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Capacity Accreditation for IESO

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Land Acknowledgement

The IESO acknowledges the land from where we are delivering today's webinar is the traditional territory of many nations including the Mississaugas of the Credit, the Anishinaabeg, 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 the traditional territories across the province, which include those of the Algonquin, Anishinaabeg, Ojibwe, Cree, Oji-Cree, Huron-Wendat, Haudenosaunee, Métis, and Inuit peoples.

Engagement Principles

This engagement is conducted in accordance with the IESO's External Engagement Framework, which includes the following principles:

- **Purposeful** – Initiate meaningful conversations that move the sector forward
- **Inclusive** – Invite many voices and diverse perspectives to the table
- **Timely** – Seek input and insight when it can have the most impact
- **Accessible** – Ensure we meet people where they are on their energy journey
- **Traceable** – Allow everyone to follow the path that is being taken
- **Transparent** – Show how engagement helped shape the final outcome

Shared Commitment to Respectful Participation

To support a focused and constructive discussion:

- We will take questions one at a time; please use the raise-hand feature to enter the speaking queue
- We encourage concise and focused comments to allow time for multiple perspectives
- Participants are encouraged to raise relevant points during the discussion and provide more detailed feedback through the written submission process
- We ask that all participants maintain a respectful and professional tone throughout the session
- Facilitators will guide the discussion and manage participation to stay aligned with today's focus and agenda
- Where necessary, we may disable a participant's microphone to manage participation

Purpose

- Provide context on why the IESO is reviewing capacity accreditation and how it supports procurement.
- Identify and assess capacity accreditation approaches and discuss trade-offs between reliability, accuracy and modelling complexity.
- Support an appropriate comparison of the relative capacity contributions of different resource types, with results informing discussions at future engagements.
- Recommend an approach going forward and seek stakeholder feedback to inform the next stage of the assessment.

Agenda

- Background and Context
- Capacity Accreditation Approaches
- Comparing Approaches
- Considerations for Ontario
- Discussion and Feedback

Background and Context

- Capacity accreditation methods estimate the contribution of specific resources to reliability, particularly during periods of need.
- Ontario's evolving resource mix requires an accreditation method that accurately reflects reliability contribution and declining marginal value, while allowing resources with different operating characteristics to be evaluated on a consistent basis.
- Applying appropriate accreditation values helps ensure that procurements secure a resource mix capable of meeting reliability needs efficiently and cost-effectively.

Capacity Accreditation Methods

About Capacity Accreditation

- Accreditation methods range from simple, backward-looking approaches like Unforced Capacity (UCAP) to forward-looking, probabilistic approaches like Marginal Reliability Impact (MRI), with different trade-offs between accuracy, transparency, and complexity.
- More advanced methods can better reflect impacts to the system and resource interactions, particularly for non-dispatchable and energy-limited resources.
- Capacity accreditation is separate from performance management, which assesses a resource’s actual performance after procurement.

Main Capacity Accreditation Methods

The primary capacity accreditation methods used by industry are:

- Unforced Capacity (UCAP)
- Effective Load Carrying Capability (ELCC)/ Equivalent Firm Capacity (EFC)
- Marginal Reliability Index (MRI)
- Direct Loss of Load (DLOL)

Unforced Capacity (UCAP)

- UCAP represents the amount of capacity a resource is expected to provide during periods of system need, after accounting for forced outages, derates, and historical availability. It translates installed capacity into an availability adjusted MW value, allowing resources to be compared based on what they can reliably deliver.
- UCAP (MW) = ICAP (MW) × Capacity Contribution Factor
- This is the main approach currently used to set capacity accreditation values for IESO procurements.

Unforced Capacity (UCAP) - Simple Example

A 100 MW resource has a capacity contribution factor of 80%.

$$UCAP = 100\ MW\ \times 80\%$$

$$UCAP = 80\ MW$$

Unforced Capacity (UCAP)

Pros:

- Simple to implement and administer using established historical availability and performance data.
- Accreditation values are relatively predictable and transparent, allowing participants to understand how they are determined.
- Works well for dispatchable resources, where outage behavior is a key indicator of contribution during periods of need.

Unforced Capacity (UCAP)

Cons:

- Limited operating data may make accreditation values less representative for new and emerging resources.
- As a backward-looking approach, UCAP may not reflect evolving system conditions or capture the declining marginal value of resources identified through probabilistic analysis, often overstating the reliability value of incremental capacity.
  - The 2025 IESO technical paper found that the reliability value of additional storage declines as penetration increases.[1]

[1] See the IESO's *Effective Load Carrying Capacity of Energy Storage* technical paper for further discussion of declining marginal capacity value.

Effective Load Carrying Capability (ELCC)/ Equivalent Firm Capacity (EFC)

- ELCC measures a resource's reliability value to the grid by comparing it to the amount of firm capacity needed to replace the same resource while maintaining the same level of adequacy.
- The ELCC value is the reduction in firm capacity expressed as a percentage of the resource’s capacity.
- ELCC values depend on system conditions and should be periodically revisited as system conditions evolve.

Effective Load Carrying Capability (ELCC)/ Equivalent Firm Capacity (EFC) - Simple Example

Adding a 100 MW resource reduces the expected unserved energy from 1150 MWh to 1080 MWh, a reduction of 70 MWh. The same reliability improvement can be achieved by adding 30 MW of firm capacity.

$$ELCC = \frac{30\ MW}{100\ MW}$$

$$ELCC = 30\%$$

Effective Load Carrying Capability (ELCC)/ Equivalent Firm Capacity (EFC)

Pros:

- Reflects how a resource contributes to reliability within the broader system, accounting for penetration, demand shape, and resource mix.
- Captures interactions between resource types and the declining marginal value of additional capacity.
- Can support accreditation that better reflects the reliability contribution of resources competing in procurement and support long-term planning.

Effective Load Carrying Capability (ELCC)/ Equivalent Firm Capacity (EFC)

Cons:

- An iterative probabilistic method that requires more computational effort and time to produce results.
- Accreditation values may be more difficult to understand and may change as system conditions evolve, requiring more information to be shared with participants to inform their proposals.

Marginal Reliability Impact (MRI)

- MRI measures the change in system reliability from adding a resource and compares it with the change from adding the same amount of firm capacity. The resulting value represents the resource's marginal reliability contribution relative to firm capacity.
- MRI is conceptually similar to ELCC, but rather than determining a full replacement value, it evaluates the reliability impact of adding a small increment of a resource.
- MRI values are dependent on system conditions and should be periodically revisited as system conditions evolve.

Marginal Reliability Impact (MRI) - Simple Example

Adding a 100 MW resource reduces expected unserved energy by 70 MWh, while adding 100 MW of firm capacity reduces it by 175 MWh.

$$MRI = \frac{\Delta EUE_{resource}}{\Delta EUE_{firm\ capacity}}$$

$$MRI = \frac{70\ MWh}{175\ MWh}$$

$$MRI = 40\%$$

Marginal Reliability Impact

Pros:

- Provides a consistent basis for comparing resource types, supporting procurement.
- Reflects how a resource contributes to reliability within the broader system, accounting for penetration, demand shape, and resource mix.
- Captures interactions between resource types and the declining marginal value of additional capacity.
- Uses a fixed set of probabilistic model runs, reducing modelling effort compared with iterative ELCC calculations.

Marginal Reliability Impact

Cons:

- Results depend on the underlying model, assumptions, and reference system, which can make the methodology more difficult to reproduce.
- Accreditation values may change as system conditions evolve, requiring a clear update process to maintain predictability between procurements.
- Requires multiple capacity adequacy runs for each resource type, increasing modelling effort.

Direct Loss of Load (DLOL)

- DLOL measures a resource class’s expected contribution during the hours when the system is most at risk.
- A probabilistic model identifies the highest-risk hours and measures resource performance during them, giving more weight to the most severe conditions.
- The resulting value represents the capacity the resource class is expected to provide during periods of greatest reliability need.

Direct Loss of Load (DLOL) - Simple Example

A probabilistic model identifies the hours with the highest reliability risk. During those hours, the 100 MW resource is expected to provide a risk-weighted average of 35 MW.

$$DLOL\,Value = 35\,MW$$

Direct Loss of Load

Pros:

- Closely aligns accreditation to expected resource performance during the hours of highest modeled reliability risk. This provides a clear indication of what the resource is expected to contribute when the system needs it most.
- Assesses resource types under the same modeled system conditions, supporting a consistent approach to accreditation.
- Despite its dependence on system conditions, it may be more predictable as it focuses on periods of need, reducing sensitivity to isolated events.

Direct Loss of Load

Cons:

- The probabilistic modelling and weighting of risk hours may be difficult for participants to independently reproduce.
- The granular modelling of risk hours can make accreditation values sensitive to dispatch algorithms and changing system conditions, making results more difficult to explain and predict between procurements.
- Computationally complex and intensive, with results depending on how critical hours are identified and weighted, and on assumptions related to resource availability and outages.

Summary of Capacity Accreditation Approaches

Method	Description
UCAP	Availability-adjusted MW using forced outages, derates, and historical availability.
ELCC	Measures a perfect capacity equivalent that preserves adequacy when the resource is added.
MRI	Normalized reliability impact of a small increment of a resource vs. the same MW of perfect capacity.
DLOL	Weighted expected performance during critical hours.

Considerations for an Improved Approach

- Reflect how reliability contribution changes with: system conditions, resource penetration, and interactions across the resource mix, in order to align procured capacity with its expected contribution during periods of system need.
- Support procurement by providing a consistent basis for comparing the reliability value of different resource types while remaining practical to implement and update without creating unnecessary modelling or process burden.
- Produce accreditation values that are explainable and reasonably predictable for procurement participants.

Considerations for an Improved Approach

- These considerations point toward a marginal, probabilistic approach that reflects reliability contribution as the system evolves.
- Unlike UCAP, which assesses a resource based on its own historical availability, a better approach would assess the resource's reliability contribution to the grid under broader system conditions, allowing the optimal set of resources to be selected to meet system needs cost effectively.
- As accreditation values may change with system conditions, a clear methodology and update cycle would be needed to provide reasonable predictability for procurement participants.

Evaluation of Capacity Accreditation Approaches

Criteria	UCAP	ELCC	MRI	DLOL
Captures system dependence	Low	High	High	High
Captures declining marginal value	Low	High	High	Medium
Computational and process burden	Low	High	Medium	High
Captures performance during periods of need	Low	Medium	Medium	High
Transparency	High	Low	Low	Low
Predictability [1]	High	Low	Medium	Medium

[1] Measured by variability from year-to-year

IESO’s Recommendation

- Based on the evaluation, Marginal Reliability Impact (MRI) is recommended to inform capacity accreditation in future procurements.
- As a probabilistic approach, it reflects how the reliability contribution of new resources changes with system conditions, resource penetration, and interactions across the resource mix.
- It also recognizes that each additional megawatt may provide a different level of reliability value.
- It meets the outlined requirements while using a fixed set of runs, reducing the complexity compared to iterative methods like ELCC.

IESO’s Recommendation

- MRI provides a consistent basis for comparing the reliability contribution of different resource types, supporting procurement.
- Accreditation values would reflect the expected contribution of each resource to the grid, rather than relying primarily on the resource’s historical availability in isolation.
- Overall, MRI provides the best balance between reliability accuracy, modelling effort, and the need for accreditation values that are explainable and reasonably predictable for procurement participants.

Key Takeaways

- There is a trade-off between computational complexity and accuracy across accreditation methods.
- Accreditation values should evolve with system conditions, while remaining predictable and explainable over time. Any changes should also be communicated to participants regularly to help inform their work.
- MRI accounts for these considerations by reflecting the changing reliability value of new resources without iterative modelling, making it a balanced approach for informing capacity accreditation values in future procurements.

Next Steps

- Implementation and validation of each methodology in the capacity adequacy model is in progress.
- In our next engagement session, the IESO will share the results of the recommended approach along with the results from the other methodologies for perspective.
- This will help show how the results change depending on the resource and methodology used.

Thank You

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