

# Market Renewal FACT SHEET

## Constraint Violations

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The single schedule market (SSM) is one initiative in the Market Renewal's Energy work stream. A SSM will include a security constrained unit commitment, which takes into account constraint violations, constraint penalty functions, and violation variables in its algorithm. Since under some conditions not all constraints can be met in scheduling the system, violation of constraints must be determined in a specific manner.

### What is it?

When committing and dispatching a power system, optimization is the process of determining the operation of resources on the system that minimizes overall costs to meet load.

The IESO is in charge of operation of the Ontario system and the calculation of market prices. The dispatch and prices are determined by optimizing the system to meet energy and operating reserve requirements. In a two schedule market, dispatch and prices are determined by two different optimization formulae. In a single schedule market, the same optimization formula is used for both dispatch and prices.<sup>1</sup>

Energy and operating reserves are defined as constraints on system operation in regards to these optimization problems.<sup>2</sup> Other constraints include transmission constraints and unit operating constraints.

When scheduling the system, there can be times during which one or more constraints cannot be met. However, there is still a need to dispatch and operate the system. To find a solution in

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<sup>1</sup> The optimization of dispatch and price is solved twice, once for dispatch and once for price as there are some pricing requirements that cannot be used in the dispatch algorithm. However, the two optimizations are very much aligned. See Market Renewal Fact Sheet on Pre- or Post-Interval Pricing for more detail.

<sup>2</sup> A constraint is a mathematical representation of a limitation on system operation. For example, the need to meet load or limitations placed on operation because of the transmission system.

such instances, a process must be put in place to allow the optimization to violate constraints in a responsible manner.<sup>3</sup> The IESO currently employs two approaches.

- Constraint relaxation – The system requirements that are being violated are reduced sufficiently to allow a solution to be found.
- Soft constraints and penalty prices – A financial penalty is set for violating a reliability constraint. The more serious the reliability constraint, the higher the penalty.

## **Why is it important?**

Historically, the IESO could define these rules without much concern that the market would be impacted since the disconnect between prices and dispatch is addressed with make whole payments. The change to a single optimization problem to set both dispatch and prices means that the rules for violating and relaxing constraints impacts both operations and market prices (and revenues/costs for market participants) more than they did in the past. This means that the rules governing the violation and relaxing of system constraints will need more scrutiny in a single schedule market.

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<sup>3</sup> Any constraint violation should be the minimal amount required such that a feasible solution can be found. An example is a reliability constraint that requires 10% excess capacity over expected demand. If a feasible solution cannot be found with the 10% requirement, it can be relaxed to 9% to obtain a feasible solution, but should not be reduced any further if a feasible solution was found.