

**JUNE 21, 2022**

# Market Renewal – Energy Project: Constraint Violation Pricing for Dispatchable Hydroelectric Resources

## Objective

- In response to stakeholder comments on the detailed design, the IESO is providing clarification on how the Day Ahead Market (DAM) and Pre-Dispatch (PD) engines will handle scheduling constraints when hydroelectric dispatch data parameters bind.
- Provide rationale for new cascade over/under generation in the constraint violation pricing hierarchy
- Provide example illustrating new cascade over/under generation constraint

## Constraint Violation Penalty Curves

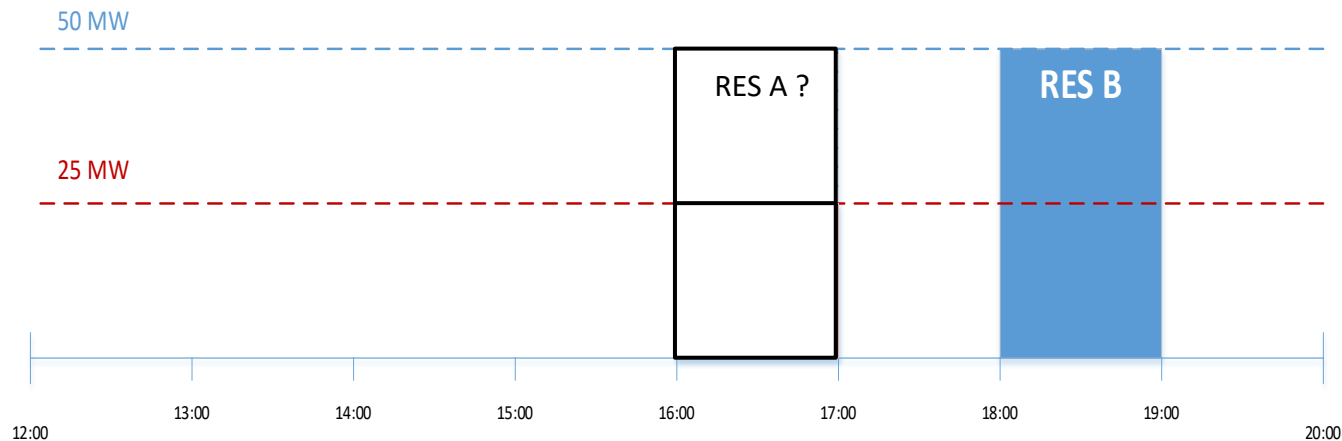
- The calculation engines may at times be unable to resolve all modelled constraints, but the dispatch algorithm can attempt to achieve a solution by allowing constraints to be violated by using a violation variable
- This violation variable, currently defined through a penalty price, adds a penalty cost to the dispatch algorithm that allows a violated constraint to be relaxed and allows the calculation engines to find a solution
- Constraint violation penalty curves will continue to be defined as the penalty functions for the violation of constraints in the dispatch algorithm

# Hydroelectric Dispatch Parameters and Constraint Violation Price Applicability

Dispatch Data Parameter	Parameter Status	Constraint Violation Price?	Rationale
Minimum Hourly Output (MHO)	New	No	Resource can be scheduled above MHO or to 0MW to resolve system constraints
Hourly Must Run (HMR)	New	No	No flexibility to violate resource constraint
Maximum Number of Starts Per Day (MNSPD)	New	No (same as today for non-quick start resources)	
Forbidden Regions	Existing	No (same as today)	
Maximum Daily Energy Limit (Max DEL)	Existing	Yes (same as today)	Flexibility to manage daily energy limit violations prior to materializing
Minimum Daily Energy Limit (Min DEL)	New	Yes	
Linked Resources, Time Lag and MWh Ratio (Cascade Over/Under Generation)	New	Yes	Flexibility to manage cascade scheduling violations prior to materializing

## Example: Cascade Over/Under Generation Scheduling Conflicts

Res A is linked to Res B with a 2-hour time lag and 1:1 MWh ratio  
Res B has also submitted an **hourly must run** value of 50 MW for HE19  
Res A is limited by an **operating security limit** in HE17 to 25 MW



- Resource A would have to be scheduled to 50MW to meet the MWh ratio requirement, but is limited by a transmission security limit to 25MW
- Calculation engine cannot solve without relaxing one of the constraints on the resource
- How will RES A be scheduled by the engine?

# Constraint Violation Penalty Curve in the Scheduling Passes

Constraint	Constraint Violation Price
Daily Energy Limits	\$100,000
Transmission Security Limits	\$60,000
Max Area Operating Reserve Limits	\$60,000
Intertie Limits	\$40,000
<b>Cascade Under/Over Generation</b>	<b>\$37,000/- \$37,000</b>
Net Interchange Scheduling Limit (NISL)	\$35,000
System Wide Under/Over Generation	\$30,000/- \$30,000
System Wide Operating Reserve 10S/10T/30T	\$12,000/\$10,000/\$6,000

**Existing Local Constraints**

←

**New Cascade Constraint**

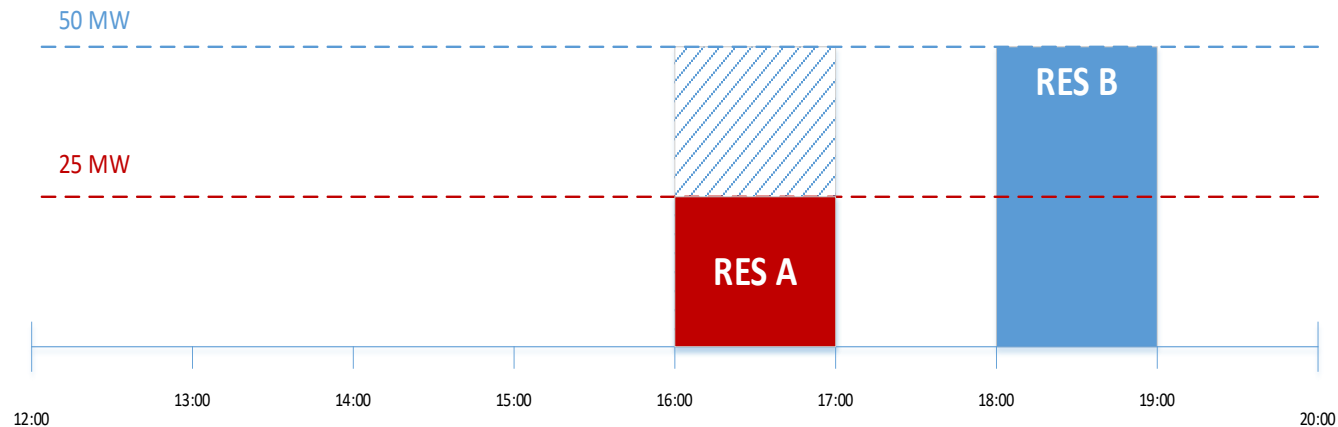
←

**Existing System-Wide Constraints**

**Rationale for Cascade Violation Price:** To resolve system-wide constraints, other resources should be scheduled before violating cascade requirements. To resolve local constraints, cascade requirements should be relaxed before local constraints, as a specific cascade resource is more likely to be required to resolve the local constraint.

# Example: Resolving Cascade Over/Under Generation Scheduling Conflicts

Res A is linked to Res B with a 2-hour time lag and 1:1 MWh ratio  
Res B has also submitted an **hourly must run** value of 50 MW for HE19  
Res A is limited by an **operating security limit** in HE17 to 25 MW



- Based on the constraint violation pricing hierarchy, the engine would relax the cascade constraint before the transmission limit constraint
- RES A would be scheduled to 25MW

# Thank You

[ieso.ca](http://ieso.ca)

1.888.448.7777

[customer.relations@ieso.ca](mailto:customer.relations@ieso.ca)

[engagement@ieso.ca](mailto:engagement@ieso.ca)



[@IESO\\_Tweets](https://twitter.com/IESO_Tweets)



[facebook.com/OntarioIESO](https://facebook.com/OntarioIESO)



[linkedin.com/company/IESO](https://linkedin.com/company/IESO)