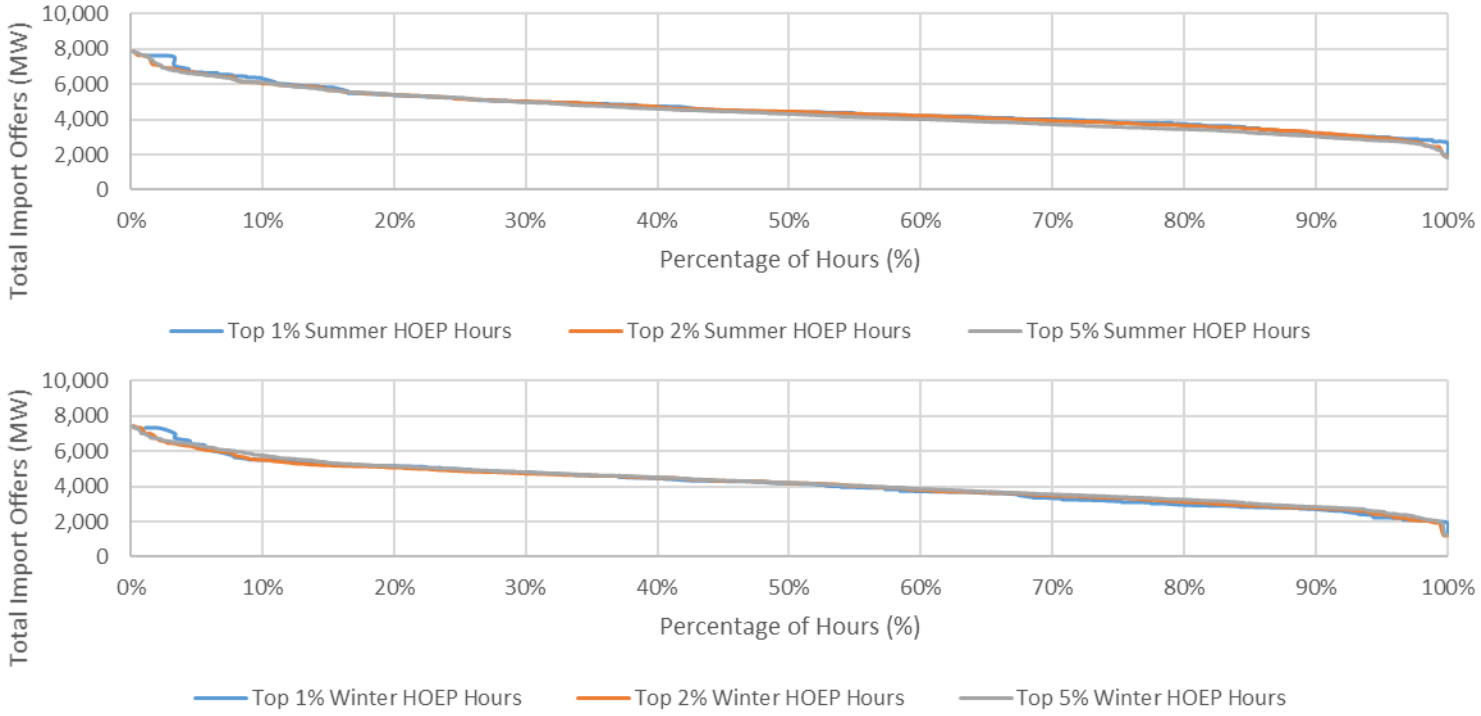
2. Excess supply available in real-time

- The best assessment of the real-time available import capacity is to review import offer data from the recent past
  - Reflects actual available capacity to be imported into Ontario under conditions that shouldn't deviate significantly from current conditions
  - Based on stakeholder feedback, last four years of data are considered
- More than 2,000 MW and 1,000 MW are consistently available to Ontario during periods of high demand or high energy prices in summer and winter, respectively

Import Offer Duration Curves– 2016-2019 Peak Demand



Import Offer Duration Curves– 2016-2019 Peak HOEP



3. Sufficient Intertie Capability

- Ontario currently has 5,910 MW of interconnection capacity with its neighbours, assuming all elements are in-service
- With one element of service at each intertie, the interconnection capacity is 2,575 MW

4. Imports likely to flow under tight supply conditions

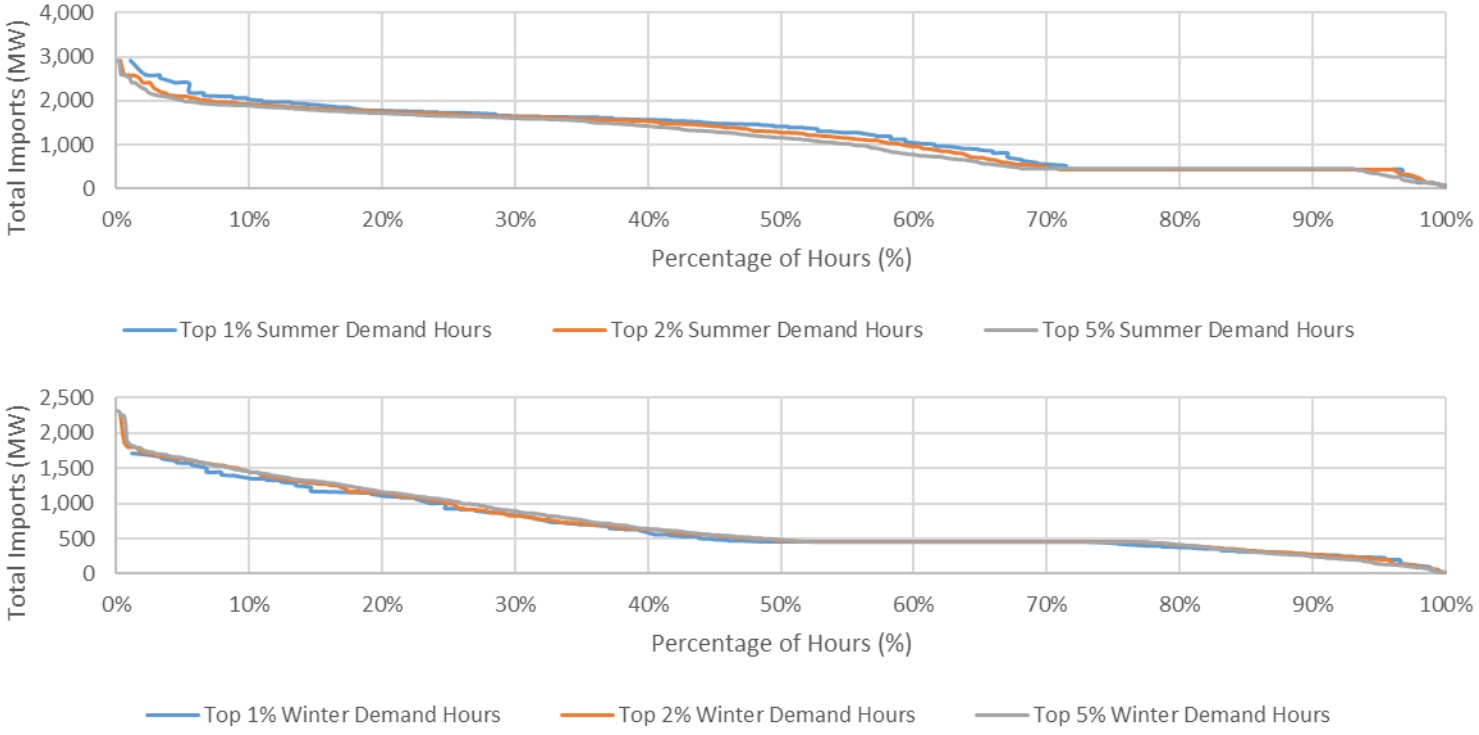
- The best assessment of the whether imports are likely to flow under tight supply conditions/prices is to review import flow data from the recent past
  - Reflects actual available capacity to be imported into Ontario under conditions that shouldn't deviate significantly from current conditions
  - Based on feedback, last four years of data are considered
- Over the last four years, the average import flow during periods of tight supply has been between 650-1220 MW, depending on assumptions

Average Import Flows – 2016 to 2019

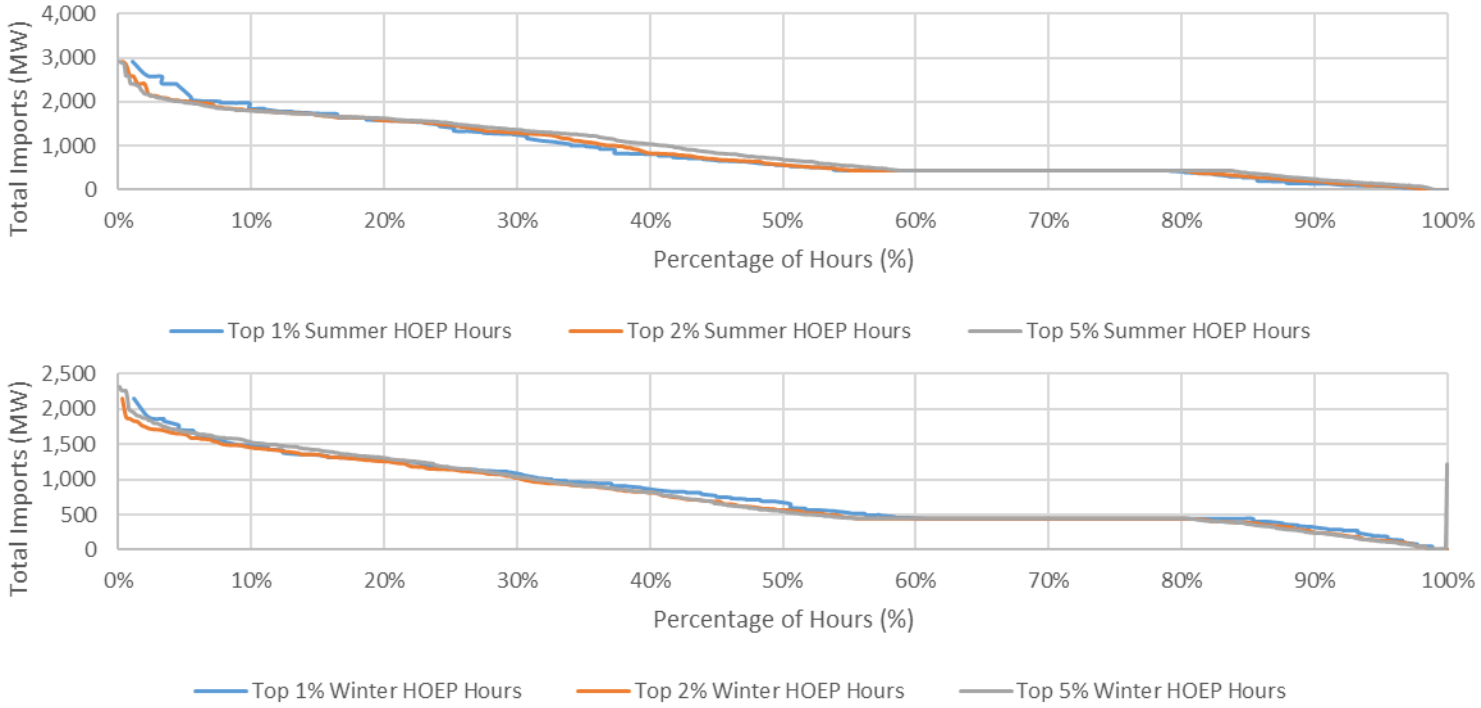
Average Flow (MW)	Top 1% of Hours	Top 2% of Hours	Top 5% of Hours
Peak Summer Demand	1,220 MW	1,180 MW	1,107 MW
Peak Summer HOEP	850 MW	882 MW	929 MW
Peak Winter Demand	653 MW	697 MW	715 MW
Peak Winter HOEP	779 MW	761 MW	776 MW

- July 9th was the highest demand day in 2020, with 6 consecutive hours of demand greater than 24,000 MW
- In those 6 hours, imports ranged from 2,200-2,500 MW, averaging over 2,300 MW

Import Flow Duration Curves– 2016-2019 Peak Demand



Import Flow Duration Curves– 2016-2019 Peak HOEP



Imports Flow Percentiles

- If a more dependable level of imports is required for the non-firm import assumption, a dependable percentile approach could be used based off the import flow duration curves
- This approach would reduce the risk of the assumed non-firm import capacity not being available at times of need
- The dependable 85th and 90th percentile flows are shown on the following slides

Summer Dependable Import Percentiles – 2016 to 2019

85th Percentile Dependable Flow (MW)	Top 1% of Hours	Top 2% of Hours	Top 5% of Hours
Demand	448 MW	448 MW	448 MW
HOEP	275 MW	310 MW	385 MW

90th Percentile Dependable Flow (MW)	Top 1% of Hours	Top 2% of Hours	Top 5% of Hours
Demand	448 MW	448 MW	448 MW
HOEP	148 MW	204 MW	251 MW

Winter Dependable Import Percentiles – 2016 to 2019

85th Percentile Dependable Flow (MW)	Top 1% of Hours	Top 2% of Hours	Top 5% of Hours
Demand	304 MW	325 MW	319 MW
HOEP	420 MW	390 MW	369 MW

90th Percentile Dependable Flow (MW)	Top 1% of Hours	Top 2% of Hours	Top 5% of Hours
Demand	263 MW	263 MW	241 MW
HOEP	315 MW	250 MW	243 MW

5. Deliverable within Ontario

- Transmission studies have indicated that maximum coincident import capability into Ontario, accounting for internal constraints, is 5,200 MW

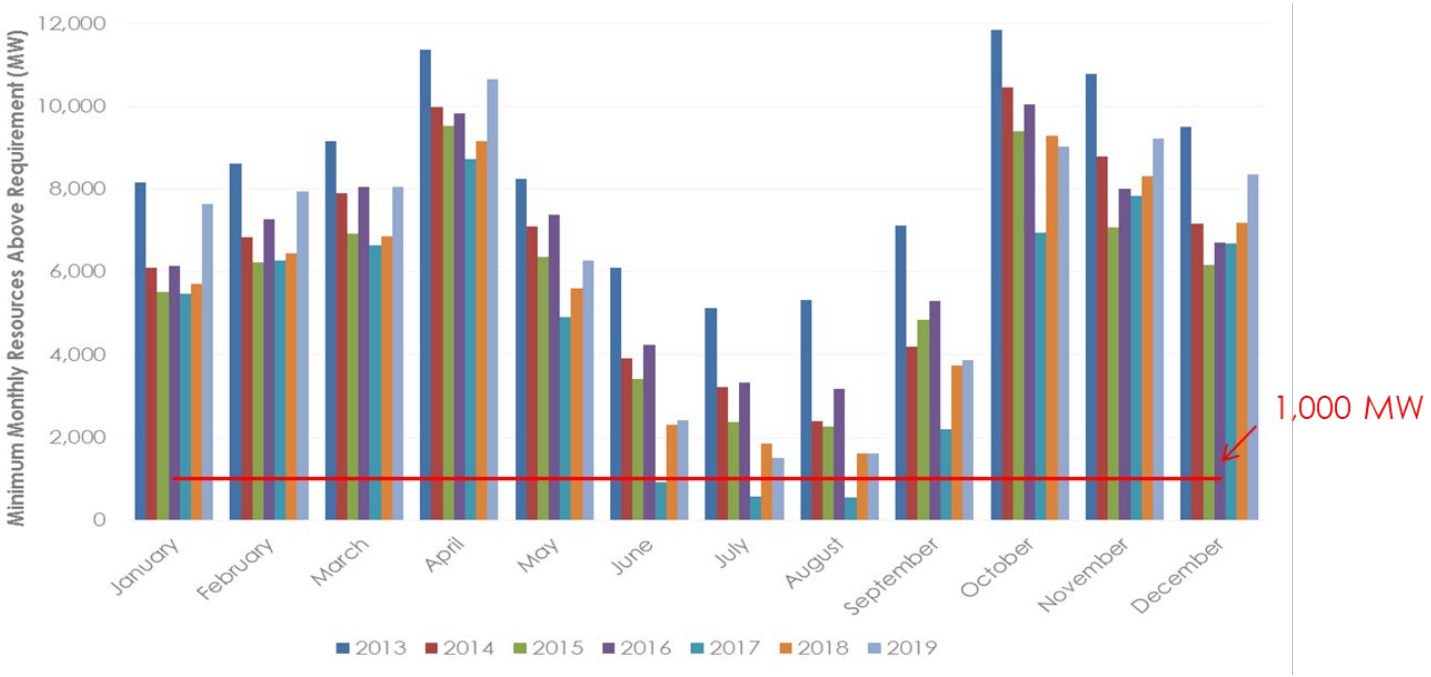
6. Ability to manage non-discretionary outages

- The impact of a non-firm import assumption on outage management is currently best assessed by reviewing how that assumption would have impacted outage assessment in the recent past
- Forward looking assessments (Reliability Outlook) do not consider additional new resources that must be procured to maintain adequacy, thus will show that no non-firm import capacity is acceptable in the long-term.

Impact on Outage Assessment - Backward Looking

- The graph on the following slide shows the minimum weekly Resources Above Requirement (with requirement equaling -2,000 MW to reflect Extreme Weather outage approval) for each month since 2013, assuming no outages or de-rates
- There has been only one year (2017- June to August) in which the extreme weather resource requirement could not have been met if there had been 1,000 MW less Ontario supply (equivalent to 1,000 MW non-firm import). The minimum RAR was 556 MW in August, 2017

Impact on Outage Assessment- Backward Looking



ieso
Connecting Today. Powering Tomorrow.

Other Considerations - Firm Import Contracts

- Ontario has not had any firm import capacity contracts over the last four years
- The HQ Energy Trade agreement is an energy agreement
  - As a leftover from an earlier agreement, Ontario is owed 500 MW of summer capacity from Quebec at some point in the future
- Up to 80 MW of import capacity is allowed in the capacity auction
- Any non-firm import assumption will need to factor firm import capacity into the calculation as to avoid double counting capacity

Risk Tolerance

- Non-firm imports have not been used in long-term resource adequacy assessments for over a decade
- Based on internal and external stakeholder feedback, the advice is to take a conservative approach as this concept is reintroduced
- Based on these discussions, for considerations that require a percentile quantification, IESO is recommending the use of the 90th percentile dependable values over the top 5% of HOEP hours
  - Periods of high HOEP better represent a period of resource adequacy need than a period of high demand

Non-firm Import Methodology- Limiting Values

Consideration	Summer Value (MW)	Winter Value (MW)	Notes
1. Excess capacity available in neighbouring areas (planning criteria)	3,663	3,663	NPCC studies don't differentiate between winter and summer
2. Excess supply available in neighbouring areas in real-time	3,017	2,810	90th percentile dependable offer in top 5% HOEP hours, 2016-2019
3. Sufficient intertie capability	2,575	2,575	Capacity with one element out of service
4. Imports likely to flow under tight supply conditions/prices	251	243	90th percentile dependable flow in top 5% HOEP hours, 2016-2019

Non-firm Import Methodology- Limiting Values (cont.)

Consideration	Summer Value (MW)	Winter Value (MW)	Notes
5. Deliverable within Ontario	5,200 MW	5,200 MW	Coincident import capability with internal constraints
6. Ability to manage non-discretionary outages (regulatory requirements)	556	5,475	Minimum RAR, no outages or de-rates
Overall Limiting Value	**251**	**243**	**90th percentile dependable flow in top 5% HOEP hours, 2016-2019**

Conclusions

- Data and an analytic approach is provided for each of the non-firm import considerations
- Using the data from each consideration and a risk tolerance from stakeholders, a methodology is proposed in which the most limiting value of the six considerations is the non-firm import capacity assumption
- This methodology yields a non-firm import assumption of 250 MW in summer and 240 MW in winter

Stakeholder Feedback

- The IESO is seeking feedback on the proposed methodology and approach outlined in this presentation with respect to intertie support:
  - Have the areas of consideration been appropriately included in the proposed methodology?
  - Are the approaches outlined reasonable for forecasting real-time market imports?
- Please use the feedback form found under the December 14 entry on the Reliability Standards Review webpage to provide feedback and send to engagement@ieso.ca by January 18, 2021

Next Steps

- The Additional Contingency Allowance will be removed from the Reliability Outlook beginning with the 2021 Q1 report
- Non-firm imports, using the proposed methodology, will be incorporated into the next Annual Planning Outlook (2021)
  - The full methodology will be included in the accompanying Resource Adequacy Methodology document
  - The non-firm import value will be reassessed in each APO