PUBLIC

Detailed Design

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Market Renewal Program: Energy

# Grid and Market Operations Integration

## Detailed Design

Issue 2.0

*This document provides a detailed overview of the processes related to the Grid and Market Operations Integration that will be implemented for the Energy work stream of the Market Renewal Program, including related market rules and procedural requirements.*

DES-22

## Disclaimer

This document provides an overview of the proposed detailed design for the Ontario Market Renewal Program (MRP) and must be read in the context of the related MRP detailed design documents. As such, the narratives included in this document are subject to on-going revision. The posting of this design document is made exclusively for the convenience of *market participants* and other interested parties.

The information contained in this design document and related detailed design documents shall not be relied upon as a basis for any commitment, expectation, interpretation and/or design decision made by any *market participant* or other interested party.

The *market rules*, *market manuals*, *applicable laws*, and other related documents will govern the future market.

## Document Change History

| Issue | Reason for Issue | Date |
|---|---|---|
| 1.0 | First publication for external stakeholder review. | May 5, 2020 |
| 2.0 | Second publication after consideration of external stakeholder feedback. | January 28, 2021 |
| | | |

## Related Documents

| Document ID | Document Title |
|---|---|
| DES-13 | MRP High-Level Design Single Schedule Market |
| DES-14 | MRP High-Level Design Day-Ahead Market |
| DES-15 | MRP High-Level Design Enhanced Real-Time Unit Commitment |
| DES-16 | MRP Detailed Design: Overview |
| DES-17 | MRP Detailed Design: Authorization and Participation |
| DES-18 | MRP Detailed Design: Prudential Security |
| DES-19 | MRP Detailed Design: Facility Registration |
| DES-20 | MRP Detailed Design: Revenue Meter Registration |
| DES-21 | MRP Detailed Design: Offers, Bids and Data Inputs |
| DES-22 | MRP Detailed Design: Grid and Market Operations Integration |
| DES-23 | MRP Detailed Design: Day-Ahead Market Calculation Engine |
| DES-24 | MRP Detailed Design: Pre-Dispatch Calculation Engine |
| DES-25 | MRP Detailed Design: Real-Time Calculation Engine |
| DES-26 | MRP Detailed Design: Market Power Mitigation |
| DES-27 | MRP Detailed Design: Publishing and Reporting Market Information |
| DES-28 | MRP Detailed Design: Market Settlements |
| DES-29 | MRP Detailed Design: Market Billing and Funds Administration |

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# Table of Changes

This detailed design document has been updated since version 1. For more detailed information about these changes, refer to the "MRP Energy Detailed Design - Version 2.0 Updates" document.

**– End of Section –**

# 1. Introduction

## 1.1. Purpose

This document is a section of the Market Renewal Program (MRP) detailed design document series specific to the Energy work stream. This document provides the details of the business design and the requirements for *market rules*, market facing and internal procedures, and the data flow required to support the Grid and Market Operations Integration process as related to the introduction of the future day-ahead market and *real-time market*. This design document will aid the development of user requirements, business processes, *market rules* and supporting systems.

As illustrated in Figure 1–1, this document is part of the MRP detailed design document series and will provide the design basis for the development of the governing documents and the design documents.

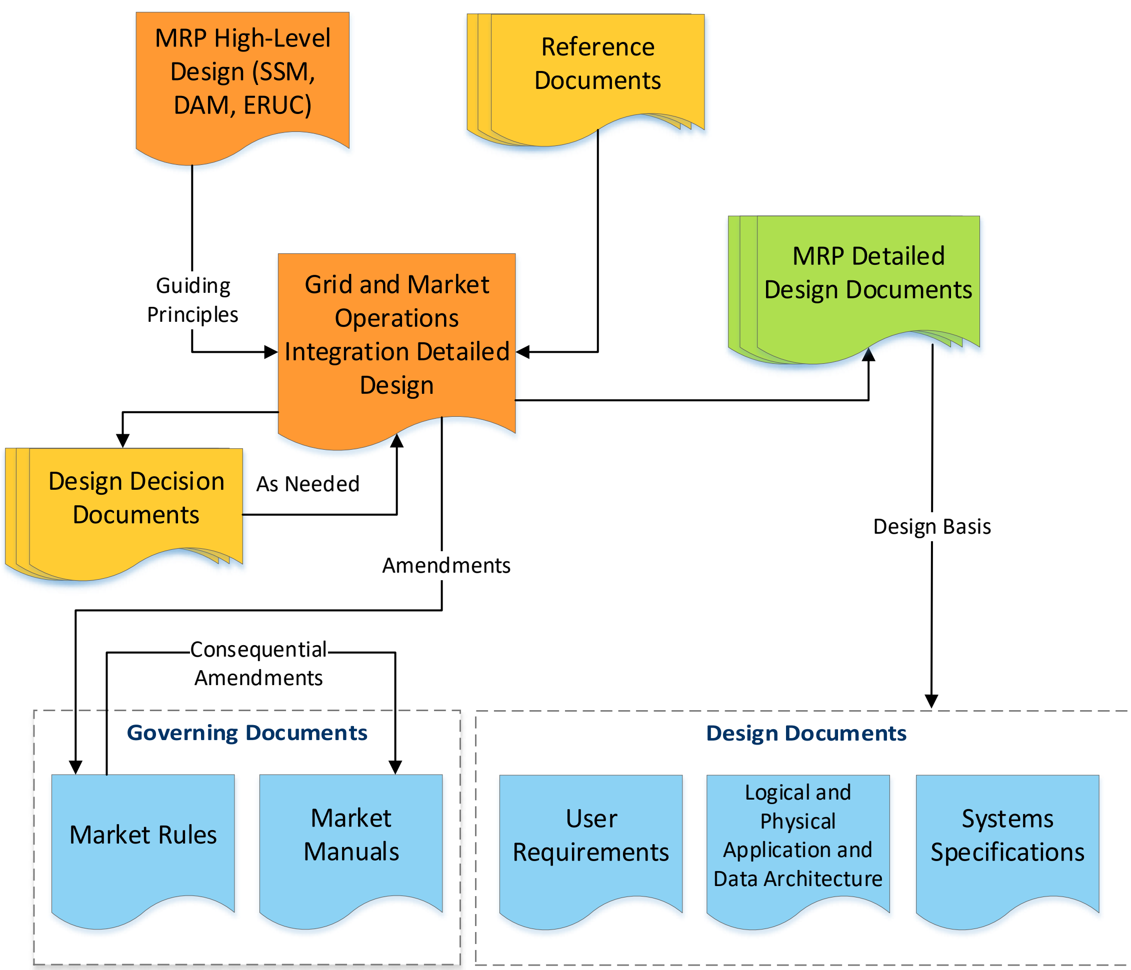


**Figure 1-1: Detailed Design Document Relationships**

## 1.2. Scope

This document describes the Grid and Market Operations Integration process requirements for the future day-ahead market and *real-time market*, in terms of:

- detailed functional design;
- supporting *market rules* requirements;
- supporting procedural requirements; and
- business process and information flow requirements.

Various portions of this document make reference to current business practices, rules, procedures and processes of Grid and Market Operations Integration. However, this document is not a restatement of the existing design of the *Independent Electricity System Operator (IESO)* process. Rather, this document focuses on existing components only to the extent that they might be used in the current or amended form in support of the future day-ahead market and *real-time market*.

## 1.3. Who Should Use This Document

This document is a public document for use by the MRP project team, pertinent *IESO* departments and external stakeholders. Portions of this document that are only pertinent to *IESO* internal processes and procedures may not be incorporated into the public version.

## 1.4. Assumptions and Limitations

**Assumptions**:

While this document makes references to specific parameters that might be used in the Grid and Market Operations Integration process, this document may not determine what the value of all those parameters might ultimately be. The value of such parameters will be determined through the development of the *market rules* and *market manuals*.

**Limitations**:

The business process design presented in Sections 2 and 6 of this document provides a logical breakdown of the various sub-processes described in the detailed business design presented in Section 3. However, factors such as existing and future system boundaries and system capabilities may alter the ultimate design of these sub-processes.

## 1.5. Conventions

The standard conventions followed for this document are as follows:

- Title case is used to highlight process or component names; and

- Italics are used to highlight *market rule* terms that are defined in Chapter 11 of the *market rules*.

## 1.6. Roles and Responsibilities

This document does not set any specific roles or responsibilities. This document provides the design basis for development of the documentation associated with the *IESO* Project Lifecycle that will be produced in conjunction with the MRP.

## 1.7. How This Document Is Organized

This document is organized as follows:

- **Section 2** of this document briefly describes the current context of the *IESO* Grid and Market Operations Integration processes, and the future context for the future day-ahead market and *real-time market*;
- **Section 3** of this document provides a detailed description of the Grid and Market Operations Integration processes;
- **Section 4** of this document describes how the Grid and Market Operations Integration processes will be enabled under the authority of the *market rules* in terms of existing rule provisions, amended rule provisions and additional rule provisions that will need to be developed;
- **Section 5** of this document describes how the requirements of the Grid and Market Operations Integration processes are expected to impact the market-facing manuals and internal procedures in terms of existing procedures, amended procedures and additional procedures that will need to be developed; and
- **Section 6** of this document provides an overview of the arrangement of *IESO* processes supporting the overall Grid and Market Operations Integration processes described in Section 3. This section also outlines the logical boundaries and interfaces of the various sub-processes related to the Grid and Market Operations Integration processes in terms of existing processes, amended processes and additional processes that will need to be developed.

– **End of Section**

# 2. Summary of Current and Future State

The Grid and Market Operations Integration (GMOI) detailed design document describes the future operation of and integration between the *energy markets* in Ontario – the future day-ahead market and *real-time market* and the operation of the *IESO-controlled grid*.

This document discusses data inputs within and between the *pre-dispatch day, dispatch day* and *dispatch hour* as well as processes associated with scheduling and dispatching *facilities* required to facilitate the *energy markets* while ensuring the reliable operation of the grid.

Frequent reference will be made to the underlying calculation engines that run *dispatch algorithms* in the day-ahead, pre-dispatch, and *real-time scheduling processes*. The detailed design documents for the Day-Ahead Calculation Engine, the Pre-Dispatch Calculation Engine, and the Real-Time Calculation Engine provide the design for these three *dispatch algorithms*.

Inputs to the Grid and Market Operations Integration processes begin with those identified in the Offers, Bids and Data Inputs detailed design document. The Market Settlement and the Publishing and Reporting Market Information detailed design documents provide the design for the downstream processes from GMOI.

### Timeframe Acronyms Used in this Document

- Day-ahead (DA): This timeframe includes submission, execution, and results of the day-ahead processes;
- Pre-dispatch (PD): This timeframe includes the forward-looking view of the *pre-dispatch scheduling* process, with a look-ahead period starting with the next *dispatch hour* and looking out over the next *dispatch day*; and
- Real-time (RT): This timeframe refers to the *dispatch hours* comprising each *dispatch day*.

### Scheduling Processes

The *real-time scheduling process* occurs throughout every hour, during which the real-time *dispatch algorithm* runs every five minutes to determine actual prices and schedules for the *dispatch intervals*. It then sends instructions to dispatchable *facilities* at the start of the next interval, indicating the operating point that needs to be reached by the end of the interval.

The pre-dispatch *dispatch algorithm* is also run hourly in an iterative *pre-dispatch scheduling* process that determines projected prices and schedules over a number of future *pre-dispatch hours*. It also determines schedules for imports and exports for the next hour.

The day-ahead scheduling process uses a separate day-ahead *dispatch algorithm* which runs once per day, producing one set of hourly schedules for the next day based on a snapshot of system conditions and market inputs at the time the day-ahead process is initialized.

Figure 2-1 illustrates the relationships between the three scheduling processes.

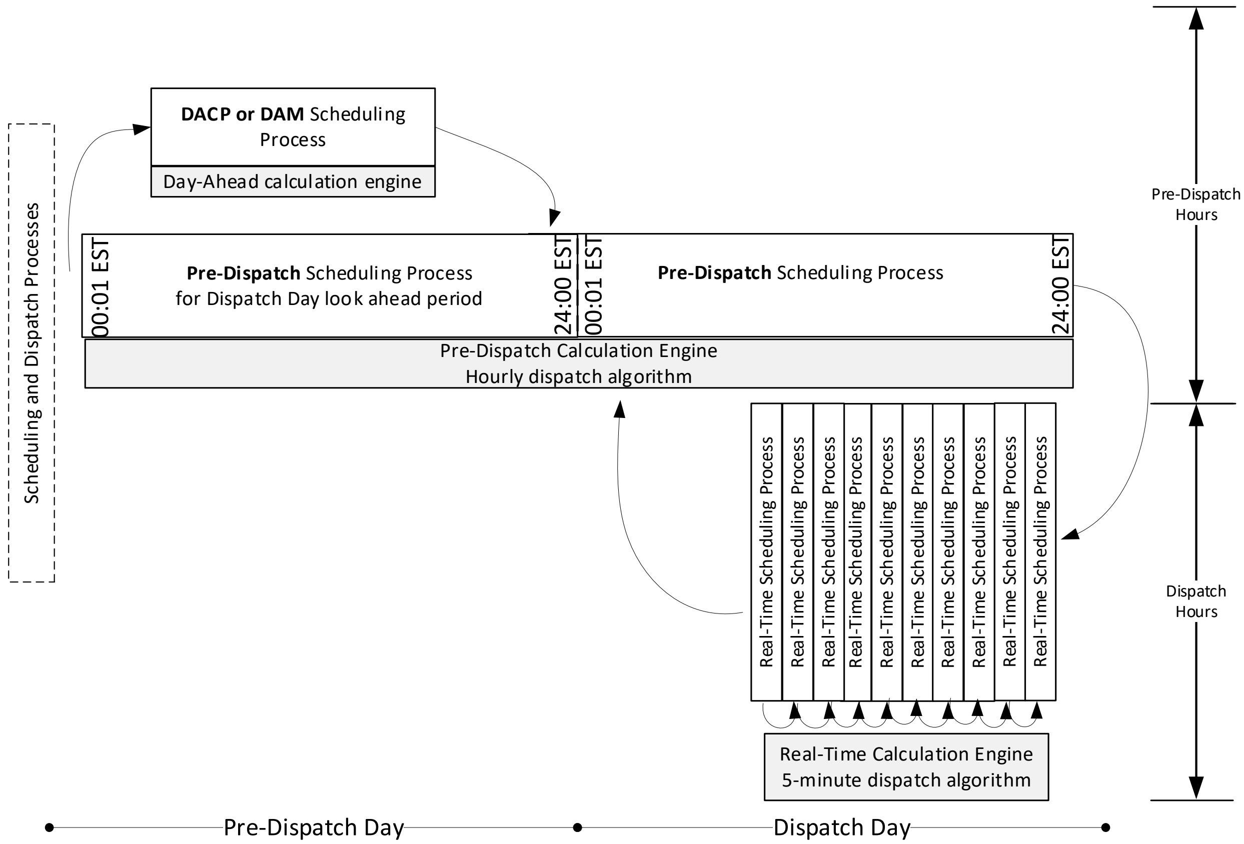


**Figure 2-1: DA, PD and RT Scheduling Processes for Each Dispatch Day**

These DA, PD and RT scheduling processes are supported by the respective calculation engines that require data inputs from both *market participants* and the *IESO*.

This data is then processed to produce schedules, commitments and prices for *market participants* and to support *IESO* system operations in reliably operating the *IESO-controlled grid*. This detailed design document outlines how data inputs will be used within the processes associated with scheduling, committing and *dispatching* resources and *intertie* transactions across the three scheduling processes. It also describes how these future market processes will impact system operations.

## 2.1. Grid and Market Operations Integration in Today's Market

Currently, the *IESO* utilizes automated and manual processes to assess inputs, optimize schedules and process outputs, and modify these processes when necessary to maintain system *reliability*. These processes are handled differently depending on the timeframe.

The following sections briefly describe the current state process of each scheduling process.

### Current Market and Resource Scheduling

The *IESO* currently administers the *real-time market* (RTM) on the *dispatch day* and runs a day-ahead commitment process (DACP) on the *pre-dispatch day*. Figure 2-2 shows the scheduling processes of the DACP, PD and RT and provides a high-level context of the major processes involved in the operation of the current *energy market*.

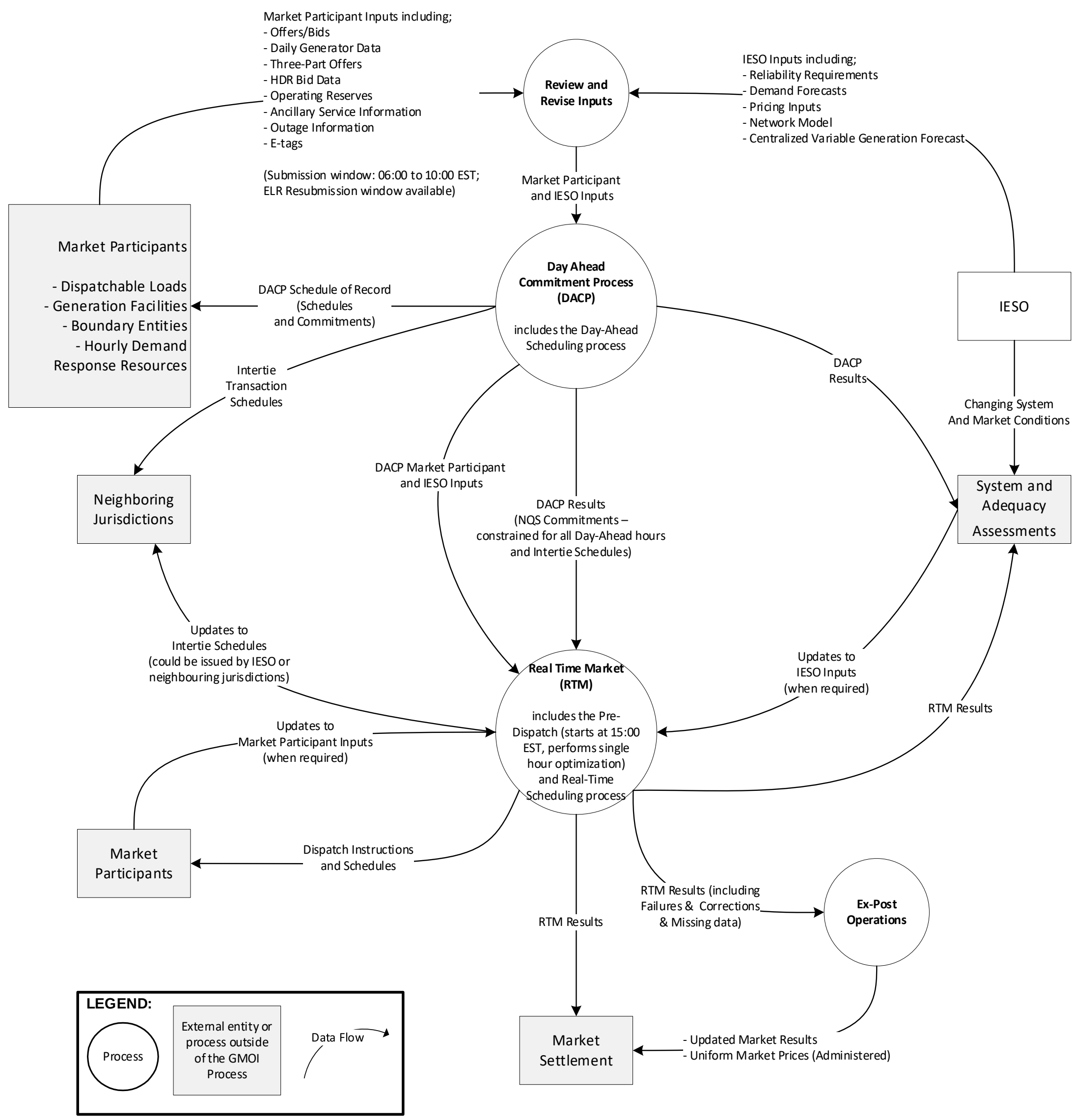


**Figure 2-2: Current State of the DACP and the RTM**

### Current Timing and Look-Ahead Period of the Day-Ahead Commitment Process and Real-Time Market

In the *pre-dispatch day*, the day-ahead commitment process (DACP) accepts *offers* and *bids* from 06:00[1] until 10:00 to allow sufficient time for the calculations and publishing of final results by 15:00.

The *real-time market* is facilitated by a *dispatch algorithm* that runs in two timeframes: pre-*dispatch* and *dispatch*.

#### Pre-Dispatch

In the pre-dispatch timeframe, the *dispatch algorithm* runs in two modes - constrained and unconstrained - each time it is run. The *pre-dispatch scheduling* run that begins at around 15:00 is the first run that looks out for the balance of hours of the current *pre-dispatch day*, and all of the hours of the next *dispatch day* for a total of 32 hours. Each run after 15:00 is shortened by one hour until 15:00 the next *dispatch day* is reached, at which point the cycle repeats. The longest number of hours included in a *pre-dispatch scheduling* run is 33 hours, the shortest is 9 hours. As shown in Figure 2-3, the PD calculation engine optimizes each hour independently, and therefore has a look-ahead period of one hour.

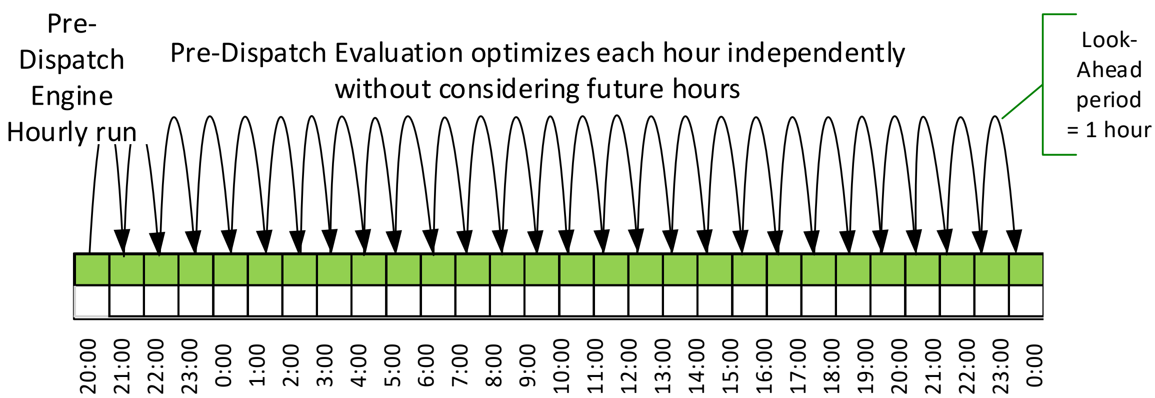


**Figure 2-3: Pre-Dispatch Calculation Engine Optimization in the Current Market**

#### Dispatch

In the *dispatch* timeframe, the *dispatch algorithm* is run in both constrained and unconstrained modes every five minutes in real-time to determine *market prices* and schedules. The RT calculation engine has a look ahead period of one hour because it optimizes schedules over a rolling window of the next twelve five-minute intervals.

## 2.1.1. The Day-Ahead Commitment Process

The day-ahead commitment process (DACP) is a non-market solution, which runs in the *pre-dispatch day*, and provides an approximation of the next day's available supply and

[1] Currently DACP and the RTM are on Eastern Standard Time (EST) all year round

anticipated *demand*. The DACP is advisory in nature, and is not financially binding. The DACP produces schedules for *market participants* who submit *bids* and *offers* and are economically scheduled. *Market participants* with NQS *generation facilities* may also receive an operational commitment if economically scheduled in DACP.

Prices are not produced in the DACP. However, importers and NQS *generation facilities* who receive a schedule are eligible for day-ahead cost guarantees.

The DACP requires that *dispatch data* be submitted for *dispatchable loads*, dispatchable *generation facilities, hourly demand response* resources[2] and *boundary entities* between 06:00 EST and 10:00 EST on the *pre-dispatch day* that reflects the expected capabilities of these resources. The *dispatch data* submitted by dispatchable *generation facilities* and *dispatchable loads* considered in this process will be used to produce an Availability Declaration Envelope (ADE) for the *dispatch day*. The ADE limits *dispatch* in real-time to the maximum quantity *offered* or *bid* into the DACP.

The day-ahead calculation engine (DACE) that facilitates the DACP co-optimizes *energy* and *operating reserve* over a 24-hour period for the next *dispatch day*. The DACE is executed using up to three runs to determine the least-cost *security*-constrained solution for a *dispatch day* based on the day-ahead *bids* and *offers* submitted by *market participants*. The final pass determines DACP schedules of all committed resources. Results of the DACP are then posted by 15:00 EST.

Some *facilities* have specific ways to participate in DACP such as those that are *energy* limited. For example, a hydroelectric *generation facility* or those that are *cogeneration facilities*. The *IESO* allows a resubmission window for an eligible *energy* limited resource (EELR) to provide *registered market participants* for these resources the ability to modify their *offer*s if the first run of DACP produced infeasible schedules. For NQS *generation facilities*, the DACP uses *pseudo-units* to model their associated scheduling dependencies.

### 2.1.2. The Pre-Dispatch Scheduling Process

The *pre-dispatch scheduling* process occurs from the completion of the DACP and the *dispatch hour*, during which optimization of *bids* and *offers* is performed to address changes in system conditions. For most resources, the *pre-dispatch scheduling* process does not produce any form of financial guarantee. Instead it provides information on how resources are likely to be *dispatched*, so that *market participants* can prepare for real-time operation.

The *pre-dispatch scheduling process* is an iterative run of the pre-dispatch algorithm looking at future *dispatch hours*, using updated *market participant* and *IESO* inputs every hour. The

[2] The *IESO* has replaced the *demand response auction* with a *capacity auction* to enable competition between additional resource types. All references to the *demand response auction* in this document should be read as reference to the *capacity auction*. Conforming changes required to align with the current or future *capacity auction* will be made during implementation via *market rules* and/or *market manuals*.

current PD calculation engine has a look ahead period (LAP) of one hour meaning that each hour is optimized independent of all other hours.

The PD calculation engine runs independently from the DACE, with two exceptions. *Offers* and *bids* submitted into the DACP are carried over as inputs to the *pre-dispatch scheduling* process with the exception of *offers* from *pseudo-unit*s which are only used in DACP. Schedules resulting from the DACP for most resources are not input to the *pre-dispatch scheduling* process. NQS *generation facility* commitments however are carried over as minimum operational commitments for the *minimum loading point* (MLP) and for at least the *minimum generation block run-time* (MGBRT) for these *generation facilities*.

These *pre-dispatch schedules* are intended to provide a projection of supply to meet *demand* for the upcoming hours and allows the *IESO* to plan for changing system conditions. Throughout the *pre-dispatch scheduling* process, the *IESO* plans operations, monitors conditions and may adjust data inputs to the scheduling tools if necessary as conditions change leading up to the *dispatch hour*.

The timing of the *pre-dispatch scheduling* process for each *dispatch day* starts after the DACP completes at 15:00 EST of the *pre-dispatch day* and encompasses all hours up to and including the last hour of the *dispatch day*. The PD calculation engine uses one functional pass, which runs hourly to determine advisory uniform prices and rolling hourly advisory schedules for 9 to 32 hours in advance of a *dispatch hour.*

In the current PD calculation engine, operating characteristics of certain *facility* types are not accounted for. Some of the parameters used in DACP to produce more feasible day-ahead schedules are not used in the PD calculation engine. These characteristics include for example *minimum loading point*, *minimum generation block run-time*, *forbidden regions* or *pseudo-unit* modelling used by the DACE but not used by the PD calculation engine.

All *market participants* may submit and/or modify their *bids* and *offers* within the *pre-dispatch scheduling* process, up to 2 hours prior to the start of the *dispatch hour* to which the *bids* and *offers* apply*.* This 2-hour window is called the mandatory window. Participants who wish to participate in the real-time generation cost guarantee (RT-GCG) program are further restricted from increasing their *offer* changes on their MLP quantity once they notify the *IESO* of an intention to synchronize or after the *IESO* has applied a manual constraint.

The RT-GCG program is a market-based mechanism that leverages PD prices to commit NQS *generation facilities* to meet changes in *demand* or supply from DA to RT. However, the program is not integrated directly with the PD calculation engine and is mostly a manually administered program.

### 2.1.3. The Real-Time Scheduling Process

The RT scheduling process occurs within and across each *dispatch hour*. During the *dispatch hour,* the *IESO* continually monitors and ensures *reliable* operation of the *IESO-controlled grid*. In doing so, the *IESO* may be taking actions to prepare for and recover from contingencies as governed by the *IESO market rules*[3], *NERC* and *NPCC* standards and guidelines.

The RT *dispatch algorithm* runs independently from the PD calculation engine. Non-quick start commitments from the DACP and the RT-GCG program, and import and export schedules produced from the PD calculation engine are carried over as inputs to the RT calculation engine.

The RT calculation engine uses real-time actual (not forecasted) operational data as an input, and is run in both the constrained and unconstrained modes every 5 minutes in and across *dispatch hours* to determine actual prices and schedules.

One of the outputs of the *dispatch algorithm* are *dispatch instructions* which are issued to *market participants* throughout the *dispatch hour*. The constrained mode determines *dispatch instructions* for the next interval.

The unconstrained mode of the *dispatch algorithm* looks backwards to the interval that just ended in order to determine the unconstrained schedules for that interval. The unconstrained mode also determines the uniform Ontario market-clearing price (MCP), that is used for *settlement* purposes.

### 2.1.4. Ex-Post Operations Process

Ex-post operations processes involve looking at real-time results after they have occurred. Validation and administration of real-time prices and corresponding *market schedules* are applied when specific *market rules* criteria are met. These processes are regularly executed after the *dispatch hour* in order to provide *settlement*-ready data. Criteria and rules are also in place to determine the viability of market information in the event of schedule failures in the PD or RT timeframes and to provide guidance for preparing *settlement*-ready data.

## 2.2. Grid and Market Operations Integration in the Future Market

The following section briefly describes the future state process of Grid and Market Operations Integration between a day-ahead market and the *real-time market* which is comprised of the pre-dispatch and real-time scheduling processes. The *IESO* will continue to administer the *real-time market* (RTM) on the *dispatch day*. The DACP will be replaced by a new day-ahead market (DAM) on the *pre-dispatch day*.

Modifications to *IESO* inputs and *market participant* inputs occur throughout the DAM, PD and RT scheduling processes as shown in red in Figure 2-4.

[3] See Market Rules, Chapter 5, Section 1.2.1 and section 1.1.1.2

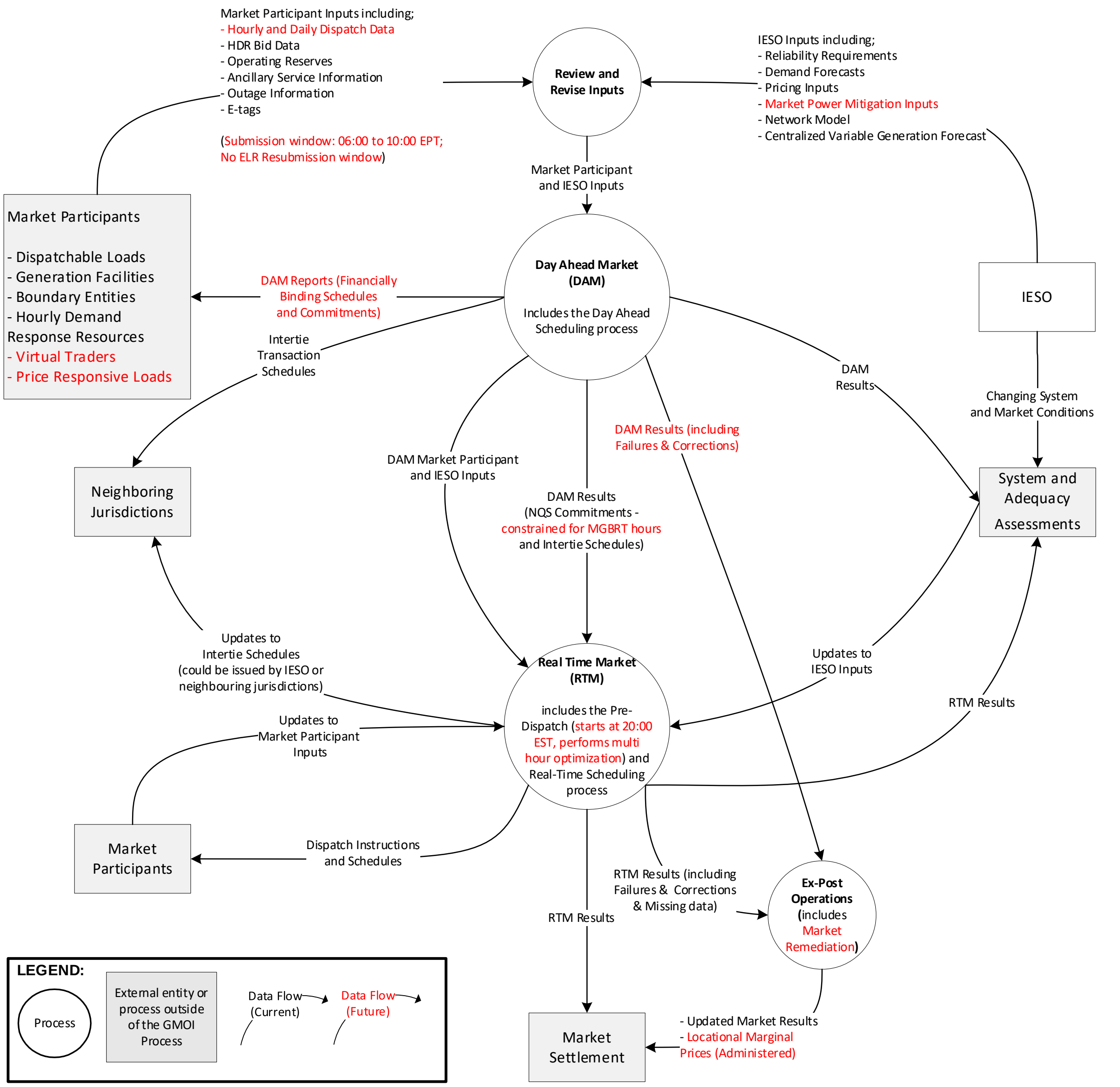


**Figure 2-4: Future State of the DAM and the RTM**

## Future Timing and Look Ahead Period of Day-Ahead Market and Real-Time Market

The DAM will run in Eastern Prevailing Time (EPT)[4]. On the *pre-dispatch day*, the DAM will accept *offers* and *bids* and other hourly and daily *dispatch data* from 06:00 EPT until 10:00 EPT to allow sufficient time for the calculations and *publishing* of final results by

[4] All activities in the future day-ahead scheduling process will occur in eastern prevailing time (EPT). Schedules and prices produced by the day-ahead market are produced in eastern standard time (EST) year-round consistent with the operation of *pre-dispatch scheduling* and the *real-time market.* See section 3.5.1 Timing of the DAM Scheduling Process for more information.

approximately 13:30 EPT. The DAM produces one set of resource schedules and day-ahead *market prices* in Eastern Standard Time for all 24 hours of the next *dispatch day*.

In real-time, the *real-time market* will continue to be facilitated by a *dispatch algorithm* that runs in two scheduling processes: pre-dispatch and *dispatch*.

In the PD timeframe, the *dispatch algorithm* will no longer have two modes – the unconstrained mode is eliminated and it will run in only the constrained mode. The *pre-dispatch scheduling* run that begins at around 20:00 EST will be the first run that looks out not only for the balance of the *pre-dispatch day*, but also for all of the *dispatch day*.

The 20:00 EST pre-dispatch run will look from 21:00 EST on the *pre-dispatch day* to 24:00 EST on the *dispatch-day*. Each pre-dispatch run after 20:00 EST is shortened by one hour until 19:00 EST in the *dispatch day* is reached, at which point the cycle repeats. As shown in Figure 2-5, the new PD calculation engine will optimize over many hours, and therefore has a look-ahead period ranging from 4 hours to 27 hours.

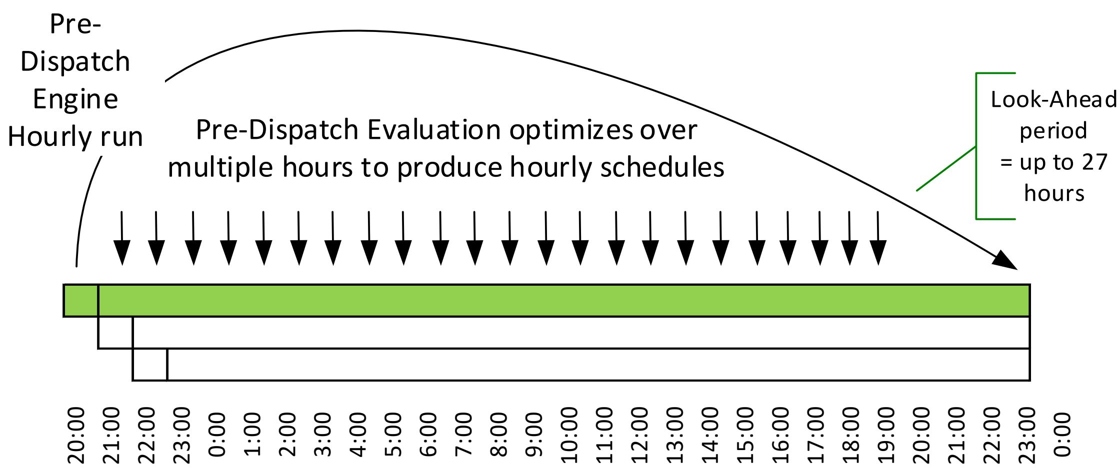


**Figure 2-5: Pre-Dispatch Calculation Engine Optimization in the Future Market**

During the *dispatch hour*, the *dispatch algorithm* will also no longer have two modes, and will be run in only the constrained mode every five minutes in real-time to determine *market prices* and schedules.

In the future, there will continue to be scheduling processes, both automated and manual, that are used within and across each of the three timeframes.

In the future day-ahead market and *real-time market*, changes as a result of MRP will impact Grid and Market Operations Integration processes in a number of ways. The following enhancements and new capabilities will be introduced to enable the integration of the future day-ahead market and *real-time market* for *energy* and *operating reserve* and operation of the *IESO-controlled grid*.

### 2.2.1. Day-Ahead Market

The day-ahead commitment process (DACP) and the existing day-ahead calculation engine (DACE) will be replaced by a new financially binding day-ahead market (DAM) and a new DAM calculation engine. The DAM calculation engine will run on the *pre-dispatch day* in Eastern Prevailing Time (EPT) and will use daily and hourly *dispatch data* parameters.

The Availability Declaration Envelope (ADE) will continue in the DAM. The DAM will use hourly and daily *dispatch data* submitted by *market participants* before the close of the DAM bidding window at 10:00 EPT, and *IESO* input data including *demand* forecasts and anticipated system conditions to produce schedules and commitments optimized over the 24 hours of the next *dispatch day*.

The DAM will produce hourly locational marginal prices, a significant change from DACP which did not produce prices.

Virtual traders and price responsive loads (PRLs) are introduced as new participation types in the DAM. Price responsive loads (PRLs) will be able to participate directly in the DAM by submitting *bids* for *energy*, but will continue to be non-dispatchable in real-time. The *IESO* will continue to represent *non-dispatchable loads* as part of the hourly average NDL *demand* forecasts for *non-dispatchable loads* that do not choose to register as a PRL.

The DAM will use new *dispatch data* parameters and scheduling for hydroelectric *generation facilities* and non-quick start *generation facilities* to produce more feasible DAM schedules that more closely represent physical limitations. The EELR resubmission window provided in the DACP for hydroelectric *generation facilities* will no longer be available.

*Pseudo-unit* modelling will continue to be available to NQS *generation facilities* and will be extended to all calculation engines and scheduling timeframes. If economically scheduled in DAM, in addition to getting a day ahead financially binding schedule, *market participants* with NQS *generation facilities* will receive an operational commitment for their MLP and MGBRT hours.

The DAM process will require that *market participants* for all *dispatchable loads*, dispatchable and self-scheduling *generation facilities*, price responsive loads, virtual traders and importers and exporters submit *dispatch data* between 06:00 EPT and 10:00 EPT that reflects the expected capabilities of these resources prior to the close of the DAM bidding window.

The DAM calculation engine will facilitate the DAM by co-optimizing *energy* and *operating reserve* over a 24-hour period for the next *dispatch day*.

Hourly schedules, commitments and locational marginal prices will be produced for the 24 hours of the next *dispatch day* as an output of the DAM, and results will be posted by approximately 13:30 EPT. The *schedule of record* produced by the DACP will be replaced by DAM reports that show schedules, commitments and prices.

*Dispatch data* submitted into the DAM, unless subsequently updated by the *market participant,* are carried over as inputs to the *pre-dispatch scheduling* process. This data includes *offers* from *pseudo-units* which will be used in all scheduling processes. Schedules resulting from the DAM will be financially binding positions for *market participants.*

While DAM schedules are not input to the PD calculation engine, DAM NQS *generation facility* commitments will be carried over as minimum operational commitments for their *minimum loading point* (MLP) and for their *minimum generation block run-time* (MGBRT).

### 2.2.2. Pre-Dispatch Scheduling Process

In the *pre-dispatch scheduling* process, the PD calculation engine and *dispatch algorithm* will be enhanced. It will be modelled on the DAM calculation engine, which will produce more feasible advisory schedules and prices by jointly optimizing *energy* and *operating reserve* schedules over multiple hours rather than each hour independently.

The timing of the *pre-dispatch scheduling* process will change, with the first run to begin at 20:00 in the *pre-dispatch day* optimizing all hours over a look-ahead period of up to 27 hours, for hours-ending 22 – 24 of the current day and hours-ending 1 – 24 of the next day.

The PD calculation engine will use the same daily and hourly *dispatch data* parameters used by the DAM, factoring in technical limitations and parameters when producing a *pre-dispatch schedule*.

*Dispatch data* submitted into the DAM will be used as inputs to the *pre-dispatch scheduling* process, except for virtual transactions and price responsive load *dispatch data* which are only used in the DAM scheduling process. *Dispatch data* submitted into the DAM are carried over as inputs to the *pre-dispatch scheduling* process, including *offers* from *pseudo-unit*s, if this *dispatch data* is not subsequently updated by the *market participant*. The latest submitted *dispatch data* will be used in all scheduling processes.

Ex-ante mitigation for economic withholding will be applied to *dispatch data* before the hourly PD advisory schedules and prices are calculated.

*Pseudo-unit* modelling used today in the DACP for combined cycle *generation facilities* will be extended for use in the future *pre-dispatch scheduling* process. Eligible *market participants* submitting *offers* for *pseudo-units* into the DAM no longer need to provide an equivalent physical unit *offer* for the *pre-dispatch scheduling* process. *Pseudo-unit* schedules will be continually translated to physical unit equivalents throughout the *pre-dispatch scheduling* process.

The voluntary Real-Time Generator Cost Guarantee (RT-GCG) program will be replaced. In the *pre-dispatch scheduling* process, an enhanced real-time unit commitment will be introduced that accounts for many of the operating characteristics of NQS *generation facilities*. These modeling improvements will result in more accurate advisory schedules produced by the future PD calculation engine.

The enhanced *pre-dispatch scheduling* process will competitively evaluate all costs on a level playing field by including daily and hourly *dispatch data offer*s for eligible NQS *generation facilities*, and will issue binding start-up instructions to those *facilities*. NQS *generation facilities* may receive a PD operational commitment that is standalone or is an advancement or extension to an existing DAM commitment.

Similar to DAM and RT, the PD calculation engine will produce locational marginal prices (LMPs), replacing constrained and unconstrained *IESO-controlled grid* models used by the current real-time *dispatch algorithm*.

The PD calculation engine will evaluate and schedule both DAM-scheduled and non-DAM-scheduled *intertie* transactions that have submitted *bids* or *offers* for forecast hours T+1 and T+2 of the pre-dispatch look-ahead period; where hour T is the hour in which the pre-dispatch run initiates. For all hours beyond T+2, the pre-dispatch algorithm will only evaluate and schedule DAM-scheduled *intertie* transactions, up to the MW quantity of the DAM schedule.

In addition, new *intertie settlement* codes will be required for curtailments and adjustments to account for the introduction of a day-ahead market and various make-whole payments.

### 2.2.3. Real-Time Scheduling Process

The RT scheduling process occurs within the *dispatch hour*. It mostly operates independently of the *pre-dispatch scheduling* process. Both DAM and PD operational commitments for NQS *generation facilities* will be carried through into RT. The most current *dispatch data* submitted by *market participants* including *dispatch data* submitted into the DAM and not updated by the *market participant* will be used as inputs in the PD and RT scheduling processes.

Certain new *dispatch data* parameters will be respected through PD into RT to improve the *dispatch* of eligible *generation facilities*. With the replacement of the RT-GCG program in which *market participants* monitor the PD results and then self-commit, new *dispatch data* parameters will be used to determine optimal commitment and will issue automated start-up instructions.

In RT, *market prices* and *dispatch* schedules will be produced by the same algorithm that similarly respects system and resource constraints. Five-minute clearing prices will be locational marginal prices instead of the uniform market clearing prices (MCP) of today.

The *real-time scheduling process* will use any mitigated *dispatch data* persisting from ex-ante market power mitigation performed during the *pre-dispatch scheduling* process. Such mitigated *dispatch data* and other accepted *dispatch data* submitted by *market participants* will be applied to *dispatch data* before the 5-minute schedules and prices are calculated.

*Pseudo-unit* modelling will be extended for use in the PD and RT scheduling processes. *Pseudo-unit* schedules will be continually translated to physical unit equivalents throughout the PD and RT scheduling processes. In the RT scheduling process, eligible NQS *generation* *facilities* with *pseudo-unit* modeling will receive real-time *dispatch* on their physical unit equivalents but will also receive the *pseudo-unit* equivalent *dispatch* for information purposes.

### 2.2.4. Ex-Post Operations Process

Ex-post operations processes (verification of results once the scheduling processes have completed) will continue to be regularly executed after the *dispatch hour* to provide *settlement*-ready data. These processes will expand in scope to include corrections to DAM locational marginal prices under specific conditions, and corrections to real-time LMPs. Principles for administering prices will remain similar to today and approaches to correct data will continue to be transparent to *market participants*. Criteria and processes are similarly expanded to encompass the broader set of data that requires validation.

**– End of Section –**

# 3. Detailed Functional Design

The Grid and Market Operations Integration detailed design document identifies the processes for the integrated operation of the *electricity system* and *energy markets*. More specifically the design identifies when data inputs are required, how they are validated or modified and importantly, how they are transferred between the day-ahead market and the *real-time market*. This design document also discusses how these inputs are assessed to maintain system *adequacy* and *reliability*, and produce market outcomes including schedules, commitments and prices.

Accompanying information is available in other detailed design documents. For information on *market participant* data inputs that are not directly used to participate in the DAM or *real-time market*, refer to the Facility Registration detailed design document. For information on *market participant* data inputs that are directly used to participate in the DAM or *real-time market* (such as *bids* or *offers*), refer to the Offer, Bids and Data Inputs detailed design document. For details on calculations, refer to the Calculation Engine detailed design documents.

### Timing Terminology Used in This Document

Due to the complex nature of data flows between the *pre-dispatch day* to the *dispatch day* and into the *dispatch hour*, it is important to have an understanding of terminology related to time references as such:

- The day-ahead market will occur on the *pre-dispatch day* to produce day-ahead schedules for the *dispatch day.*
- The *real-time market* runs for a specific *dispatch hour* within a *dispatch day*.
    - A *dispatch hour* is a one-hour period within a *dispatch day*, and consists of twelve 5-minute *dispatch interval*s.

Figure 3-1 illustrates the time relationship of the day-ahead market, pre-dispatch and the *real-time market*.

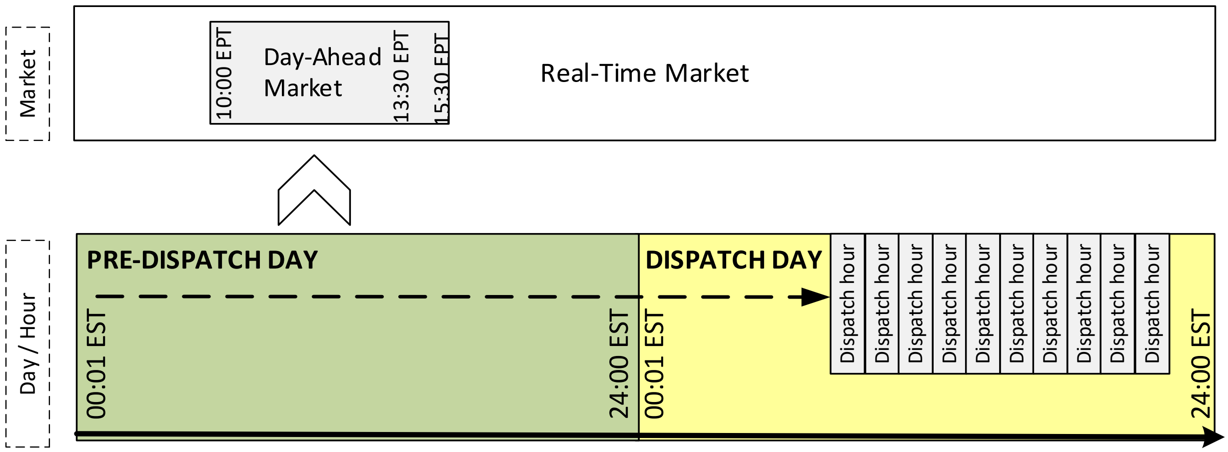


**Figure 3-1: Relationship of the DAM, PD and the RTM**

The *real-time scheduling* and *dispatch* process occurs every hour in the *dispatch day*. During every *dispatch hour,* the *dispatch algorithm* runs every five minutes. This five-minute interval is the *dispatch interval* and used to determine real-time prices and operating schedules. It then sends *dispatch instructions* to dispatchable *facilities* at the start of the next interval, indicating the operating point that needs to be reached by the end of that *dispatch interval.*

In the *pre-dispatch scheduling* process, the *dispatch algorithm* runs hourly instead of every five minutes. It also determines prices and operating schedules over a number of future hours and also determines schedules for imports and exports for the next hour.

## 3.1. Structure of this Section

A key aspect of operating the *IESO-controlled grid* is the transfer of data between the day-ahead market and the *real-time market*. Due to this, content within each section below is generally organized to explain scheduling and commitment processes within each of these markets or if greater granularity is required, the specific *pre-dispatch day, dispatch day* and *dispatch hour*.

Subsequent sections are arranged to follow a logical sequence of events beginning with data inputs and revisions, followed by the scheduling, commitment processes of the day-ahead, pre-dispatch and real-time timeframes. The design of the Grid and Market Operations Integration process in the future day-ahead market and *real-time market* will be described in terms of:

- Objectives;
- Market Participant Data Input, Revisions, and Restrictions;
- IESO Data Inputs and Revisions;
- DAM Scheduling and Commitments Process;

- Pre-Dispatch Scheduling and Commitments Process;
- Real-Time Scheduling and Dispatch Process;
- System Operation Processes and Control Actions; and
- Market Remediation.

## 3.2. Objectives

The processes for the integrated operation of the *electricity system* and *energy markets* are critical to ensuring the *reliability* of the *IESO controlled grid* and transparency of the *IESO-administered markets*. These processes interact with the various calculation engines to produce schedules, *dispatch instructions* and prices, and facilitate appropriate *settlement*-ready data for market *settlement*.

The objective of this detailed functional design is to identify the functions supporting the detailed design for both *market participants* and the *IESO* needed to operate the grid and future DAM and *real-time market*.

To this end, the Grid and Market Operations Integration detailed design identifies the changes necessary to support the future day-ahead market and *real-time market* while addressing the following design considerations:

- Leverage to the greatest extent possible existing processes and programs for the operation of the *IESO-controlled grid* and the *IESO-administered markets*;
- Identify the integration of *market participant* input data and *IESO* input data on the *pre-dispatch day, dispatch day* and *dispatch hour*;
- Identify restrictions to the revision or withdrawal of *market participant* input data on the *pre-dispatch day, dispatch day* and *dispatch hour*;
- Identify the timing of activities and actions taken to revise and update *IESO* input data on the *pre-dispatch day, dispatch day* and *dispatch hour*; and
- Identify changes and impacts to system operation processes and actions taken during normal and abnormal operation of the *IESO-controlled grid* and *IESO-administered markets*.

In addition to required changes, the Grid and Market Operations Integration detailed design identifies existing functions that have been assessed and will not change.

## 3.3. Market Participant Data Inputs, Revisions, and Restrictions

This section describes the timeframes for submission or revision in reference to a specific *dispatch day* or *dispatch hour*. This includes both hourly and daily *dispatch data* and other inputs for *registered facilities* that are *dispatched* to supply or consume *energy*, provide *operating reserve*, or provide *ancillary services* in the future day-ahead market and *real-time market*.

Also described are conditions under which the submission or revision of hourly and daily *dispatch data* will be restricted in order to facilitate *dispatch*, scheduling and commitments in the day-ahead market (DAM), pre-dispatch (PD) and real-time (RT) calculation engines.

The section is structured as follows:

- Participation in the Day-Ahead Market;
- Standing Dispatch Data;
- Regulation Services: Available Quantity;
- Hourly Dispatch Data;
- Daily Dispatch Data;
- Market Participant Inputs for the Day-Ahead Scheduling Process;
- Market Participant Inputs for the Pre-Dispatch Scheduling Process; and
- Market Participant Inputs for the Real-Time Scheduling and Dispatch Process.

This section does not include submission requirements for *outage* information, which is addressed in Section 3.4.6, and it does not discuss *physical bilateral contract data* which is addressed in the Offers, Bids and Data Inputs detailed design document.

Please refer to the Offers, Bids, & Data Inputs detailed design document for more information on the definition and construct of specific data parameters required for various *facility* types. This section 3.3 will describe when these parameters may be submitted and/or revised by *market participants* for use by the *IESO* for scheduling and *dispatch*.

Figure 3-2 shows the *dispatch data* DAM submission window and the *real-time market* mandatory window on the *pre-dispatch day* and *dispatch day* respectively.

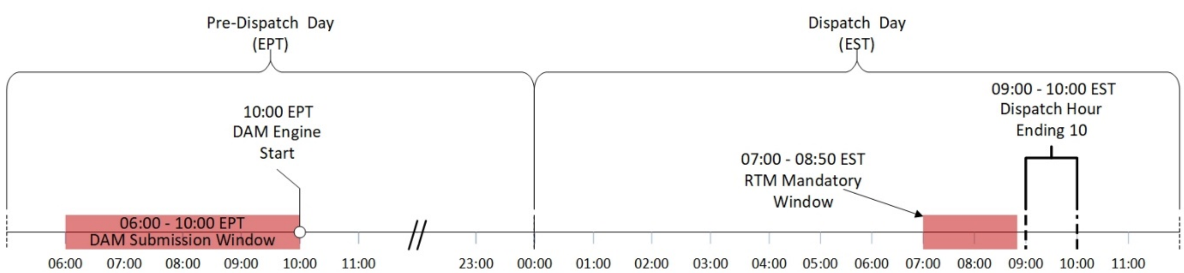


**Figure 3-2: Dispatch Data Submission Windows on the PD Day and Dispatch Day**

As shown in the Figure 3-2 above, during the DAM submission window, *dispatch data* is submitted for evaluation in the day-ahead market that will determine financially binding schedules and operational commitments for the *dispatch day*. The day-ahead market operates in Eastern Prevailing Time (EPT).

The *real-time market* (RTM) mandatory window applies to *dispatch data* submissions for a particular *dispatch hour* of the *dispatch day*. As shown in the Figure 3-2 above, for *dispatch hour* ending 10:00 EST, the mandatory window starts two hours prior to the *dispatch hour* at 07:00 EST on the *dispatch day*, and ends ten minutes prior to the start of the *dispatch hour* at 08:50 EST on the *dispatch day*. The *real-time market* will continue to operate in Eastern Standard Time (EST) throughout the year.

### 3.3.1. Participation in the Day-Ahead Market – Availability Declaration Envelope

The Availability Declaration Envelope (ADE) requirement will be retained for *registered market participants* submitting *dispatch data* for a dispatchable *generation facility*, *dispatchable load* or *hourly demand response* resource. This means that these *market participants* will be required to submit *dispatch data* into the day-ahead market to be eligible to submit *dispatch data* into the *real-time market. Registered market participants* submitting *dispatch data* for the following are not subject to the ADE requirement:

- *self-scheduling*, *intermittent* and *transitional scheduling generation facilities*;
- *boundary entities*;
- virtual transaction *energy* transactions; and
- price responsive loads.

*Market participants* representing *generation facilities*, *dispatchable loads*, *hourly demand response* resources or *boundary entity resources* will continue to be required to submit *dispatch data* into the day-ahead market if they are subject to requirements as part of:

- an *IESO* contract for *ancillary services* for *regulation* service*, reactive support service* and *voltage control service* or a *reliability must-run resource* contract;
- a *demand response capacity obligation* associated with a *demand response auction*; and
- *reliability* constraints identified in Section 3.5.2.3.

### 3.3.2. Standing Dispatch Data

*Market participants* will continue to have the ability to submit standing *dispatch data* into the day-ahead market. The ability to submit standing *dispatch data* will be extended to all new hourly and daily *dispatch data* parameters, and to *registered market participants* representing price responsive loads (PRL) and virtual transaction *energy* traders.

In the future market, standing *dispatch data* will be converted to initial *dispatch data* for the *dispatch day* at 06:00 EPT on the *pre-dispatch day* to align with the timing of the day-ahead market. Similarly, any withdrawals or revisions made to standing *dispatch data* must be submitted prior to 06:00 EPT on the *pre-dispatch day* to be considered in effect for the conversion to *initial dispatch data* on the *pre-dispatch day*. Changes to standing *dispatch data* made after 06:00 EPT on the *pre-dispatch day* will be converted the following day.

Standing *dispatch data* submitted by price responsive loads (PRL) and virtual transaction *energy* traders into the DAM will not be used in the PD or RT scheduling processes.

Standing *dispatch data* will not be available for participation in the *real-time market* only.

### 3.3.3. Regulation Services: Available Quantity

*Regulation* services will continue to be one of the *ancillary services* provided by *market participants* to the *IESO* in the day-ahead and *real-time markets*. *Ancillary service providers* within the *IESO-controlled grid* will continue to be eligible to provide *regulation* services under the terms of Automatic Generation Control (AGC) contracts. Under these contracts, *ancillary service providers* are currently required to submit *regulation* services availability data prior to 09:00 EST on the *pre-dispatch day*. In the future market, this requirement will be changed to 08:00 EPT to reflect the change in timing of the DAM scheduling process (see section 3.6.1).

The *IESO* will continue to determine which *ancillary service provider* resources are selected to provide AGC *regulation* in each *dispatch hour* of the *dispatch day*. The *IESO* will communicate the accepted nominations to the *market participants* before 09:00 EPT on the *pre-dispatch day*. For more information on how the *IESO* schedules *regulation* capacity see section 3.4.2.3.

### 3.3.4. Hourly Dispatch Data

Consistent with today, *a market participant* can submit *dispatch data* for a *facility* or a *boundary entity* as inputs into the *IESO energy market* and *operating reserve market*. *Dispatch data* can be designated to specific hours of a *dispatch day* to allow a resource to become scheduled by the *IESO*. *Dispatch data* submissions, based on the submitting resource type, will continue to include:

- *Offers* from dispatchable suppliers to provide *energy* and optional *operating reserve*;
- *Bids* from *dispatchable loads* for *energy* withdrawals or reduction of withdrawals, and optional *operating reserve;* and
- Schedules from non-dispatchable suppliers (such as *intermittent generators* and *self-scheduling generation facilities*).

In the future market, two new *market participant* authorization types - virtual transaction *energy* traders and price responsive loads - will be able to submit hourly *dispatch data* to the day-ahead market only. In addition, *market participants* with *variable generation* resources will be enabled to submit their own forecasts for the provision of *energy* as part of *dispatch data* using the new *variable generator* forecast quantity parameter. The use of this parameter is exclusively for the day-ahead market.

### 3.3.5. Daily Dispatch Data

Daily *dispatch data* are new submissions that will be required for certain *dispatchable generators* whose *facility* operational characteristics can vary on a daily basis. Daily *dispatch data* will replace the submission of daily generator data (DGD) by *dispatchable* non-quick start *generation facilities*.

Currently in the DACP, DGD is used to produce schedules that respect operational characteristics for resources registered as *dispatchable* non-quick start *generation facilities*. In the future, daily *dispatch data* submissions will be used to determine a *generation facility's* DAM and PD schedule and/or commitments. The following existing and new parameters will be available for submission as daily *dispatch data*:

- Linked resources, time lag and MWh ratio;
- *Forbidden region*s;
- Maximum daily *energy* limit (Max DEL);
- Minimum daily *energy* limit (Min DEL);
- Single cycle mode;
- *Maximum number of starts per day*
- *Minimum loading point* (MLP);
- *Minimum generation block run-time* (MGBRT);
- *Minimum generation block down time* (MGBDT);
- Lead time; and
- Ramp up *energy* to MLP.

These parameters will be subject to different submission and revision rules than hourly *dispatch data*, as described in the following sections.

### 3.3.6. Market Participant Inputs for the Day-Ahead Market

The day-ahead market will produce schedules, commitments and prices for the next *dispatch day*. *Dispatch data* submissions for the day-ahead market are made on the *pre-dispatch day*. Figure 3-3 provides an overview of the day-ahead scheduling process timelines as it relates to *market participant* submission of *dispatch data*.

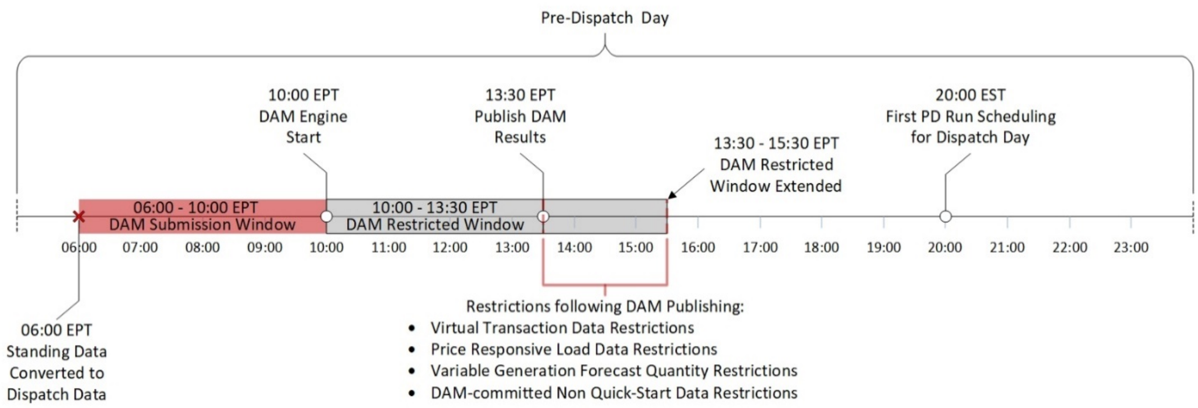


**Figure 3-3: Day-Ahead Scheduling Process Timelines**

#### 3.3.6.1 Day-ahead Market Submission Window

In the future DAM, *market participants* will continue to be able to submit, revise or withdraw hourly and daily *dispatch data* without restriction during the new day-ahead market submission window for:

- *generation facilities* (dispatchable and non-dispatchable);
- *dispatchable loads* and price responsive loads;
- *hourly demand response* resources;
- *boundary entity* resources; and
- virtual transactions.

The DAM submission window will begin at 06:00 EPT and end at 10:00 EPT on the *pre-dispatch day*, to align with the new start time of the day-ahead market engine at 10:00 EPT on the *pre-dispatch day*.

#### 3.3.6.2 Day-Ahead Market Restricted Window

In the future DAM, *dispatch data* submissions and revisions for the next *dispatch day* will be restricted from 10:00 EPT on the *pre-dispatch day* until DAM schedules and prices are published[5]. This restriction applies to *market participants* representing all *facility* and resource types, including new price responsive loads and virtual transactions.

[5] DAM results will normally be published by 13:30 EPT on the *pre-dispatch day*; delayed DAM publishing may occur up to approximately 15:30 EPT on the *pre-dispatch day*.

This restriction means that new submissions or revisions to *dispatch data* for the next *dispatch day*[6] within this window will require *IESO* approval; and will only be approved in the rare case of an *IESO* tool failure which prevents the *IESO* from receiving *dispatch data* submissions. If such a tool failure occurs, a notification will be sent to *market participants.*

New submissions or revisions for the next *dispatch day* that are made during the day-ahead market restricted window and are not approved by the *IESO* will be automatically rejected, and will not be included for evaluation in the *real-time market* (*pre-dispatch* and *real-time scheduling processes*) for the next *dispatch day*.

## 3.3.7. Market Participant Inputs for the Real-Time Market

Once the DAM has completed and results have been published for the *dispatch day, dispatch data* submissions or revisions for the *dispatch day* will be used in the *real-time market*, which includes both the *pre-dispatch scheduling* process and the *real-time dispatch process*.

### 3.3.7.1 DAM Dispatch Data for the Real-Time Market

In the future market, most hourly and daily *dispatch data* for the next *dispatch day* that have been accepted by the *IESO*[7] as of the time that DAM results are published will in general be included for evaluation in the *real-time market*.

*Dispatch data* for specific *facility* or resource types that will not be included for evaluation in the *IESO real-time market* are:

- All *dispatch data* associated with price responsive load resources that was accepted for evaluation in the DA scheduling process;
- All *dispatch data* associated with virtual transaction *bids* and *offers* that was accepted for evaluation in the DA scheduling process; and
- The *variable generator* forecast quantity *dispatch data* parameter that was accepted for evaluation in the DA scheduling process.

The hourly and daily *dispatch data* that will be included for evaluation will be *dispatch data* submissions that are accepted prior to the close of the DAM submission window at 10:00 EPT on the *pre-dispatch day*. Any *dispatch data* submissions made after 10:00 EPT and prior to DAM publishing that were approved by the *IESO* will also be included.

[6] This refers to revisions to *dispatch data* intended for use in *next dispatch day*. Revisions to *dispatch data* intended for use in the current *dispatch day* (in subsequent pre-dispatch and *real-time schedules*) may be made while the DAM is running for the next day, and are subject to PD and RT *dispatch data* revision rules.

[7] In today's market at 14:00 EST on the *pre-dispatch day*, any and all *dispatch data* that: a) passed automated validations and, b) was either automatically accepted by the *IESO* tools, or manually accepted by the *IESO*, will be included for evaluation in the RTM. Any and all *dispatch data* submissions that either failed validation or was not automatically or manually approved by the *IESO* will be discarded and not considered in the RTM.

Any *dispatch data* that has been modified due to ex-ante market power mitigation processes during the DAM, will revert back to its pre-mitigation values for use in the *real-time market*. The pre-dispatch calculation engine run that initiates at 20:00 EST is the first that will evaluate this *dispatch data* for all hours of the next *dispatch day*.

#### 3.3.7.2 Restrictions on Energy Offer/Bid Quantity – Availability Declaration Envelope

Similar to today's ADE requirement, *registered market participant*s submitting *dispatch data* on behalf of a dispatchable *generation facility*, *dispatchable load* or *hourly demand response* resource for the *real-time market* will be restricted from increasing their *energy offer* quantity or *energy bid* quantity above the quantity submitted for the DAM, for any *dispatch hour* of the *dispatch day*.

In regards to restrictions for conversions of dispatchable and non-dispatchable portions of *dispatchable loads* for any *dispatch hour* of the *dispatch day,* the following will apply:

- the non-dispatchable portions of *bids* submitted for the DAM by a *registered market participant* will be restricted for conversion to *dispatchable* status; and
- the dispatchable portion of *bids* submitted for the DAM by a *registered market participant* will not be restricted for conversion to non-dispatchable status.

Restrictions may be lifted under one of the following conditions:

- *IESO* requests for additional *offers* and *bids*;
- an early return from a planned or *forced outage*, or a forced de-rating, or the cancellation of a *planned outage* by a *facility*;
- avoidance of violating applicable laws, endangering the safety of any person or damaging property or environmental restrictions; or
- emerging *reliability* concerns.

Increases in response to one of the reasons must be requested from the *IESO* by specifying a corresponding reason for each *dispatch hour* of the *dispatch day* in which an increase is required. *Registered market participants* will be notified of approved requests by the *IESO*. After a request is approved, a *registered market participant* will be able to increase its *energy offer* quantity or *energy bid* quantity within each *dispatch hour* of the *dispatch day* specified in the notification provided by the *IESO*.

In the future market, the ADE deadband will be expanded to allow for increases of up to 15% of the ADE or 10 MW, whichever is less.

#### 3.3.7.3 Revision Rules for NQS Generation Units Dispatch Data After DAM Publishing

Specific *dispatch data* revisions rules will apply to *registered market participants* who submit *dispatch data* parameters for NQS *generation units* or *pseudo units* that are eligible to receive a DAM operational commitment. This section describes rules associated with the following hourly *dispatch data* parameters[8] following the publishing of DAM results:

- Start-Up Offer;
- Speed-No-Load Offer; and
- *Energy Offer* Price for MW quantities up to and including *minimum loading point*.

The start-up offer and speed-no-load offer hourly *dispatch data* parameters will be used in both the day-ahead market engine to schedule DAM commitments, and the new pre-dispatch process to schedule:

- stand-alone pre-dispatch commitments;
- advancements to existing DAM commitments, and
- extensions to existing DAM or PD commitments.

**Revision rules – Without a DAM Commitment and Schedule**

Revisions to the start-up offer, the speed-no-load offer, and the *energy offer* price for MW quantities up to and including *minimum loading point*, will now be permitted without restriction prior to 20:00 EST on the *pre-dispatch day*. Following 20:00 EST on the *pre-dispatch day*, revisions to these three parameters will be restricted such that only decreases to the value of the initially submitted or subsequently reduced parameters will be permitted.

**Revision rules – With a DAM Commitment and Schedule**

The following revision rules shall apply following the publishing of DAM results when a *generation unit* or a *pseudo unit* receives a DAM operational commitment and a financially binding schedule:

- For the *dispatch hours* in which a NQS *generation unit* or *pseudo unit* has received both a DAM financially binding schedule and operational commitment (MGBRT hours):
    - o the value of the start-up *offer* parameter shall not be increased above the latest value that was accepted by the *IESO* and used to establish the DAM commitment and schedule. For all other *dispatch hours*, submissions and revisions to the start-up *offer* parameter may be made without restriction until 20:00 EST of the *pre-dispatch*

[8] All other hourly and daily *dispatch data* parameters (including *energy offer* price for MW quantities above *minimum loading point*) will be subject to the submission and revision rules for the *real-time market* as described in this section.

*day*. This restriction only applies to the MGBRT hours that make up the DAM operational commitment.

- For all *dispatch hours* in which the NQS *generation unit* or *pseudo unit* has received a DAM financially binding schedule:
  - the value of the speed-no-load offer parameter shall not be increased above latest value that was accepted by the *IESO* and used to establish the DAM commitment and schedule. For all other *dispatch hours*, submissions and revisions to the speed-no-load offer parameter may be made without restriction until 20:00 EST of the *pre-dispatch day*; and
  - incremental *energy offer* prices for *offered* MW quantities up to and including MLP shall not be increased above the latest prices that were accepted by the *IESO* and used to establish the DAM commitment and schedule. For all other *dispatch hours*, submissions and revisions to the incremental *energy offer* prices for MW quantities up to and including MLP may be made without restriction until 20:00 EST of the *pre-dispatch day*.

In cases where a resource provides updated offers that are priced lower than the respective reference levels, the updated offers will be used for the current PD calculation engine run.

#### 3.3.7.4 Real-Time Market Unrestricted Window for Hourly Dispatch Data

In the future market, the unrestricted window for hourly and daily *dispatch data* submissions into the *real-time market* will begin following the publishing of DAM results on the *pre-dispatch day*.

For hourly *dispatch data*, the unrestricted window will continue until the mandatory window - two hours prior to the start of the *dispatch hour* for which the *dispatch data* submission or revision applies.

#### 3.3.7.5 Real-Time Market Mandatory Window for Hourly Dispatch Data

In the future market, the mandatory window will continue to be used with the same timelines as today's *real-time market* for *boundary entities* and non-boundary entities for hourly *dispatch data* submissions for all *facilities* and resources eligible to participate in the *real-time market*.

The mandatory window for non-boundary entities starts 2 hours prior to the start of the *dispatch hour* to which the hourly *dispatch data* applies, and ends 10 minutes prior to the start of the *dispatch hour*. For *boundary entities* the mandatory window starts at the same time, but ends an hour earlier, 10 minutes prior to start of the hour before the *dispatch hour*. Submissions and revisions to hourly *dispatch data* are not allowed once the mandatory window has ended.

Hourly *dispatch data* submissions that are made within the mandatory window will continue to require *IESO* approval, subject to meeting criteria defined in the *market rules*. The criteria will be generally consistent with existing criteria, with the potential for changes to be identified further during MRP implementation.

Consistent with today, *dispatchable load* resources will continue to be permitted to revise *energy bids* and *operating reserve offers* within the mandatory window subject to the guidelines currently specified in Market Manual 4.2 Submission of Dispatch Data in the Real-Time Energy and Operating Reserve Markets, Appendix B Short Notice Change Criteria.

#### 3.3.7.6 Real-Time Market Restricted Window for Daily Dispatch Data

In the future market, a *real-time market* restricted window for daily *dispatch data* will be introduced for all daily *dispatch data* parameters. This restricted window will begin at the time that DAM schedules, commitments and prices are published on the *pre-dispatch day* and continue until the end of the *dispatch day*.

Refer to Section 3.4.1.3 Offers, Bids and Data Inputs: Daily Dispatch Data, for the list of eleven daily *dispatch data* parameters.

**Revision Rules – Daily Dispatch Data**

Daily *dispatch data* submissions and revisions within the daily *dispatch data* restricted window will be permitted without requiring *IESO* approval.

These submissions and revisions will be subject to meeting criteria to be defined in the *market rules*. *Market participants* will be required to include with their daily *dispatch data* submission the reason for the submission that must adhere to defined criteria. The criteria will be consistent with criteria for the existing (two-hour) mandatory window for *dispatch data*, with additional provisions to allow combined cycle facilities to reflect changing capabilities between single and combined cycle modes. Additional changes may be identified further during MRP implementation.

Revision rule exceptions apply to three of the eleven daily *dispatch* parameters identified below.

**Revision Rule Exceptions:**

*MLP and MGBRT*

The following daily *dispatch data* parameters will not be allowed to be revised during the *real-time market* restricted window for daily *dispatch data*:

- *Minimum loading point* (MLP); and
- *Minimum generation block run-time* (MGBRT).

*Single Cycle Mode*

For the Single Cycle Mode daily *dispatch data* parameter, the following additional restrictions apply:

- If the *pseudo unit* has either a DAM or PD commitment for any of the remaining *dispatch hours* of the current *dispatch day*, or is currently online and operating, revisions to the Single Cycle Mode *dispatch data* parameter will not be permitted; and
- The above restriction will be lifted if the *pseudo unit* is operating in combined cycle mode, and the steam turbine *generation unit* of the *pseudo unit* experiences a *forced outage* and an outage slip for the steam turbine *generation unit* is submitted.

#### 3.3.7.7 Restrictions on Energy and Operating Reserve Offer Price with Pre-Dispatch Commitments

In the future market, *registered market participants* for *generation facilities* that are eligible for the generator *offer* guarantee (GOG) and receive a pre-dispatch commitment or advancement of a DAM commitment, shall be subject to restrictions on increases to the *energy offer* price and *operating reserve offer* price parameters.

The restrictions come into effect at the start of the specific *pre-dispatch schedule* run that issues a binding start-up instruction and pre-dispatch commitment to the *generation unit* or *pseudo unit*. This *pre-dispatch schedule* will be referred to as the binding pre-dispatch advisory schedule.

The restrictions will apply to each *dispatch hour* where the *generation unit* or *pseudo unit* has been scheduled to at least its *minimum loading point* (MLP) in the binding pre-dispatch advisory schedule, but does not overlap with *dispatch hours* that have also received a DAM commitment and schedule. The restrictions are as follows:

a) *Energy offer* prices for *offered* megawatt (MW) quantities between the *minimum loading point* MW value and up to and including the MW value scheduled by the binding pre-dispatch advisory schedule will not be increased above the latest price that was accepted by the *IESO* that was used to establish the binding *pre-dispatch* advisory schedule.
b) *Energy offer* prices for *offered* megawatt (MW) quantities above the MW value scheduled by the binding pre-dispatch advisory schedule will not be increased above the latest price that was accepted by the *IESO* and used to establish the binding pre-dispatch advisory schedule.
c) *Operating reserve offer* prices for all *offered* MW quantities will not be increased above the latest price that was accepted by the *IESO* and used to establish the binding pre-dispatch advisory schedule.

#### Exceptions to PD Commitment Offer Price Restrictions

The following are exceptions to the above *energy offer* price and *operating reserve offer* price restrictions:

- The restrictions on *offer* price increases described in a), b) and c) above will no longer apply for the remaining *dispatch hours* of the PD binding advisory schedule if the *pre-dispatch scheduling* process does not extend the PD operational commitment for any *dispatch hour* beyond the *minimum generation block run-time* (MGBRT) hours associated with the original PD operational commitment;
- The restrictions on *offer* price increases described in a), b) and c) above will no longer apply if the steam turbine *generation unit* of a *pseudo unit* experiences a *forced outage* and an *outage* slip for the steam turbine *generation unit* is submitted. *Energy offer* price increases will be permitted up to the *energy* reference level (a market power mitigation parameter) of the combustion turbine *generation unit*; and
- The restrictions on *offer* price increases described in b) and c) above will no longer apply if the following conditions are met:
  - An increase to the fuel or opportunity cost for the combustion turbine *generation unit* or *pseudo unit* must have occurred after the binding pre-dispatch advisory schedule was published, and prior to the *real-time market* mandatory window; and
  - An increase to the *energy* reference level (a market power mitigation parameter) must have been approved by the *IESO* after the binding pre-dispatch advisory schedule was published, and prior to the *real-time market* mandatory window.

### 3.3.7.8 Dispatch Data Submissions for Boundary Entity Resources

In the future market, *dispatch data* submissions for *boundary entity* resources in the *real-time market* scheduling timeframe will adhere to the Real-Time Market Unrestricted Window and the Real-Time Market Mandatory Window described above.

*Dispatch data* submissions for *boundary entity* resources will continue to require submission of an NAESB e-Tag Identifier (ID) parameter as part of the *dispatch data* submission. The *IESO* deadline to submit a corresponding e-Tag for scheduled *intertie* transactions will continue to be 32-minutes prior to the *dispatch hour* for all *intertie* transactions.

In the future market, the PD calculation engine will evaluate and schedule both DAM-scheduled and non-DAM-scheduled *intertie* transactions that have submitted *bids* and *offers* for hours T+1 and T+2 of the pre-dispatch run look-ahead period; where hour T is the hour in which the pre-dispatch run initiates. For all hours beyond T+2, the pre-dispatch algorithm will only evaluate and schedule DAM-scheduled *intertie* transactions, up to the MW quantity of the DAM schedule; unless the *intertie* transaction is associated with a *capacity obligation*, an *emergency energy* transaction or as otherwise indicated by the *IESO*. For more information on the *pre-dispatch schedule* process of *intertie* transactions associated with *boundary entity* resource *bids* and *offers*, see section 3.6.2.4.

An example of the pre-dispatch treatment of *boundary entity bids* and *offers* is illustrated in Figure 3-4 below: the 05:00 pre-dispatch run will evaluate both DAM-scheduled and non-DAM-scheduled transactions for *dispatch hours* 7 (06:00-07:00) and 8 (07:00-08:00), but only DAM-scheduled transactions for *dispatch hour* 9 (08:00-09:00) and beyond.

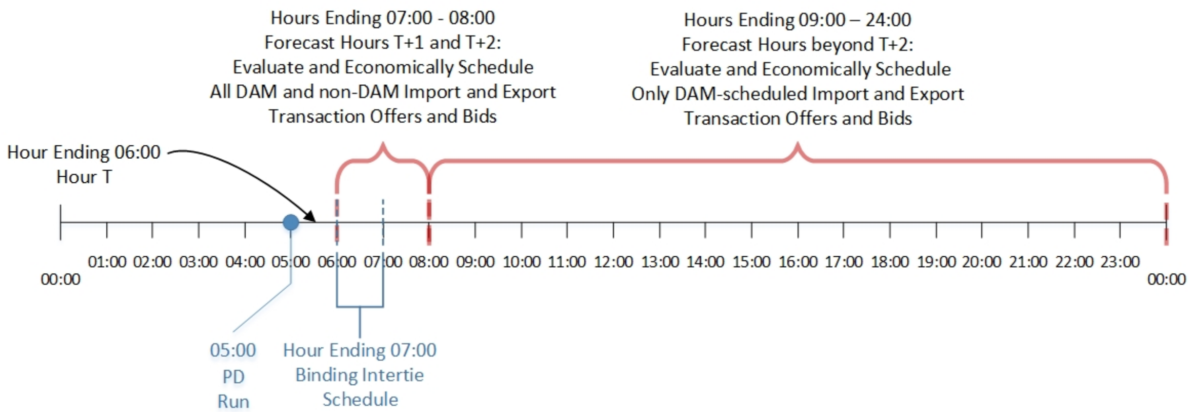


**Figure 3-4: Pre-Dispatch Intertie Transaction Scheduling**

## 3.4. IESO Data Inputs and Revisions

The *IESO* is responsible for providing a number of inputs into the calculation engines to use when scheduling and dispatching *registered facilities*. Definition and construct of these input parameters is described in the Offers, Bids and Data Inputs detailed design document. The *IESO* submits and revises four of these inputs during the *pre-dispatch day, dispatch day* and *dispatch hour.* They are:

- *Reliability* Requirements;
- Network Model;
- Centralized Variable Generation Forecasts; and
- *Demand* Forecasts.

This section describes the interaction of the *IESO* with these inputs. Further information on how these inputs are used by the calculation engines can be found in the following sections of this document:

- 3.5 – DAM Scheduling and Commitments Process;
- 3.6 – Pre-Dispatch Scheduling and Commitments Process; and
- 3.7 – Real-Time Scheduling and Dispatch.

Additionally, pricing and market power mitigation inputs also flow into the calculation engines. See the Offers, Bids and Data Inputs and the Market Power Mitigation detailed design documents for further information on these inputs.

### 3.4.1. Timing of IESO Data Inputs for DAM, PD and RT Scheduling

The *IESO* will provide a set of inputs to the DAM calculation engine in advance of the initiation of the day-ahead market similar to the current DACP.

Currently, the *IESO* provides an initial set of *IESO* inputs for the first DACP run and modifies these inputs between each DACP run to ensure the latest system conditions are reflected in the DACP results.

In the future market, there will be a single DAM calculation engine run. The *IESO* will provide *IESO* data inputs that reflect the best information available prior to the DAM submission deadline of 10:00 EPT. *IESO* inputs used by the day-ahead market will not be modified to reflect changing system conditions after 10:00 EPT. *IESO* inputs into the DAM calculation engine will only be modified after 10:00 EPT to correct an input error that results in invalid day ahead market results as discussed in Section 3.5.3.1.

The *IESO* data input values used in the formulation of day-ahead schedules and prices are also used in pre-dispatch and real-time to formulate schedules and prices. In the future *energy market*, the *IESO* will continue to update data inputs used by PD and RT calculation engines based on changing system conditions. These updates are made at any time to ensure that the latest information is available. Updates made while the PD and RT calculation engine runs are in progress will be used in subsequent PD and RT calculation engine runs.

*IESO* data inputs related to *reliability* requirements, *demand* forecasting and centralized *variable generation* forecasts are made public to *market participants* through public reports and advisory notices. The timing of report publication is detailed in the Publishing and Reporting Market Information detailed design document. Advisory notices will continue to be ad hoc and present additional information not available through public reports.

### 3.4.2. Reliability Requirements

*Reliability* requirements are operational inputs produced by the *IESO* to satisfy grid *reliability* and *security* standards as per *NERC*, *NPCC* and *IESO market rules*. As defined in the Offers, Bids and Data Inputs detailed design document, these *reliability* requirements are:

- Maximum Import/Export Limits;
- Net Interchange Scheduling Limit (NISL);
- Lake Erie Circulation Forecast;
- Minimum/Maximum Area *Operating Reserve*;
- *Operating Reserve* Requirements;

- *Regulation* Capacity Requirements;
- *Security Limits*; and
- *Reliability* Constraints.

The first five inputs are derived and updated based on *generation facility* and *load facility* schedules and are described further below. The approach to managing one of these five inputs, *operating reserve*, will change in the future market, and is expanded in its own section. The remaining three *IESO* inputs are described in subsequent sections.

#### 3.4.2.1 IESO Inputs Revised Based on Resource Schedules and Energy Flow

These five *IESO* inputs are normally derived and updated based on resource schedules. Since resource schedules are not available prior to the first run of DACP in the current market and prior to DAM in the future market, a different methodology is used to determine initial input values for the following *IESO* inputs:

- Maximum Import/Export Limits;
- Net Interchange Scheduling Limit (NISL);
- Lake Erie Circulation Forecast;
- Minimum/Maximum Area *Operating Reserve*; and
- *Operating Reserve* Requirements - The approach to managing *operating reserve* will change in the future market, and is expanded in its own section.

The *IESO* will continue to derive and forecast these five inputs for use in the day-ahead market based on an assessment of conditions on similar days in the recent past as they best reflect anticipated conditions. Other factors like day of the week and *outages* that may impact flows are also taken into account when forecasting these inputs. The *IESO* will continue updating these inputs for use in PD and RT using resource schedules and *energy* flows calculated by each engine and actual *energy* flows in real-time.

While the approach to these inputs will remain the same as today, one change to *operating reserve* requirements is discussed below in more detail.

#### 3.4.2.2 Operating Reserve Requirements

Additional *thirty-minute operating reserve* is currently scheduled above the contingency reserve required by *NPCC* when there is limited spare generation available on the system to meet flexibility needs. The *IESO* assesses the flexibility need and resources available to supply flexibility based on *variable generation* forecast, *demand* forecast and generation schedules.

In the current market, this additional *thirty-minute operating reserve* for flexibility is scheduled as an input into the PD and RT calculation engines. In the future market, additional *thirty-minute operating reserve* for flexibility will also be scheduled as an input into the DAM calculation engine to accurately reflect anticipated needs and to avoid introducing known differences between the day-ahead market and *real-time market*.

#### 3.4.2.3 Regulation Capacity Requirements

The *IESO* will continue to determine which *regulation* resources are selected to provide AGC *regulation* in each *dispatch hour* of the *dispatch day* to meet the minimum AGC requirement. Due to operability needs, the *IESO* may determine the need to schedule more than the minimum *regulation* requirement. Currently, accepted AGC nominations are communicated to the *market participants* prior to 10:00 EST and used as an input into DACP.

In the future market, accepted AGC nominations will be communicated to the *market participants* prior to 10:00 EPT and used as an input into DAM. More information on the selection of *regulation* resources can be found in the Offers, Bids and Data Inputs detailed design document.

In the *pre-dispatch day* and *dispatch day*, the *IESO* will retain the ability to update the *regulation* capacity requirement, adjust *regulation* schedules due to unplanned *outages* of selected *regulation* resources, and adjust *automatic generation control* from a *generation facility* that is providing *regulation.*

#### 3.4.2.4 Security Limits

*Security limit* inputs are Operating *Security Limits* (OSLs) and thermal ratings that are used by the *security* assessment function of all calculation engines. In the future market, the *IESO* will continue to apply and update *security limits* to ensure reliable *dispatch* as follows:

- The *IESO* will apply and update *security limits* as inputs into the DAM calculation engine to reflect anticipated system conditions and *outages*; and
- The *IESO* will continue to apply and update *security limits* on the *dispatch day* as system conditions change. Adjustments to *security limits* applied on the *dispatch day* will be used by all subsequent DAM, PD, and RT calculation engine runs where the condition is expected to persist.

#### 3.4.2.5 Reliability Constraints

In some cases, the *IESO* may require certain *generation facilities* or *dispatchable load facilities* to be generating or consuming at, above or below specific levels to maintain *reliability* during certain system conditions or *outages*. Today, this is reflected through a minimum, maximum or fixed scheduling constraint on the *facility*(s) that may span multiple intervals, hours or days. These constraints are incorporated as inputs into the applicable DACP, PD and RT calculation engines and may result in a higher or lower *market schedule* for the affected *facility*.

In the future, the *IESO* will continue to enter constraints for *reliability*. Constraints will only be entered as an input into DAM if the calculation engine is not able to recognize the *reliability* need for the *facility* to generate or consume at a specific level*. Reliability* constraints are described further in Section 3.5.2.3.

In the current market, the *IESO* may request that a combined cycle *generation facility* operate in either combined or single cycle mode to allow the *facility* to come online faster or have a higher capacity available to meet a *reliability* need. In the future market, the *IESO* will continue to request that a combined cycle *generation facility* operate in either single or combined cycle mode. When such a request is made for a *reliability* need, *market participants* will have an opportunity to reflect the mode change in their operating costs. Minimum scheduling constraints will be applied and identified as *reliability* constraints to ensure appropriate *settlement* treatment.

## 3.4.3. Network Model Monitoring and Update

The network model contains a detailed topology representation of the *IESO-controlled grid* and a simplified representation of power systems in neighboring jurisdictions. It is used as an input for all calculation engines. The *IESO* will continue to monitor and update network model inputs related to:

- *outages*;
- equipment status; and
- telemetry.

### 3.4.3.1 Outages

The *outage* assessment and approval process will not change in the future market. Most *outages* require *IESO* approval before they are used as inputs into the DAM, PD and RT calculation engines that are scheduling for the *outage* period. Approved *outages* will be used as inputs into DAM, PD and RT calculation engines as follows:

- *Outages* approved by the *IESO* in advance of the day-ahead market will be used as inputs into all calculation engines in applicable timeframes;
- Opportunity and urgent[9] *outages* can be submitted on either the *pre-dispatch day* or the *dispatch day.* After approval, such *outages* are used as inputs into the calculation engines that are scheduling for the *outage* period; and

[9] According to Market Manual 7.3 Outage Management: Non-discretionary outages on equipment that must be manually removed from service for equipment protection, public safety, environmental concerns or regulatory requirements are classified as urgent *outages*.

- *Forced outages* can be submitted at any time and are automatically approved and used as an input into the calculation engines scheduling for the *outage* period.

*Planned outages* submitted for *one-day advance approval* are an exception and will continue to be automatically included as an input into the DAM, PD and RT calculation engines prior to *IESO* approval.

#### 3.4.3.2 Equipment Status

Each piece of equipment in the network model has a defined normal equipment status. For example, a breaker is normally open or normally closed. Calculation engines use this defined normal status, *outages*, and real-time operational telemetry to determine the status of each piece of equipment in the network model.

During telemetry failures, the *IESO* applies manual overrides in the real-time *energy* management system (EMS) to reflect actual equipment status. These overrides are used instead of real-time operational telemetry to define the status of equipment in the network model. The *IESO* monitors equipment status to improve the accuracy of information provided to calculation engines. In the future market, the *IESO* will continue to monitor equipment status and override failed telemetry.

#### 3.4.3.3 Telemetry

Operational telemetry is used by calculation engines to initialize the current state of power system elements in the network model, such as equipment status, *generation unit* output, circuit MW and MVar flows and transformer tap position. It is also used to update *demand* forecast models and load distribution patterns.

The *IESO* monitors telemetry for failures and if necessary applies manual overrides to telemetered values to improve the accuracy of information. This will not change in the future market.

### 3.4.4. Centralized Variable Generation Forecast Adjustments

The *IESO* produces a centralized *variable generation* forecast for all registered *variable generation* resources. In the current market, this forecast is used by the applicable calculation engines to determine the maximum amount of *energy* for which a *variable generation* resource can be scheduled and *dispatched*. The *IESO* has the ability to adjust the centralized *variable generation* forecast up or down to better align with observed *variable generation* trends.

In the future market, calculation engines will continue to determine the maximum amount of *energy* for which a *variable generator* can be scheduled and *dispatched* based on a *variable generation* forecast. PD and RT calculation engines will continue to use the centralized *variable generation* forecast provided by the *IESO*, but the DAM calculation engine will use both the centralized *variable generation* forecast and *variable generation* forecasts submitted by *market participants*. The *IESO* will retain the ability to adjust the centralized *variable generation* forecast, but the mechanics behind how they apply adjustments will change.

These changes are described below.

#### 3.4.4.1 Variable Generation Forecast in the Day-Ahead Scheduling Process

In the day-ahead scheduling process, the *registered market participant* for *variable generation* will have the option to submit their own *variable generation* forecast using a new hourly *dispatch data* parameter called *variable generation* resource forecast quantity. This alternative forecast will be used in DAM Pass 1, Market Commitment and Market Power Mitigation, and DAM Pass 3, Day-ahead Market Scheduling and Pricing. The *IESO's* centralized *variable generation* forecast will be used in DAM Pass 2, *Reliability* Scheduling and Commitment. If no alternative forecast is provided, the *IESO's* centralized forecast will be used for all DAM Passes.

The *IESO* will continue to have the ability to adjust the centralized *variable generation* forecast, but will be restricted from adjusting the *variable generation* resource forecast quantity submitted by *market participants*. Like other *dispatch data*, the *IESO* will only modify a *variable generation* resource forecast quantity at the request of the *market participant* to submit changes on the *variable generator*'s behalf.

#### 3.4.4.2 IESO Adjustments to the Centralized Forecast

The *IESO* adjusts the centralized *variable generation* forecast to better align with observed *variable generation* output trends. Currently this is done by applying either overrides or using persistence depending on whether the adjustment is required as an input to the DAM, PD or RT calculation engines.

The *variable generation* forecast used by the DAM and PD calculation engines is adjusted by applying overrides. Currently, the *IESO* may apply system-wide overrides affecting all *variable generation* or zonal overrides targeting any of the *variable generation* zones in Ontario; Northwest, Northeast, Bruce, West, Southwest, East and Essa. In the future, the *IESO* will apply overrides on a zonal basis to ensure that *variable generation* forecasts in each zone reflect conditions in each zone. Global overrides will only be used to address *reliability* concerns when timeframes do not permit the application of zonal overrides.

The centralized *variable generation* forecast used by the RT calculation engine is adjusted by using persistence. Persistence is the actual telemetered output from each *variable generation* resource blended with the centralized forecast for the *facility* to produce a forecast that more accurately reflects current trends. Currently, persistence is applied globally to all *variable generation* resources. In the future, the *IESO* will have the ability to apply persistence on a zonal basis to ensure that *variable generation* forecasts in each zone reflect conditions in the zone.

During unplanned *outages* to the centralized *variable generation* forecast system, the *IESO* has the ability to manually set the forecast for each *variable generation* resource based on their actual output. This is used by calculation engines in the absence of a centralized *variable generation* forecast. In the future, the *IESO* will also have the ability to set the forecast for each zone based on the output in the zone. This forecast will be assigned to the *variable generation* in the zone pro rata based on current observed output for use by calculation engines in the absence of a centralized *variable generation* forecast. This will provide greater accuracy than the current method of a static manual override for each *variable generation* resource.

Additional details on centralized *variable generation* forecast can be found in the DAM Calculation Engine, PD Calculation Engine and RT Calculation Engine detailed design documents.

## 3.4.5. Demand Forecast Assessment and Adjustment

The *IESO* requires an accurate *demand* forecast as it is a crucial input for meeting grid *reliability* obligations. The *IESO* currently forecasts *demand* globally for Ontario.

In the future market, the *IESO* will produce the existing province-wide *demand* forecast as the sum of four separate *demand* forecast areas. *Demand* forecast areas are discussed in greater detail in the Offers, Bids and Data Inputs detailed design document.

The *demand* forecast produced by the *IESO* will continue to be used as an input for expected load in each *demand* forecast area by the DAM, PD and RT calculation engines. The following types of *demand* forecasts are used by calculation engines:

- Hourly global *demand* forecast (peak and average) – used for DAM and PD; and
- Five-minute global *demand* forecast – used for five-minute RT *dispatch*.

In order to have the most up to date *demand* forecast input in the DAM, PD and RT scheduling algorithms, the *IESO* must be able to assess and adjust the forecast in an effective manner within timelines appropriate for each timeframe. *Demand* forecast assessment, adjustment and the use of peak and average *demand* forecasts during each timeframe are discussed below.

### 3.4.5.1 Demand Forecast in the Day-Ahead Scheduling Process

The *IESO* currently forecasts the average and peak hourly global *demand* which is used as an input into DACP. In the future, the *IESO* will forecast average and peak hourly *demand* for each *demand* forecast area instead of globally. The forecasts for each *demand* forecast area will be used as inputs into the DAM calculation engine.

The average hourly *demand* forecast is used in DAM Pass 1, Market Commitment and Market Power Mitigation, and DAM Stage 3, Day-ahead Market Scheduling and Pricing.

The peak hourly *demand* forecast is used in DAM Pass 2, Reliability Scheduling and Commitment.

For more information on the DAM calculation engine pass structure see Section 2.2, Day-Ahead Market Calculation Engine detailed design document.

#### 3.4.5.2 Demand Forecast in the Pre-Dispatch Scheduling Process

The *IESO* updates the *demand* forecast used as an input into the PD calculation engine to reflect the latest anticipated conditions based on actual *demand* trends and changing weather forecasts. *Demand* adjustments are applied to future hours at any time and are used by subsequent PD runs. In the future market, *demand* adjustments will continue to be made by the *IESO* and used by the PD calculation engine in the same manner. The only change is that the *IESO* will forecast the average and peak hourly *demand* for each *demand* forecast area instead of globally.

One additional control the *IESO* has that is unique to the *pre-dispatch scheduling* timeframe is to determine the hours in which the PD calculation engine will use either the peak or the average hourly *demand* forecast. By default, the *IESO* uses average hourly *demand* unless an hour is deemed an *IESO* ramp hour. *IESO* ramp hours are any hour in which the peak *demand* forecast exceeds the average *demand* forecast by 300MW or more. The *IESO* may use either peak or average hourly *demand* in any given hour to address *adequacy* or surplus baseload concerns, regardless of whether the criteria for *IESO* ramp hours is met. The use of peak and average hourly *demand* will not change in the future market. When peak or average hourly *demand* is used in any given hour, it will be applied across all forecast *demand* areas for that hour.

Average and peak *demand* forecasts and the automated selection to use peak or average *demand* in each *dispatch hour* are and will continue to be available through the public *adequacy* reports. *Market participants* will continue to be notified through advisories when peak or average *demand* is used to address *reliability* concerns.

#### 3.4.5.3 Demand Forecast in the Real-Time Scheduling and Dispatch Process

*Demand* forecasting for use by the RT calculation engine is primarily an automated function, compared with DA and PD *demand* forecasting where the *IESO* manually assesses *demand* trends, uses similar day load forecasting, trend analysis and weather patterns. In real-time, the *IESO* has the ability to adjust the 5-minute global *demand* forecast to ensure that the quantity of *energy dispatched* meets actual system needs.

In the future market, the *IESO* will continue to have the ability to adjust the 5-minute global *demand* forecast. However, this global *demand* forecast adjustment will be apportioned to each *demand* area based on the relative *demand* in that area. Since the *IESO* applies *demand* adjustments to resolve global supply and *demand* imbalance, it is appropriate to continue to apply the *demand* adjustment globally. Given the short timeframe to apply *demand* adjustments for the next 5-minute *dispatch interval*, separately determining and manually applying appropriate adjustments to each *demand* area is not feasible.

## 3.5. DAM Scheduling and Commitments Process

This section describes the future DAM scheduling and commitment process and is divided into the following sections:

- Timing of DAM scheduling process;
- DAM submission window supporting processes;
- DAM calculation engine execution and supporting processes;
- Determination of DAM schedules; and
- Post-DAM.

### 3.5.1. Timing of DAM Scheduling Process

All activities in the future day-ahead scheduling process will occur in eastern prevailing time (EPT). DAM notifications occur as required within the submission window and during the calculation engine execution. Schedules and prices produced by the day-ahead market are produced in eastern standard time (EST) year-round consistent with the operation of *pre-dispatch scheduling* and the *real-time market*. Figure 3-5 shows the timing of the various activities within the DAM scheduling process.

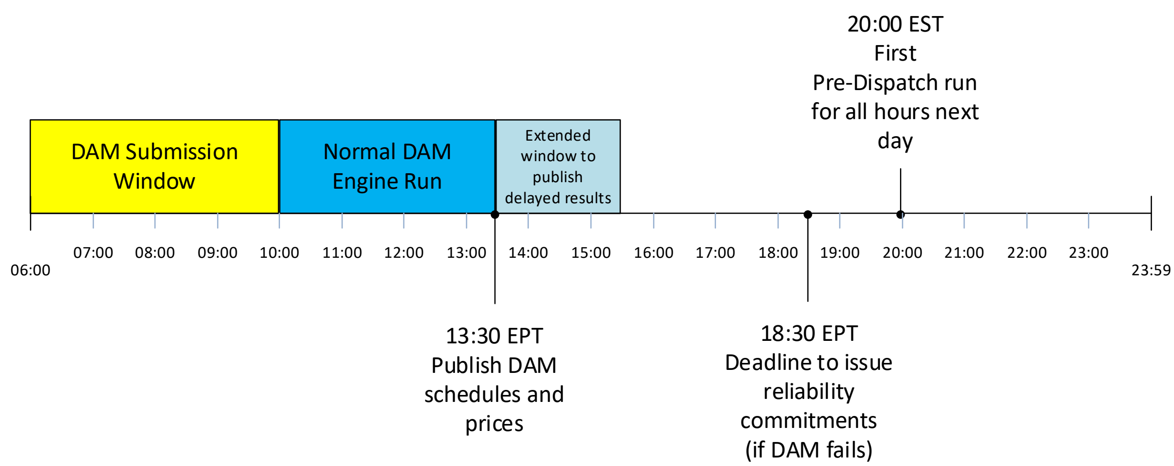


**Figure 3-5: Activities and Associated Timing within the DAM Scheduling Process (all times in EPT except where noted)**

### 3.5.2. DAM Submission Window Supporting Processes

The window for *dispatch data* submission by the *market participants* into the day-ahead market will be from 06:00 to 10:00 EPT. Prior to the DAM calculation engine execution at 10:00 EPT, the *IESO* is responsible for reviewing that inputs into the algorithm are verified and correct. A description of inputs and how they are received and derived is in Sections 3.3 and 3.4 above, as well as the Offers, Bids and Data Inputs detailed design document. This section addresses the activities required to facilitate the preparation and validation of these inputs to execute and administer the DAM.

#### 3.5.2.1 Pre-DAM Validation of IESO Inputs

The current DACP is designed primarily to determine NQS *generation unit* commitments for the next day; it is not a financially binding market for all resources. In the future day-ahead market, financially binding schedules and prices will be produced for all resources and they will be *settled* based on them. Therefore, relative to the current design, there is an increased importance for thorough pre-DAM validation of *IESO* inputs into the DAM calculation engine. This will ensure that accurate data is used to determine DAM results and minimize the frequency of errors.

#### 3.5.2.2 Market Participant Submission of Dispatch Data During Tool Failures

In the current DACP, *market participants* may be prevented from submitting *dispatch data* due to a tool failure on the *market participant* side. If this occurs, there are two actions that can be taken:

- Communicating with the *market participant* before or if necessary after the submission window closes.
  - If communication resolves the tool failure, the *market participant* can re-submit *dispatch data*; or
  - If communication does not resolve the tool failure, the *IESO* may submit *dispatch data* on the *market participant's* behalf.
- Using a previously submitted set of standing *offers* and *bids*.

In the rare case of an *IESO* tool failure which prevents the *IESO* from receiving *dispatch data* submissions, the DAM submission window deadline for all *market participants* will be extended. If this occurs, a notification will be sent to *market participants.*

In the future DAM, these actions will continue to be used with one exception: additional inputs and changes to *dispatch data* for the DAM will not be considered or requested by the *IESO* after the close of the DAM submission window unless there is an *IESO* tool failure. Therefore, to detect issues earlier and provide the opportunity for a *market participant* to re-submit *dispatch data* prior to the close of the submission window, the *IESO* will perform an early assessment to determine if sufficient *dispatch data* was submitted to satisfy the day ahead forecast *demand*. This assessment will be conducted early enough within the submission window to allow time for the *IESO* to communicate with the *market participant(s)* to identify the issue and resolve it while minimizing the potential for delays to the DAM calculation engine run.

#### 3.5.2.3 Reliability Constraints

Under specific system conditions, the *IESO* may require certain *generation facilities* to be in-service and generating above a certain output or *dispatchable load facilities* to be consuming below a certain level to maintain *reliability*. If these system conditions are not recognized by the calculation engine, the *generation facilities* or *dispatchable load facilities* may not be scheduled at the amount required for *reliability*. An example is an *outage* condition where voltage support is required from a *generation facility* to maintain *reliability*. To ensure the resources required are scheduled even if uneconomic, the *IESO* creates a minimum, maximum, or fixed scheduling constraint on the *facility*(s) as an input to the calculation engine.

When these constraints are identified prior to the submission window closing in the future day-ahead market, they will be applied as inputs into the DAM calculation engine.

#### 3.5.2.4 Determination of Additional OR Requirement in DAM

Additional *operating reserve* beyond *reliability* requirements may be scheduled under certain conditions; this is known as Flexibility *Operating Reserve* (Flex OR). Currently, Flex OR is additional 30 minute OR that can be scheduled only in PD and RT to account for conditions such as uncertainty in system supply and *demand* forecast error. In the current DACP, there is no option to schedule Flex OR.

The ability to schedule Flex OR will be incorporated into the day-ahead market. A new process will enable the *IESO* to determine if Flex OR is required as well as the quantity for the day-ahead market and notification will be provided to *market participants*. On a daily basis after the day-ahead market is complete, a re-evaluation of Flex OR may also be performed. The *IESO* may determine that an adjustment of Flex OR will be required for PD and RT.

### 3.5.3. DAM Calculation Engine Execution and Supporting Processes

The future day-ahead market will be executed in three Passes with multiple steps per Pass. One complete run will be executed per day. This is a significant change from the current three passes of the DACP today with at least two complete runs per day. See Figure 3-6 for a simplified diagram of the single run execution of the DAM calculation engine.

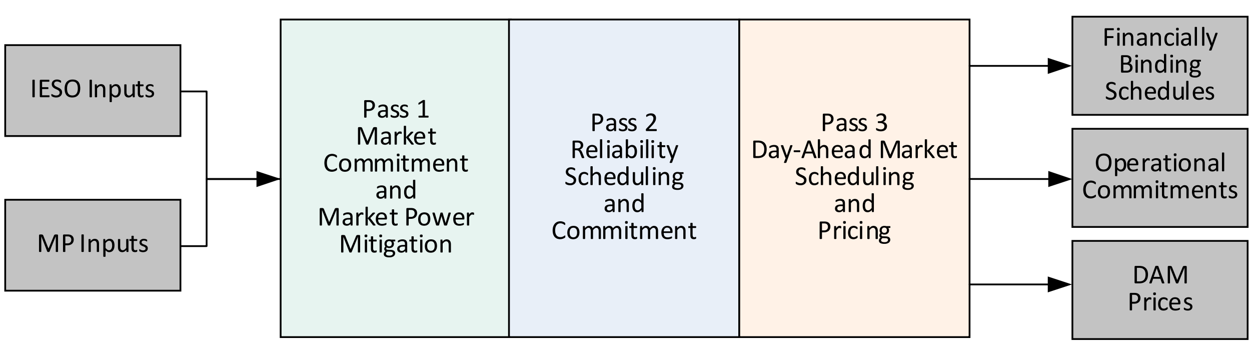


**Figure 3-6: DAM Calculation Engine Execution**

#### 3.5.3.1 Re-running the DAM Calculation Engine

The current DACP includes criteria for determining if an additional run is warranted due to changing system conditions that are expected to impact the next day. Currently, the *IESO* is permitted to request additional *dispatch data* if required to evaluate a changing system condition in the re-run. An additional run is only performed if the necessary changes to *dispatch data* and/or *IESO* inputs can be made in time for them to be included in the *publish*ing of the DACP results before 15:00 EST.

In the future day-ahead market, no changes to *dispatch data* will be permitted after 10:00 EPT, unless there is an *IESO* tool failure. During the DAM scheduling process, the DAM calculation engine will not be re-run for changing system conditions. Any changes will be considered in subsequent evaluation processes such as pre-dispatch.

The *IESO* will continue to have the ability to correct *IESO* inputs and re-run the DAM calculation engine in order to produce valid DAM results due to *IESO* errors or calculation engine issues. When a re-run occurs, notification will be provided to *market participants* as well as information on any revised inputs.

Once DAM results are validated and published, it will be considered final and no re-runs of the DAM calculation engine will be executed.

#### 3.5.3.2 Delays to DAM Execution

The current DACP includes a requirement for the *IESO* to notify *market participants* of delays in the DACP. Delays can occur due to tool failures or issues with results.

This will continue to be a requirement in the future day-ahead market. During the DAM calculation engine execution, issues may be encountered. This may delay the execution of the calculation engine or necessitate a re-run of the calculation engine. When this occurs, the *IESO* will perform an assessment on whether the issue will cause a delay in meeting the 13:30 EPT publishing target. If a delay is declared, the *IESO* will issue a notification to *market participants,* including the nature for the delay and an estimated time for results to be *published*.

#### 3.5.3.3 DAM Calculation Engine Failure

The current DACP is declared a failure if it does not produce a single valid DACE run by 15:00 EST.

In the future day-ahead market, a failure will be declared if valid results cannot be produced by approximately 15:30 EPT. The specific time will be determined once software capabilities and the time required to perform the processes in the event of a DAM failure are determined. When a failure is declared, the *IESO* will issue a notification to *market participants* and appropriate internal business units.

See section 3.9 for more information on the approach to managing future DAM failures.

### 3.5.4. Determination of DAM Schedules

The DAM calculation engine will evaluate all *market participant* data inputs and *IESO* data inputs, optimizing over a 24-hour period to produce hourly resource schedules. All resources*, boundary entity* resources and virtual transactions will receive a financially binding schedule, some resources may also receive a commitment. Specific changes to DA scheduling of resources in relation to the DACP process are noted below. There are no changes to how *self-scheduling generation facilities* and *non-dispatchable load* resources are scheduled.

#### 3.5.4.1 Determination of NQS and Pseudo-Unit Resource Schedules and Commitments

The following *dispatch data* parameters for which comparable data are used in today's DACP will continue to be included as daily *dispatch data* inputs into the DAM calculation engine and used to optimize NQS *generation unit* and *pseudo unit* schedules and operational commitments:

- Start-up offer;
- Speed no-load offer;
- *Minimum loading point* (MLP);
- *Minimum generation block run-time* (MGBRT);
- *Minimum generation block down time* (MGBDT);
- *Maximum number of starts per day; and*
- Single cycle mode.

New daily *dispatch data* parameters for the day-ahead market are:

- Ramp up *energy* to MLP.

The ramp up *energy* to MLP parameter will be evaluated by the DAM calculation engine in order to schedule *energy* when a NQS *generation facility* or *pseudo-unit* resource starts up. The ramping *energy* will also receive a financially binding schedule in the hours it is scheduled.

*Dispatch data* parameters are further described in the Offers, Bids and Data Inputs detailed design document.

#### 3.5.4.2 Determination of Hydroelectric Generation Facility Schedules

In the current DACP, the only physical operating characteristic of a hydroelectric *generation facility* that the DACE respects as *dispatch data* submitted by a *registered market participant* is the maximum daily *energy* limit (Max DEL).

In the future market, the DAM calculation engine will evaluate Max DEL and new *dispatch data* parameters that reflect additional physical operating characteristics of hydroelectric *generation facilities*. The new *dispatch data* parameters are:

- *Forbidden regions*;
- Minimum daily *energy* limit (Min DEL);
- Hourly must run (HMR);
- Minimum hourly output (MHO);
- *Maximum number of starts per day* (MNSPD); and
- Linked resources, time lag and MWh ratio (linked resource parameters).

For *registered market participants* that are eligible to submit multiple hydroelectric *dispatch data* parameters for a particular resource, the DAM calculation engine will respect all of the parameters when scheduling this resource.

### Forbidden Regions

In the current DACP, no *forbidden region*[10] parameters exist and therefore a hydroelectric resource may be scheduled within a *forbidden region*. An example of this is shown in Figure 3-7, where resource A is scheduled within the 40-85MW *forbidden region*.

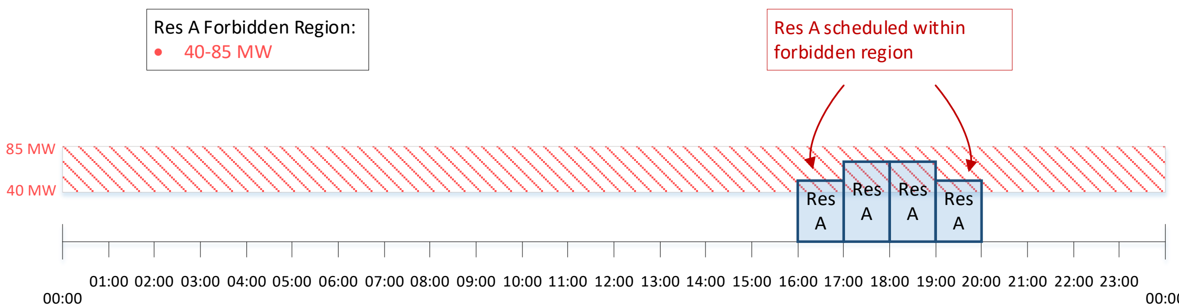


**Figure 3-7: Current - Forbidden Region Parameter not Respected in DACP**

In the future DAM, the inclusion of the *forbidden region* parameter will ensure that the hydroelectric resource is scheduled outside its submitted *forbidden regions*. Figure 3-8 shows an example of the treatment of this parameter in DAM. In this example, Res A is scheduled below its *forbidden region* in HE 17 and 20, and above its *forbidden region* in HE18 and 19.

[10] A *forbidden region* is a predefined operating range within which a hydroelectric *generation facility* cannot maintain steady operation without causing equipment damage.

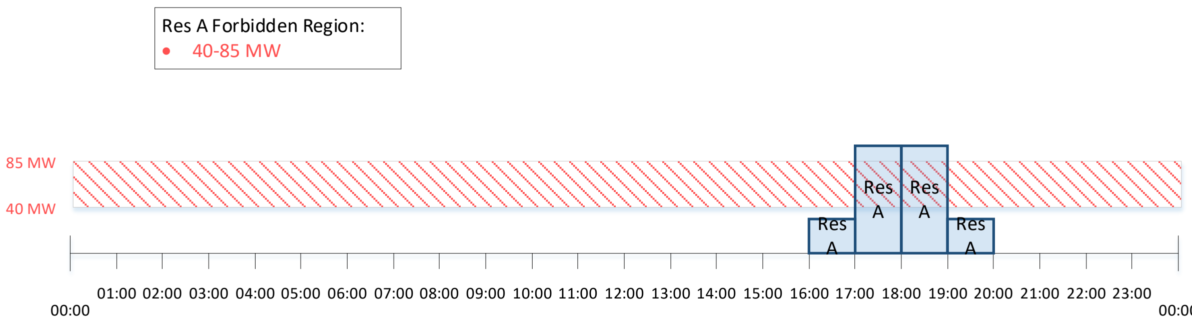


**Figure 3-8: Future - Treatment of Forbidden Region Parameter in DAM**

### Maximum Daily Energy Limit (Max DEL) and Minimum Daily Energy Limit (Min DEL)

In the current DACP, a Max DEL value is respected but not a Min DEL value. Therefore, a resource will not be scheduled for more *energy* over the day than the Max DEL, but may be scheduled for less *energy* over the day than required by the *market participant*. An example of the DACP not respecting a minimum *energy* requirement is shown in Figure 3-9.

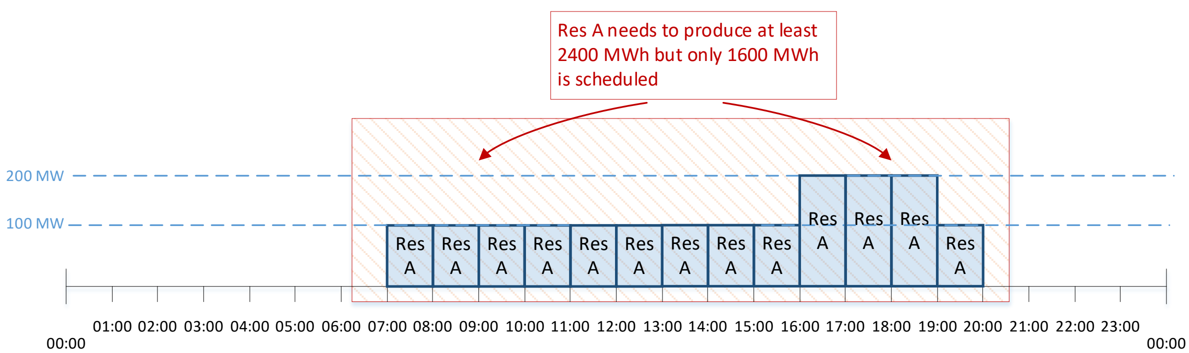


**Figure 3-9: Current - Min DEL Parameter not respected in DACP**

In the future DAM, the sum of the resource's scheduled *energy* over the 24-hour look-ahead period will be no less than the Min DEL value and no more than the Max DEL value. Figure 3-10 shows an example of the treatment of the Min DEL parameter in the DAM calculation engine in which the sum of the daily schedule equals the Min DEL of 2400 MWh.

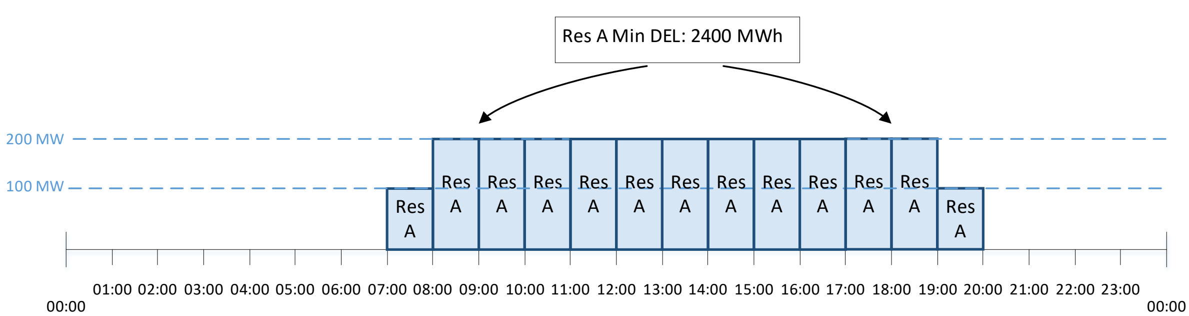


**Figure 3-10: Future - Treatment of Min DEL Parameter in DAM**

### Hourly Must-Run (HMR)

In the current DACP, hourly must run values for hydroelectric resources are not respected. An example of this is shown in Figure 3-11 where Res A requires a schedule of 200 MW from HE 17-20, but is scheduled for less than this amount in HE 17 and HE 18.

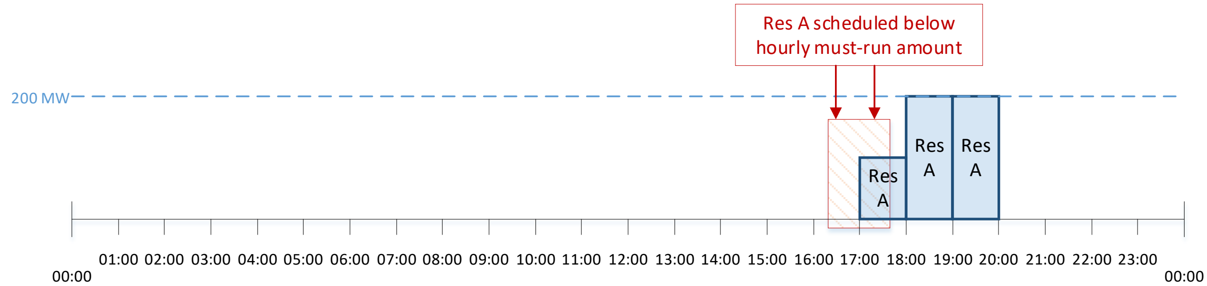


**Figure 3-11: Current - Hourly Must Run Parameter not Respected in DACP**

In the DAM, hydroelectric resources will be scheduled to at least its submitted hourly must run value. Figure 3-12 shows an example of the treatment of this parameter in DAM.

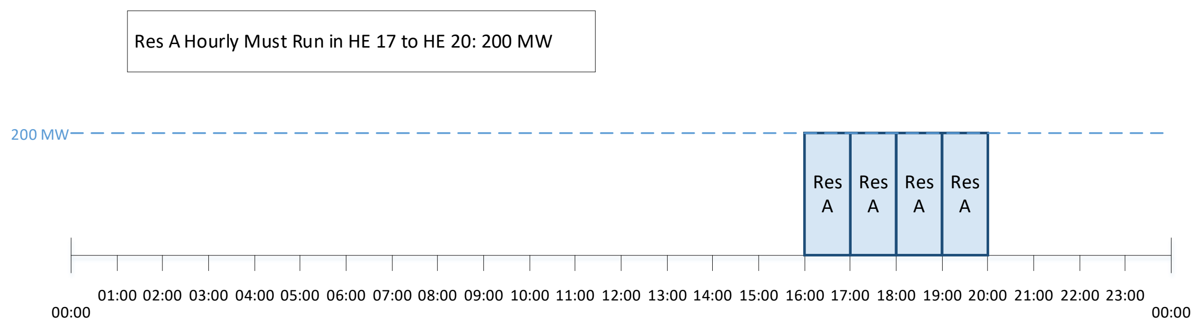


**Figure 3-12: Future - Treatment of Hourly Must Run Parameter in DAM**

### Minimum Hourly Output (MHO)

In the current DACP minimum hourly output values for hydroelectric resources are not respected. An example of this is shown in Figure 3-13 where Res A requires a minimum output of 100 MW scheduled between HE8 to HE11, but with no parameter to indicate this, is only scheduled to 50 MW by the DACP.

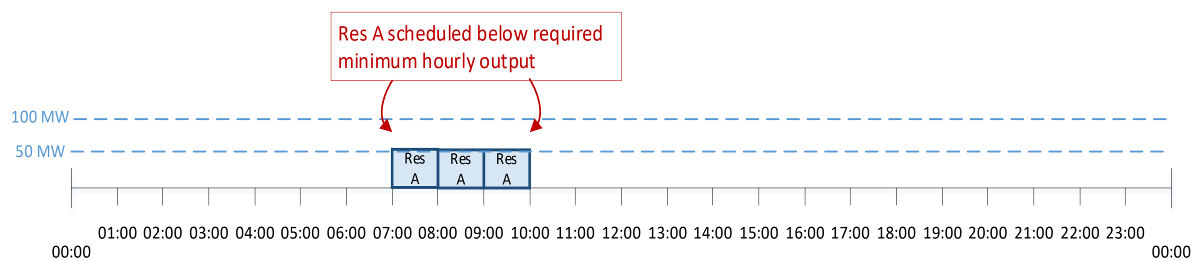


**Figure 3-13: Current - Minimum Hourly Output Parameter not Respected in DACP**

In the DAM, a minimum hourly output parameter will be respected for hydroelectric resources. This means that the resource will either be scheduled to 0 MW or at least its submitted minimum hourly output value. Figure 3-14 shows an example of the treatment of this parameter in DAM, in which Res A is scheduled for 0MW in HE8, and then scheduled to its MHO parameter of 100MW in HE9 and HE10.

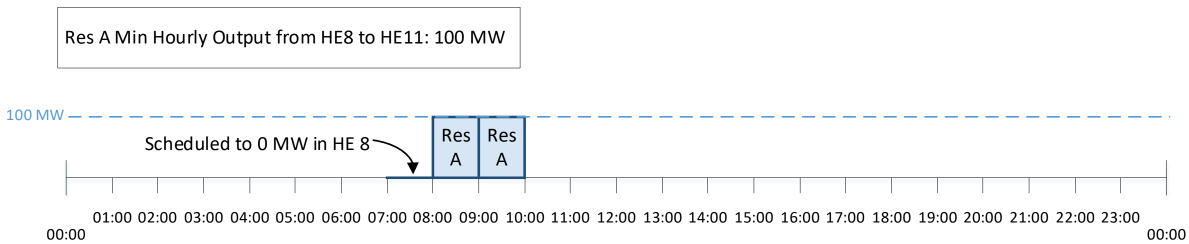


**Figure 3-14: Future - Treatment of Minimum Hourly Output Parameter in DAM**

### Maximum Number of Start per Day

The current DACP does not respect *maximum number of starts per day* for hydroelectric resources. An example of this is shown in Figure 3-15 where Res A, limited to 4 starts, receives a schedule for 5 starts in the day. Note that Res A consists of an aggregate of two *generation units*.

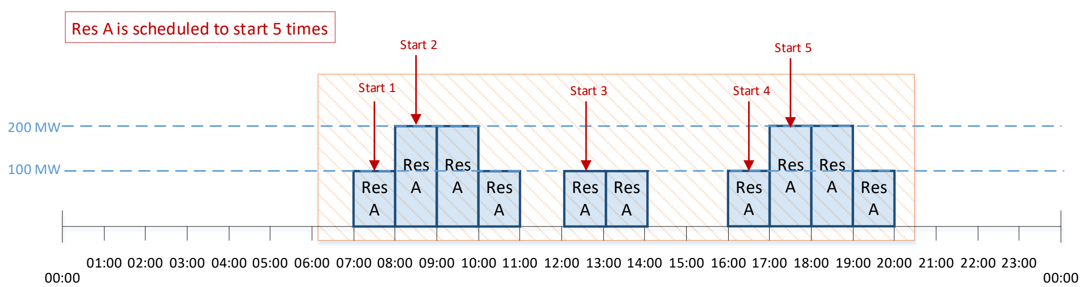


**Figure 3-15: Current - Maximum Number of Starts Per Day Parameter not Respected in DACP**

In the DAM, the sum of resource starts over the 24-hour look-ahead period will be no greater than the submitted *maximum number of starts per day* value. For a hydroelectric resource registered as an aggregate of *generation units*, starts will be counted based on registered start indication values for the resource. Figure 3-16 shows an example of the treatment of this parameter in DAM. In this example, Res A consists of an aggregate of two *generation units*, and correspondingly, there are two start indication values.

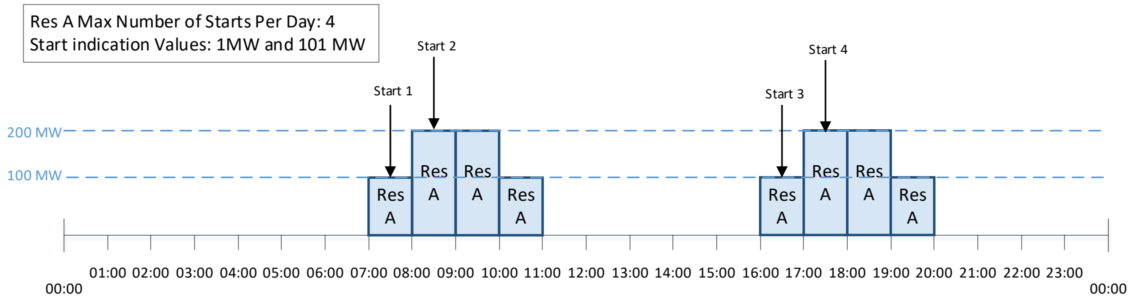


**Figure 3-16: Future - Treatment of Maximum Number of Starts Per Day Parameter in DAM**

### Linked Resources, Time Lag and MWh ratio (Linked Resource Parameters)

In the current DACP hydroelectric cascade parameters are not respected. An example of a scheduling outcome due to this is shown in Figure 3-17. In this example Res A, the upstream resource and Res B, the downstream resource are separated by a 3-hour time lag. As well, every 1 MW produced at Res A necessitates that 1 MW be produced at Res B.

However, because these resources are scheduled independently by the DACP, infeasible schedules can result. This can be seen in Figure 3-17 in HE 11 of Res B's schedule. In this hour, physical cascade characteristics dictate that Res B requires a schedule equal to Res A's schedule in HE8, since by this hour – 3 hours after HE8 - the water utilized to produce Res A's HE8 schedule will have reached Res B. However, independent scheduling has resulted in Res B being scheduled to an infeasible 0 MW in HE 11.

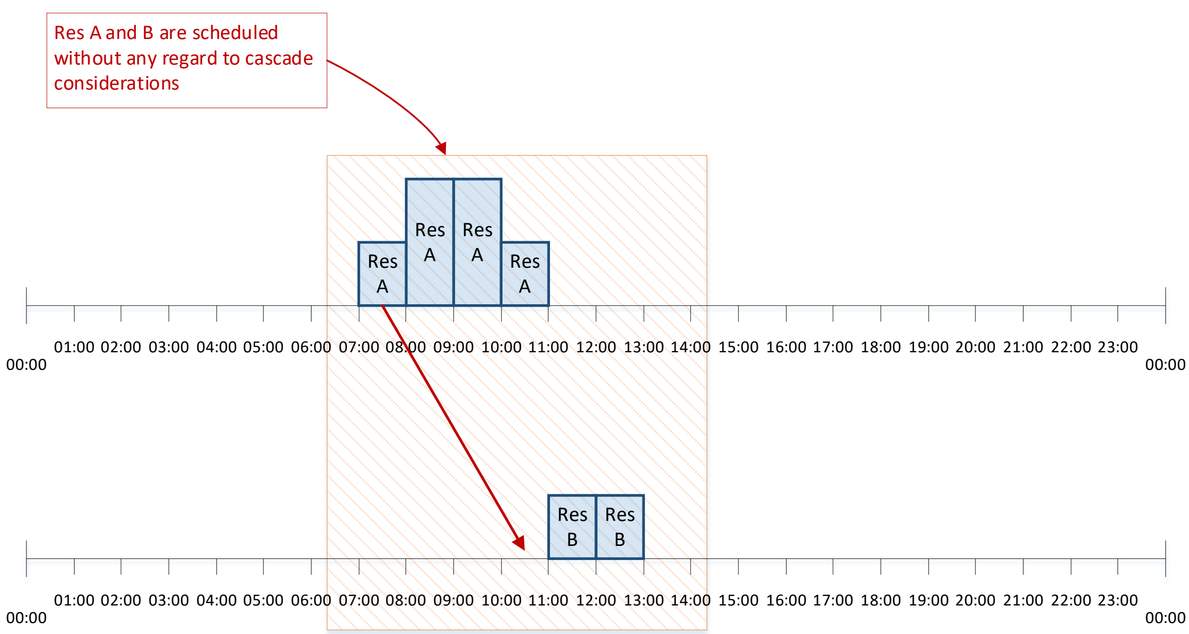


**Figure 3-17: Current - Linked Resource Parameters not Respected in DACP**

In the DAM, cascade hydroelectric resources owned by the same *market participant* will be scheduled respecting their intertemporal dependencies represented by the linked resources, time lag and MWh ratio parameters. Each set of linked resources, time lag and MWh ratio parameters will link a pair of resources on a cascade, defining the upstream and downstream resource, time and MW relationship between the two resources.

Figure 3-18 shows an example of the treatment of these parameters in DAM for upstream Res A linked to downstream Res B. Referring back to same example hour, HE 11 of Res B's schedule, it can be seen that this hour now has a feasible schedule, as it corresponds to Res A's schedule for HE8 as required by the submitted link resource parameters' values.

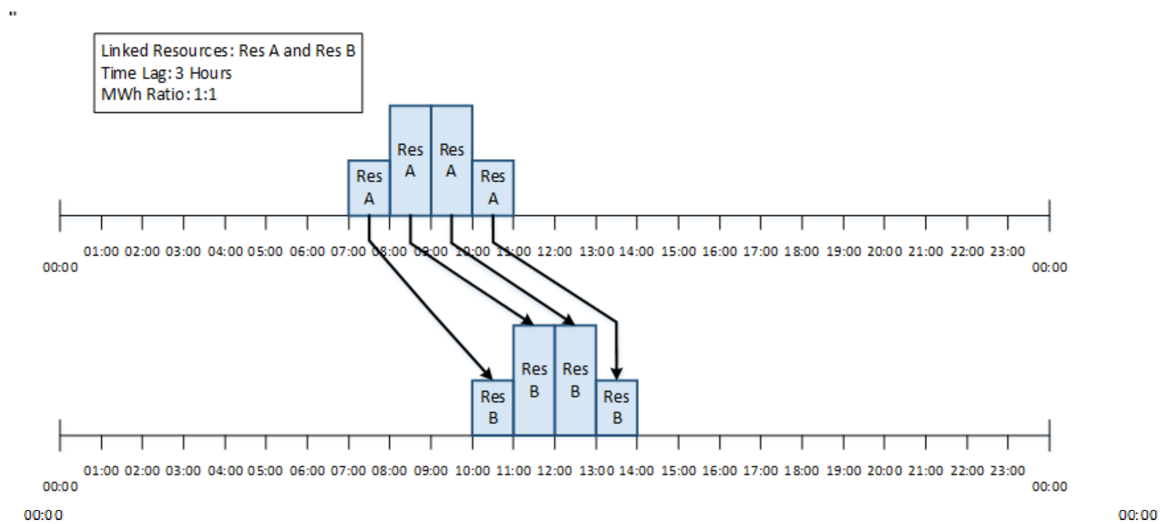


**Figure 3-18: Future - Treatment of Linked Resource Parameters in DAM**

### Scheduling Linked Resources at the Boundaries of the DAM

The current DACP schedules hydroelectric resources such that *dispatch data* submitted for the next *dispatch day* can be evaluated independently of *dispatch data* submissions and resource schedules from the previous *dispatch day*. Consistent with the approach used for existing *dispatch data* in DACP, the DAM calculation engine will evaluate *dispatch data* for linked resources independent of linked resource *dispatch data* submissions and schedules from the previous *dispatch day.*

For *registered market participants* to manage their intertemporal cascade dependencies from one *dispatch day* to the next, the DAM calculation engine will evaluate a linked downstream resource independent of the time lag and MWh ratio value for the first *h* hours of the DAM look-ahead period, where *h* is the value of the time lag parameter submitted.

*Registered market participants* should submit an hourly must run quantity for the downstream resource to respect the MWh ratio and time lag if they expect a must run condition to develop to pass the water received from the upstream resource scheduled in the previous *dispatch day*. A minimum hourly output value should be submitted for the downstream resource if it has the ability to spill the water but spill restrictions are expected to prevent it from being partially scheduled. An *outage* should be submitted for the downstream resource if it is expected to be unavailable or have limited availability because either no water or a limited amount is expected to be passed from the upstream resource.

Similarly, in the last *h* hours of the DAM look-ahead period, where *h* is the value of the time lag parameter submitted, a linked upstream resource will be independently evaluated of time lag and MWh ratio. This allows the DAM calculation engine to evaluate any available *energy* on the upstream resource. Schedules produced during these hours can inform the *registered market participant* whether they will have intertemporal dependencies to carry over into the following day's day-ahead market.

Figure 3-19 below demonstrates an example of linked resources at the start of DAM. In this example Res B is the downstream resource that is linked to Res A, an upstream resource, with a time lag of 3 hours. Res B will be independently evaluated in the first three hours of the day-ahead market. This allows the *registered market participant* to inform the DAM calculation whether a minimum amount of *energy* must be evaluated for the downstream resource in any of the first three hours to pass the water received from the upstream resource that is expected to be scheduled in the last 3 hours of the previous *dispatch day.*

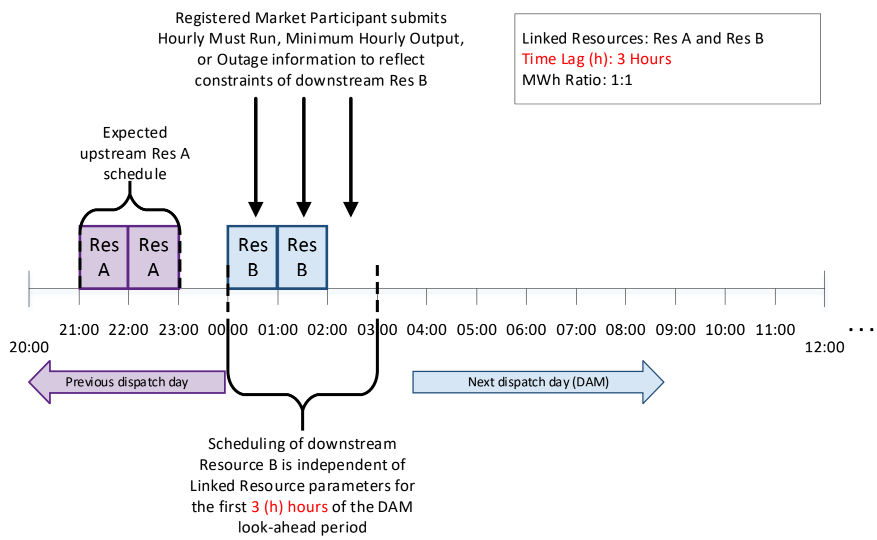


**Figure 3-19: Managing Linked Resources for the Start of the DAM**

### 3.5.4.3 Determination of Price Responsive Load Resource Schedules

With the introduction of a day-ahead market, *market participants* will be able to register their *load facility* as a price responsive load (PRL). A PRL resource will have the ability to participate in the DAM by submitting *bids* to consume *energy*, which will be economically evaluated by the DAM calculation engine to determine financially binding schedules.

### 3.5.4.4 Determination of Virtual Transaction Schedules

In the future DAM, authorized *market participants* will be able to submit virtual transaction *offers* or *bids* to sell or buy *energy* with no expectation to physically consume or supply that *energy* in the *real-time market* during the corresponding real-time *settlement hour.*

The DAM calculation engine will economically evaluate virtual transaction *bids* and *offers* similarly to physical *bids* and *offers* to determine financially binding schedules.

## 3.5.5. Post DAM Processes

Once the DAM has executed, the following processes are performed:

- Publishing DAM results; and
- Coordination of DA Transactions with Other Balancing Authorities.

In addition, it is important to identify the DAM results that will be used by the *pre-dispatch scheduling* process.

### 3.5.5.1 Publish DAM Results

Currently, the successful completion of the DACP includes the production of the DACP *schedule of record* (SOR) for each *market participant* by 15:00 EST. The SOR consists of two sets of private reports – the Day-Ahead Scheduled Energy and Operating Reserve Reports and the Day-Ahead Check/Source Availability Declaration Envelope (ADE) Reports. The SOR is used for market *settlement* and to establish a resource's ADE amount for PD and RT operations. As well, various public reports containing aggregate market results are *published* by the IESO.

In the future day-ahead market, similar public and private reports will be *published* or provided to *market participants* following the successful execution of the DAM calculation engine. *Market participants* will not receive a SOR, but instead will receive private reports containing their financially binding schedules and commitments. *Market participants* will also receive private reports on any mitigation actions that were taken by the calculation engine. *Demand response market participants* with *demand response capacity obligations* will continue to receive standby reports and notifications as required. Public reports will be *published* consisting of market results in aggregate form and all market pricing.

Refer to the Publishing and Reporting Market Information detailed design document for more information on the content and timing of DAM related reports.

### 3.5.5.2 Coordination of DA Intertie Transactions with Other Balancing Authorities

Currently on the *pre-dispatch day*, coordination of *intertie* transactions is typically limited to a check on eligible marketers with NYISO. All coordination of *intertie* transactions occurs during the hour prior to the *dispatch hour*, known as the hourly *interconnection schedule* checkout (hourly checkout). During this hourly checkout, operators from both balancing authorities match transactions that have cleared their respective markets. The objective of the hourly checkout is to resolve discrepancies and issues in transactions between the two markets to come to a final agreed-upon scheduled flow for the upcoming hour.

With the introduction of a financially-binding DAM, it is anticipated that the volume of *intertie* transactions on the *pre-dispatch day* will increase. Additional coordination with other balancing authorities in the DAM scheduling timeframe will be expanded with the introduction of a DAM Transaction Intertie Comparison. This is for informational purposes and will be performed post-DAM when Ontario is expected to be import dependent the next day.

### 3.5.5.3 Use of DAM Results in Pre-Dispatch

While DAM schedules will not be carried through into the *pre-dispatch scheduling* process it is important to note that certain DAM results have specific treatment in the *pre-dispatch scheduling* process: NQS operational commitments, and DAM import and export schedules.

#### NQS Operational Commitments

NQS operational commitments that are made in the DACP are passed to the pre-dispatch calculation engine through minimum constraints for the *generation facility's* MLP for a period equal to the day-ahead schedule, per the DACP *schedule of record*. For steam turbine (ST) *generation units*, the minimum constraint is applied at the corresponding n-on-1 MLP based on the number of combustion turbine (CT) *generation units* committed (n). This allows the pre-dispatch calculation engine to respect NQS commitments made in the DACP in each pre-dispatch run after 15:00 EST.

NQS *generation facilities* and *pseudo-unit* operational commitments made in DAM will continue to be passed to PD through minimum constraints at the CT MLP and ST n-on-1 MLP. The period of the operational commitment and resulting constraint applied to PD will be equal to the MGBRT hours for each separate start. The constraint will not be for the entire duration of the DAM schedule as shown in the example in Figure 3-20. The hourly PD runs will evaluate the need to extend the length of operational commitments beyond the MGBRT period.

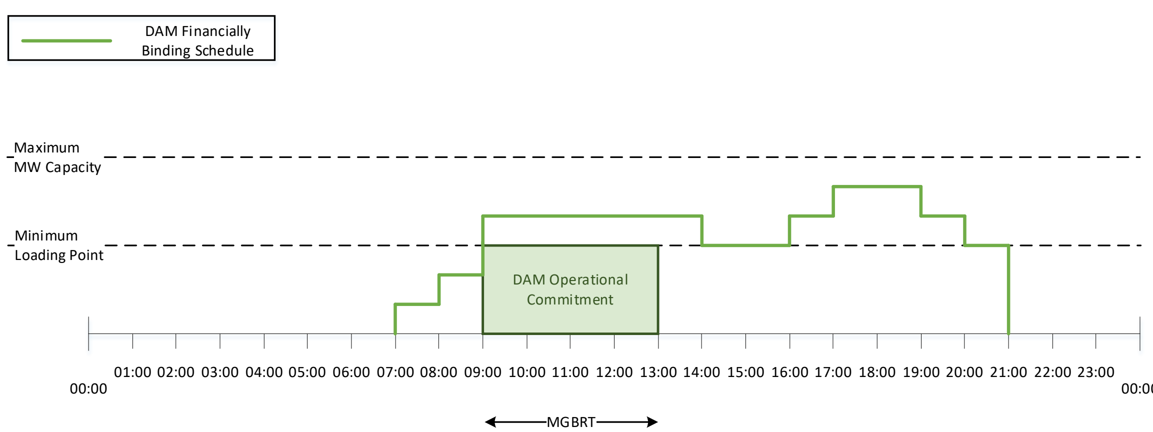


**Figure 3-20: Example of DAM Financial Schedule and Operational Commitment for NQS Generation Facility**

#### Import and Export Schedules

In the current DACP, resulting import and export schedules are not utilized in PD.

In the future market, import and export schedules resulting from the DAM will be passed onto PD in order to inform scheduling limits for import and export *offers* and *bids* in the PD evaluation. See section 3.6.2.4 for information on how *intertie* schedules are determined in PD.

## 3.6. Pre-Dispatch Scheduling and Commitments Process

The future PD calculation engine will include multi-hour optimization and evaluation of hourly and daily *dispatch data*. This enables enhancements to the way the *IESO* schedules resources during the *pre-dispatch scheduling* and commitment process.

This section describes the future *pre-dispatch scheduling* and commitment process, and is organized as follows:

- Timing of Pre-Dispatch Scheduling Process:
    - Timing of Publishing PD Results;
- Pre-Dispatch Scheduling and Supporting Processes:
    - Reliability Commitments for NQS Generation Facilities;
    - Determination of Non-Quick Start Generation Facility Schedules & Commitments;
    - Determination of Hydroelectric Generation Facility Schedules;
    - Determination of PD Intertie Schedules; and
    - Intertie Scheduling Treatment under Unique Conditions.
- Post Pre-Dispatch Calculation Engine Run Processes:
    - Coordination of Intertie Schedules with Neighbouring Jurisdictions;
    - Pre-Emptive Curtailment of Intertie Schedules; and
    - Settlement Code Application for Intertie Schedule Curtailments.
- Pre-Dispatch Reports.

### 3.6.1. Timing of Pre-Dispatch Scheduling Process

Consistent with the current *energy market*, the *pre-dispatch scheduling* process will run hourly, and the look ahead period (LAP) will vary across the day depending on the time that the PD calculation engine run occurs.

In the current market, the first run of the *pre-dispatch scheduling* process where hours for the next day are evaluated is at 15:00 EST on the *pre-dispatch day*, immediately after DACP results are *published*.

Figure 3-21 shows the timing and look-ahead period of the future *pre-dispatch scheduling* process, relative to the DAM.

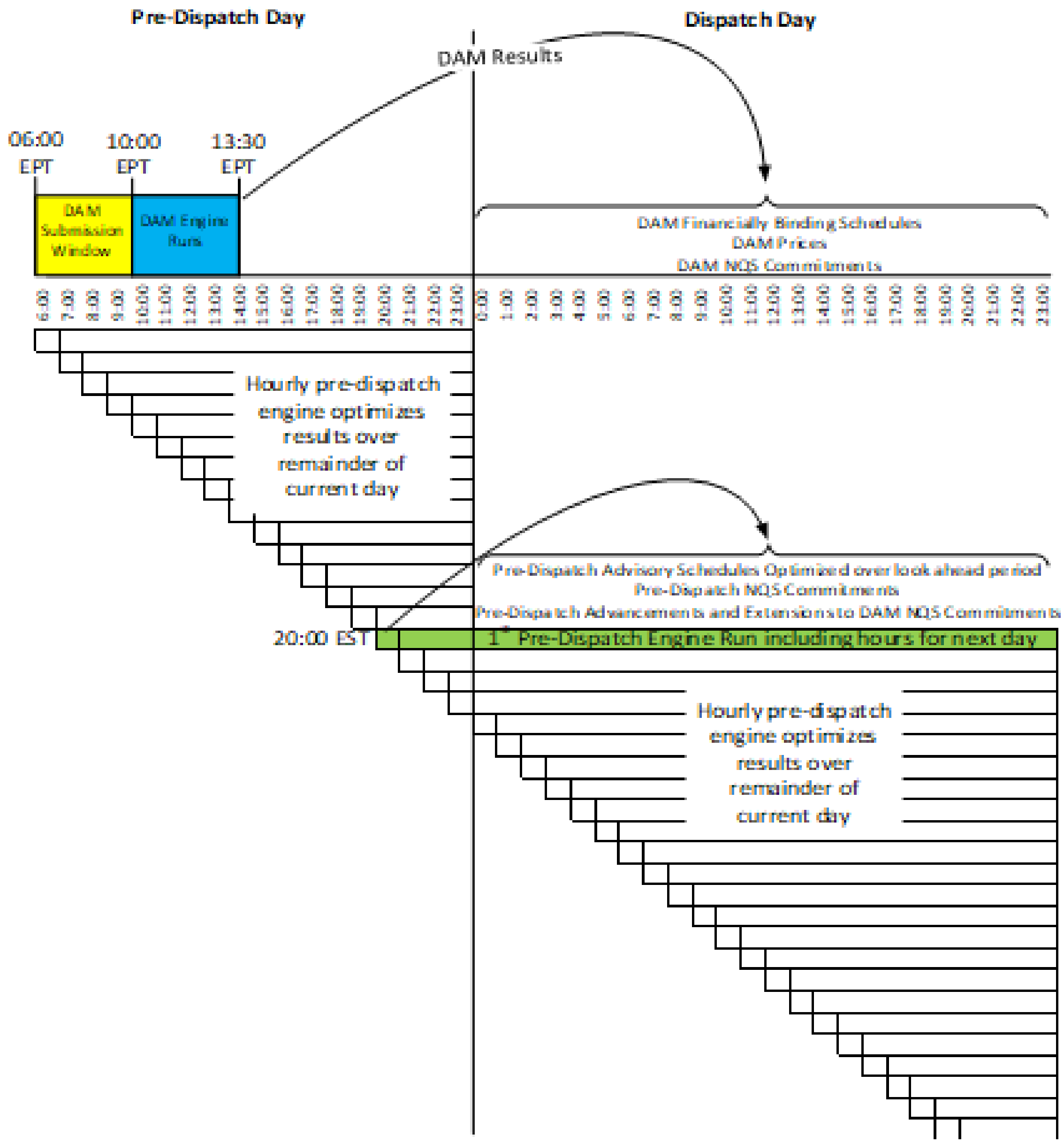


**Figure 3-21: Timing of the Pre-Dispatch Scheduling Process**

In the future market, the first run of the PD calculation engine that includes all hours of the next day will occur at 20:00 EST on the *pre-dispatch day,* approximately 5 – 6 hours[11] after the DAM results are published.

#### 3.6.1.1 Timing of Publishing PD Results

In the future market, *pre-dispatch scheduling* results shall be *published* according to the following timelines:

- *Interchange schedules* must be *published* no later than 15 minutes past the current hour for the first two *dispatch hour*s of the pre-dispatch look ahead period. Extensions to operational commitments for the first *dispatch hour* of the PD forecast horizon, must be *published* no later than 15 minutes past the current hour; and
- Advisory schedules and binding start-up instructions must be *published* no later than 30 minutes past the hour for operational commitments for the entire PD look ahead period. The information provided at 30 minutes past the hour will not change information already provided at 15 minutes past the hour.

### 3.6.2. Pre-Dispatch Scheduling and Supporting Processes

The existing *pre-dispatch scheduling* process uses a calculation engine which provides an iterative, hourly forecasted view of future hours.

The future PD calculation engine will not be limited to optimize one hour in isolation, but will use multi-hour optimization over a look-ahead period considering start-up offers and speed-no-load offers, resource operational restrictions and market power mitigation. The look ahead period will range from the shortest LAP of 4 hours (the 19:00 PD calculation engine run on the *dispatch day*), to the longest LAP of 27 hours (the 20:00 PD calculation engine run).

Changes to how the *pre-dispatch scheduling* process will operate are outlined in this section.

#### 3.6.2.1 Reliability Commitments for NQS Generation Facilities Prior to 20:00 EST Pre-Dispatch Calculation Engine Run

In response to changes in system conditions for the *dispatch day* that materialize after the DAM submission window; the *IESO* may choose to evaluate the *adequacy* and *security* of the *IESO-controlled grid* soon after the DAM results have been *published*.

This evaluation may identify the need for additional NQS *generation facilities* to be operationally committed in the *pre-dispatch day* for the *dispatch day.* Some resources will require to be given a binding start-up instruction before the first PD calculation engine run

[11] DAM results will be *published* at approximately 13:30 EPT, which is 6 hours and 30 minutes before 20:00 EST, and 5 hours and 30 minutes before 20:00 EST during daylight savings time.

at 20:00 EST is able to issue the instruction. This early instruction would be necessary to ensure the *generation facility* reaches its *minimum loading point* at the required time for the next *dispatch day*.

In these circumstances, the *IESO* will issue *reliability* commitments ahead of the 20:00 EST pre-dispatch calculation engine run. Upon issuing such a *reliability* commitment, a system advisory notice will be *published* on the *IESO* website to notify the market.

#### 3.6.2.2 Determination of NQS Generation Facility Schedules and Commitments

To determine schedules and commitments for dispatchable non-quick start (NQS) *generation facilities*, the future pre-dispatch calculation engine will use the same set of hourly and daily *dispatch data* parameters as the DAM calculation engine used.

Specifically, the following *dispatch data* parameters will be included as new inputs into the pre-dispatch calculation engine:

- Start-up offer;
- Speed no-load offer;
- *Minimum loading point* (MLP);
- *Minimum generation block run-time* (MGBRT);
- *Minimum generation block down time* (MGBDT);
- *Maximum number of starts per day;*
- Single cycle mode;
- Lead time (LT); and
- Ramp up *energy* to MLP.

These *dispatch data* parameters are further described in the Offers, Bids and Data Inputs detailed design document.

NQS *generation facilities* which are also combined cycle *generation facilities* may elect to use *pseudo-unit* (PSU) models. The PD calculation engine will be capable of determining schedules and commitments for PSU's if a *registered market participant* elects to submit *dispatch data* using *pseudo-units.* The pre-dispatch calculation engine shall produce advisory schedules, advisory prices and binding commitments for both the PSU and its associated physical units. This capability will be facilitated through a *generation facility* specific PSU model.

**Pre-Dispatch Binding Start-Up Instruction for NQS Generation Facilities**

The *pre-dispatch scheduling* process will use the lead time *dispatch data* parameter to issue a binding start-up instruction to the NQS *generation facility*. The binding start-up instruction will be issued by the last pre-dispatch run that respects the lead time *dispatch data* parameter of the resource, while ensuring that it will achieve its MLP for the first hour of its operational commitment.

The *IESO* shall send a binding start-up instruction no later than 30-minutes past the hour of the PD calculation engine run that issues the commitment. The PD calculation engine will also use the ramp up *energy* to MLP *dispatch data* parameter submitted by the NQS *generation facility* to schedule in the hour(s) prior to its first hour of commitment.

Upon receipt of a binding start-up instruction and no later than 45-minutes past the hour of the PD calculation engine run that issues the commitment, the *registered market participant* for the *generation facility* will:

- acknowledge receipt of the start-up instruction;
- identify its expected synchronization time; and
- confirm the time it expects to reach MLP.

These communication requirements are similar to existing communication requirements for *market participants* when invoking participation in the current real-time generation cost guarantee program.

Figure 3-22 is an example that shows the link between a *generation facility's* lead time, and the last possible PD calculation engine run that can issue that *generation facility* a binding start-up instruction.

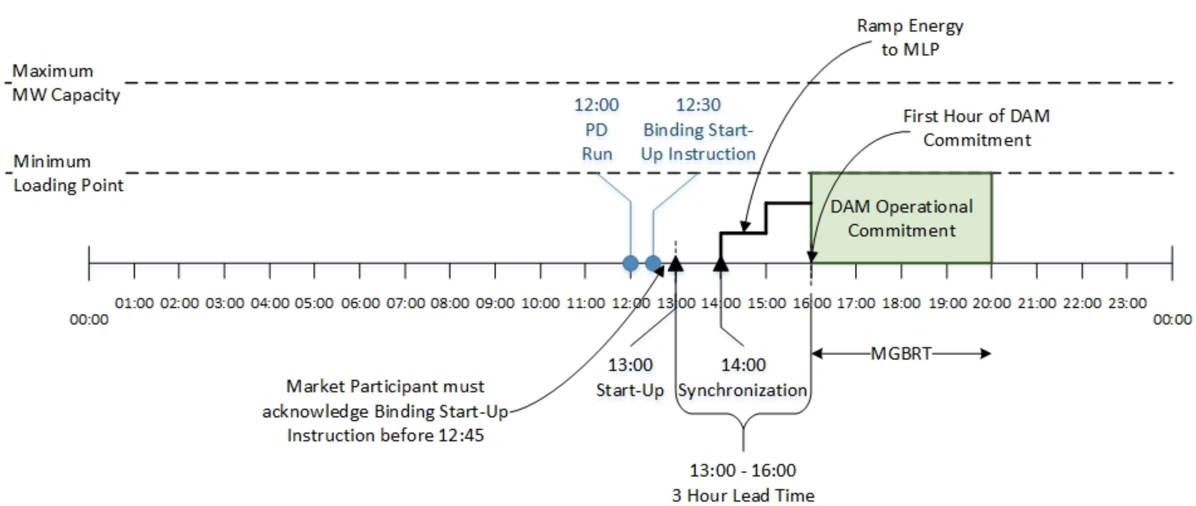


**Figure 3-22: Binding Start-Up Instruction (all times in EST)**

Figure 3-22 shows an example where the resource has a 3-hour lead time and the first hour of the DAM commitment is 16:00 EST;

- in order for the resource to reach MLP by 16:00 EST, it must start up at 13:00 EST to satisfy its 3-hour lead time;

- the 12:00 EST PD calculation engine run is the last possible PD run that can issue a binding start-up instruction, which will be sent no later than 12:30 EST. Earlier runs of the PD calculation engine will not issue a binding start-up instruction;
- prior to 12:45 EST, the *registered market participant* for the resource must acknowledge receipt of the start-up instruction; identify its expected synchronization time (14:00 EST); and confirm the expected time to reach MLP (16:00); and
- the *generation unit* submitted ramp up *energy* to MLP *dispatch data* parameter will be used to schedule the *generation unit* in the hour(s) prior its first hour of commitment.

**Types of Pre-Dispatch Commitments for NQS Generation Facilities**

The future *pre-dispatch scheduling* process will have the ability to schedule NQS *generation facilities* based on submitted hourly *dispatch data*, and may issue three different types of operational commitments. These will be:

- Pre-dispatch advancement of a DAM operational commitment;
- Stand-alone pre-dispatch operational commitment; and
- Pre-dispatch extension to existing operational commitment.

In all cases:

- The *IESO* will send a notification no later than 30-minutes past the hour of the PD run that issues the commitment; and
- the binding start-up instructions issued will respect a *generation unit's* submitted lead time.

All operational commitments issued by the PD calculation engine will be respected by the *real-time dispatch process* as minimum constraints at the CT and n-on-1 ST MLP. These operational commitments are described below.

*Pre-Dispatch Advancement of a DAM Operational Commitment*

Operational commitments produced by the DAM calculation engine for NQS *generation facilities* will be passed to the PD calculation engine through minimum constraints for the *facility*'s MLP.

The *pre-dispatch scheduling* process will not change the commitment status of the hours in which the DAM has operationally committed the *generation facility*. However, if economic, the PD calculation engine may consider advancing the DAM commitment by operationally committing the *generation facility* in hours prior to the start of its DAM commitment. The first PD run that will consider advancement of a DAM commitment is the first PD run that evaluates hours in the *dispatch day* at 20:00 EST PD run on the *pre-dispatch day*.

Figure 3-23 shows a DAM commitment and the earlier hours in which *pre-dispatch scheduling* will consider advancing that commitment.

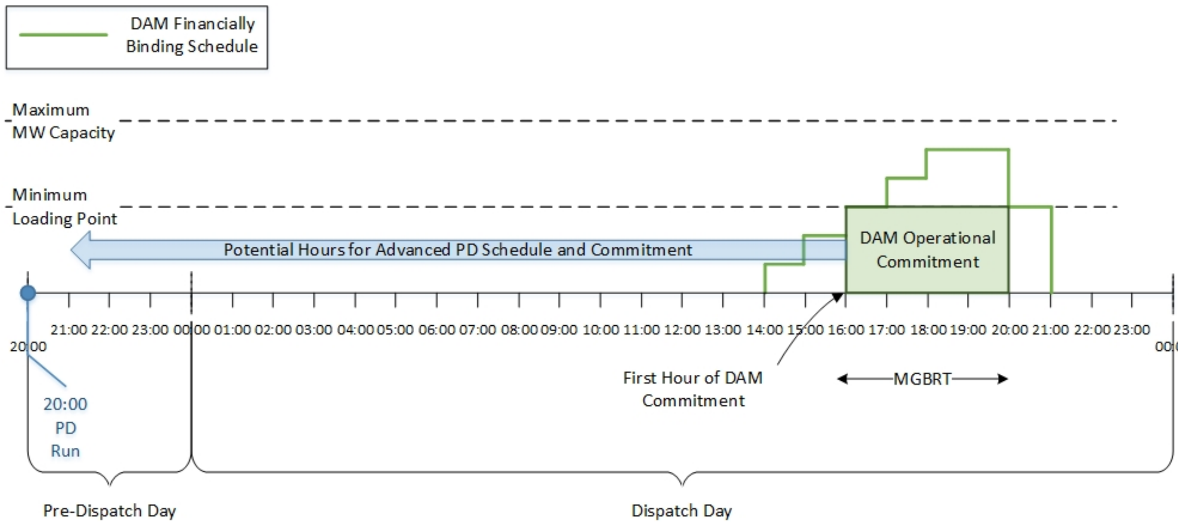


**Figure 3-23: DAM Commitment and Potential Hours for PD Advancement**

When the PD engine determines to advance a DAM commitment, a PD commitment will be issued starting with the first hour of the advanced PD advisory schedule. The PD commitment associated with a PD advancement can be for as little as one hour as illustrated in Figure 3-24 below, where the DAM commitment is advanced by only one hour.

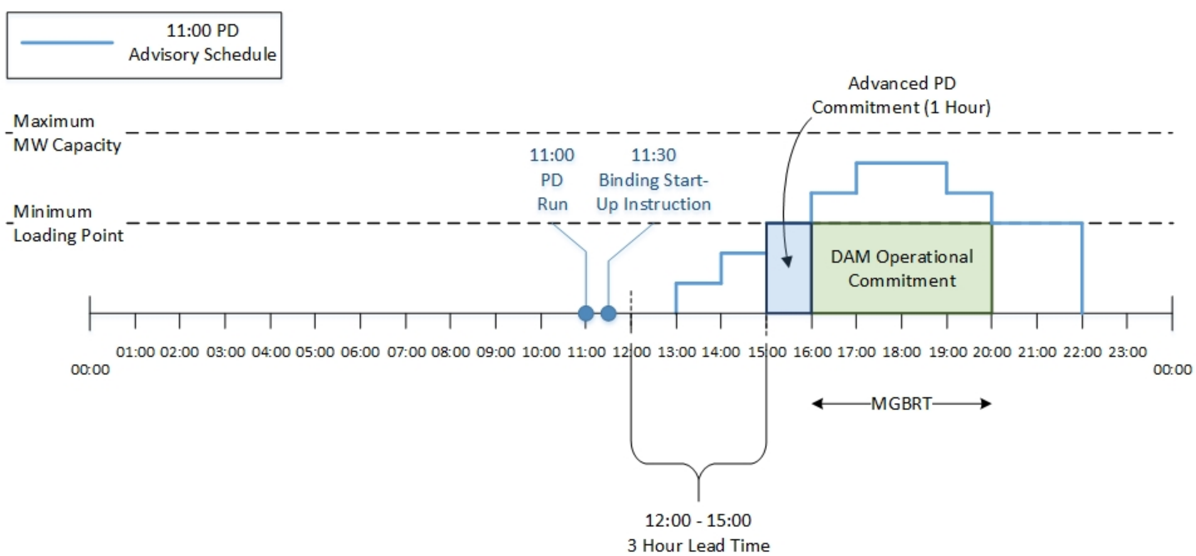


**Figure 3-24: Advanced PD Commitment (1 Hour)**

It is also possible for an advanced PD commitment to be issued many hours in advance of the original DAM commitment however, only the MGBRT hours will be committed by the PD calculation engine. A PD commitment is considered an advancement to a DAM commitment if the PD advisory schedule remains at or above MLP contiguously until the start of the DAM commitment.

Figure 3-25 shows an example of the PD calculation engine advancing a DAM commitment by a number of hours greater than the *generation unit's* MGBRT. Note that only the MGBRT hours are given the advanced PD commitment.

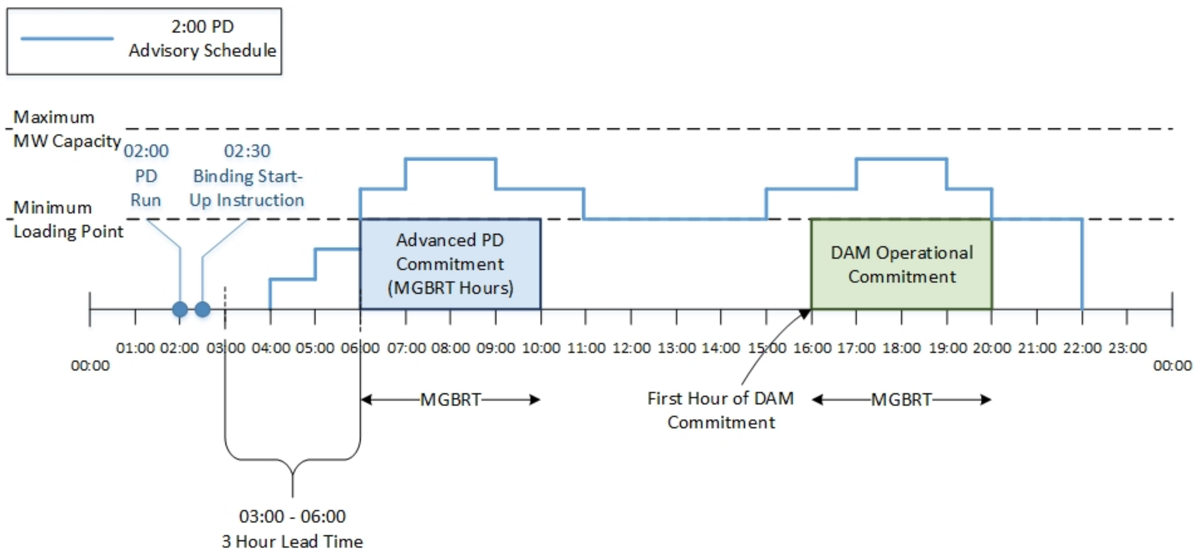


**Figure 3-25: Advanced PD Commitment (MGBRT Hours)**

If PD issues an advanced commitment, the advanced hours will be *settled* as part of a separate real-time generator *offer* guarantee (GOG) calculation. For more information on the real-time GOG associated with an advanced PD commitment, see the Market Settlement detailed design document.

### *Stand-Alone Pre-Dispatch Operational Commitment*

The future *pre-dispatch scheduling* process will be able to issue stand-alone operational commitments for a *generation unit's* MLP and MGBRT, starting with the first hour that the PD calculation engine has scheduled the *generation unit* at or above its MLP. This PD commitment is considered stand-alone if the PD schedule that initiated it, is not associated with a PD advancement or extension of a DAM commitment. Figure 3-26 provides an example of a stand-alone PD commitment for an NQS *generation facility* that did not receive a DAM commitment.

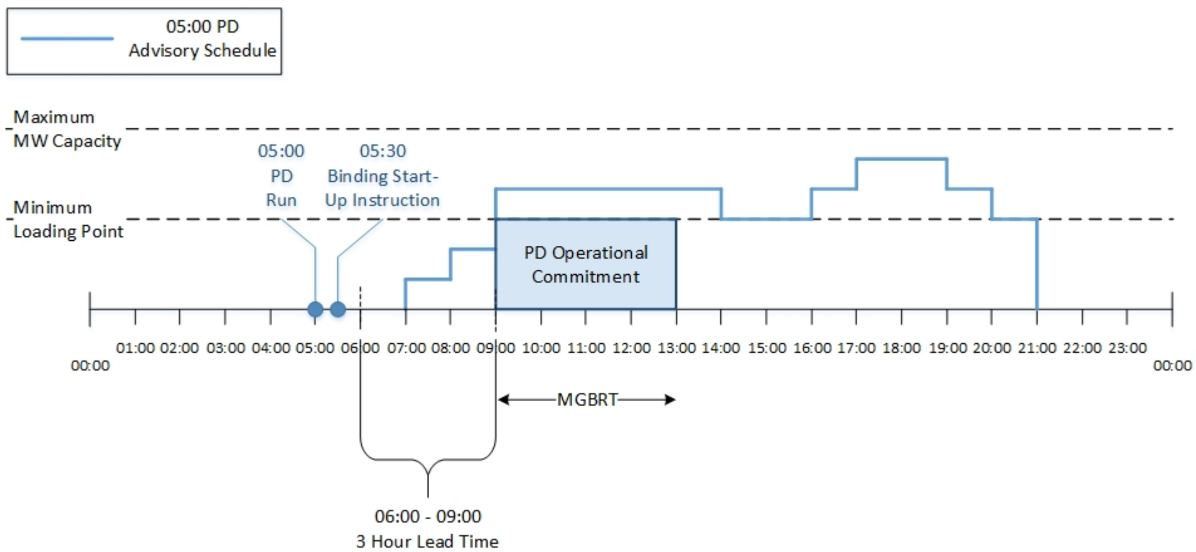


**Figure 3-26: Stand-Alone PD Commitment (No DAM Commitment)**

Figure 3-27 is an example of a stand-alone PD operational commitment for an NQS *generation facility* that also has a DAM commitment. This is not considered a PD advancement of a DAM commitment because the PD advisory schedule has the *generation unit* shutting down at 10:00 EST, and restarting later in the day to meet its separate DAM commitment at 16:00 EST. In this scenario, the binding start-up instruction is for the PD operational commitment starting at 06:00 EST. A start-up instruction for the DAM operational commitment at 16:00 EST is not required until later in the day.

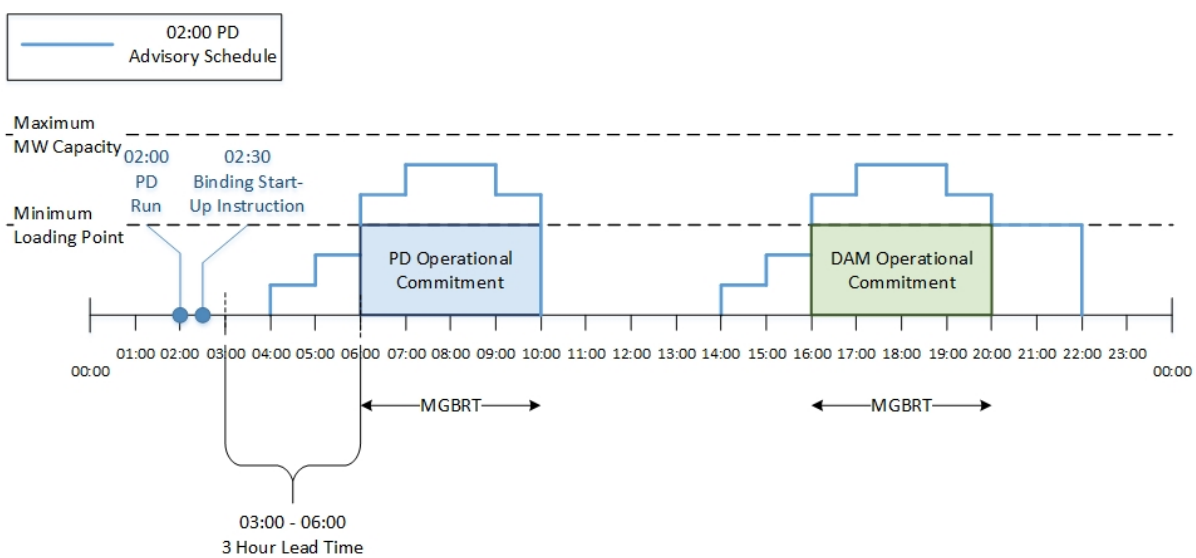


**Figure 3-27: Stand-Alone PD Commitment (with a separate DAM commitment)**

### *Pre-Dispatch Extension to Existing Operational Commitments*

The PD calculation engine will also be responsible for extending DAM or PD operational commitments for a *generation unit* beyond its MGBRT hours. These extensions will be issued on an hour-by-hour basis for the next *dispatch hour* of a given PD calculation engine run.

Figure 3-28 provides an example of an extension in which the initial PD operational commitment for MGBRT hours ends at 10:00 EST. The PD run at 09:00 EST evaluates whether to issue a one-hour extension to the operational commitment for 10:00 EST to 11:00 EST, based on the *generation facility's* advisory schedule. In this case, the 09:00 EST advisory schedule shows the resource *is* scheduled above its MLP for the next two hours until 12:00 EST. As a result, the 09:00 EST PD calculation engine run issues the one-hour extension.

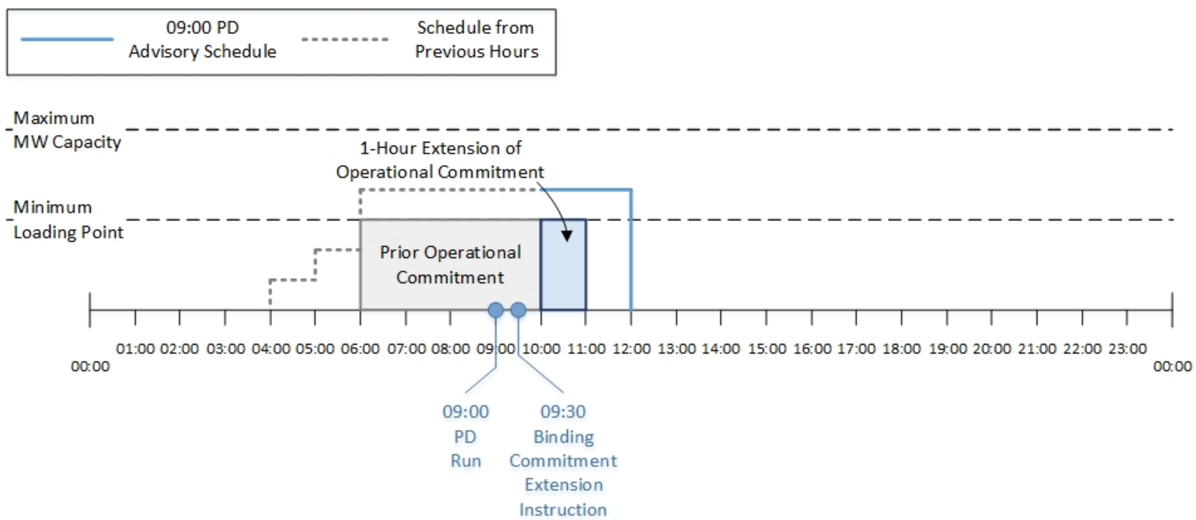


**Figure 3-28: PD Extension of an Operational Commitment Example 1**

Figure 3-29 is a continuation of the previous example shown in Figure 3-28 and shows the following hour's PD calculation engine run at 10:00 EST. This PD calculation engine run will evaluate whether to issue a one-hour extension for the next *dispatch hour* from 11:00 to 12:00 EST. Again, the *generation facility's* 10:00 EST PD advisory schedule shows the resource is scheduled above its MLP until 12:00, so another one-hour extension to the operational commitment is issued.

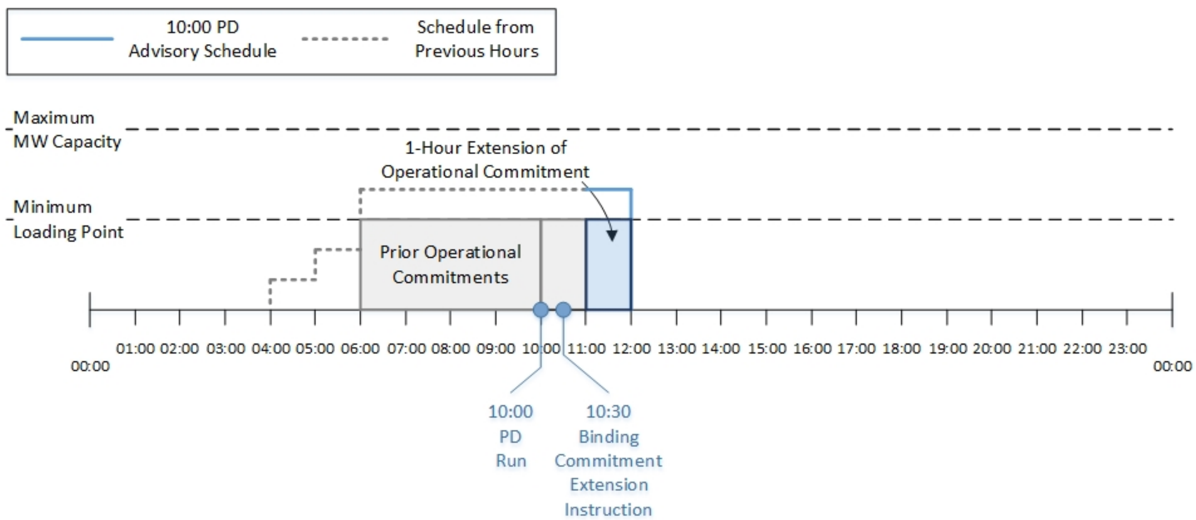


**Figure 3-29: PD Extension of an Operational Commitment Example 2**

### *Pre-Dispatch Not Issuing an Extension to an Existing NQS Operational Commitment*

The PD calculation engine will not issue an extension to an operational commitment if the resource is no longer economic. In this case, a PD de-commitment instruction will be issued no later than 30-minutes past the hour of the PD calculation engine run that makes this determination. The *registered market participant* for the *generation facility* will acknowledge receipt of the PD de-commitment instruction no later than 45-minutes past the hour of the PD calculation engine run that makes this determination.

When the PD calculation engine run does not extend an operational commitment, the *real-time dispatch process* may continue to *dispatch* the *generation unit* above its *minimum loading point* or shut it down. This process is further described in Section 3.7.2.2.

Figure 3-30 shows an example of the 11:00 EST PD calculation engine run that does not issue an extension to the operational commitment. A PD de-commitment instruction will be issued no later than 11:30 EST, and the *registered market participant* must acknowledge receipt of this instruction no later than 11:45 EST.

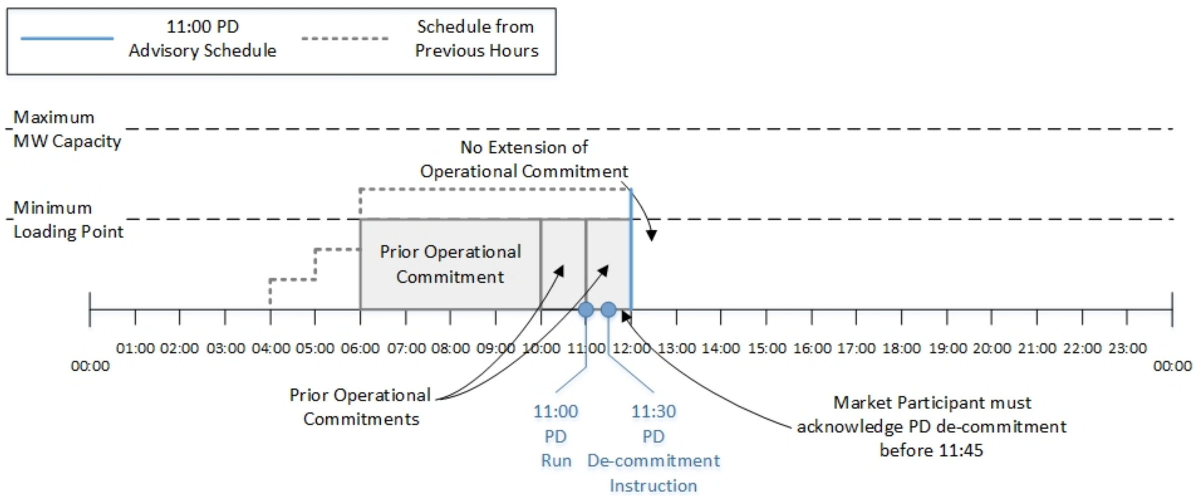


**Figure 3-30: No PD Extension of Operational Commitment**

### Interactions Between DAM and PD NQS Operational Commitments

The previous sections describe the ability of the PD calculation engine to issue advancements to DAM commitments, issue stand-alone commitments, and to extend or not extend existing commitments beyond MGBRT hours.

Based on the potential interaction of these actions there are two possible schedule outcomes:

- Pre-dispatch may initially issue a stand-alone PD commitment with a separate DAM operational commitment in a later hour (e.g. Figure 3-27**)**. This PD commitment could however, be extended by subsequent PD calculation engine runs such that the stand-alone PD commitment is bridged to the start of the DAM commitment.

  In this case the contiguous operational commitment for the *dispatch day* will be treated as a PD advancement of an existing DAM operational commitment (e.g. Figure 3-24) and will be *settled* accordingly; and

- Pre-dispatch may initially issue an advanced PD commitment to an existing DAM operational commitment in a later hour (e.g. Figure 3-24). This PD advancement may not be extended by subsequent PD runs and result in a shutdown of the *generation unit* prior to its return to meet its DAM commitment later in the *dispatch day*.

  In this case the *generation unit* would receive two starts for the *dispatch day*, one for the PD operational commitment and one for the original DAM commitment (e.g. Figure 3-26) and will be *settled* accordingly as two separate starts.

See Section 3.7.9 of the Market Settlements detailed design document for more information on the *settlement* considerations of these cases.

**Cancelling a DAM or Pre-Dispatch NQS Operational Commitment**

DAM or pre-dispatch operational commitments may be cancelled at any time by the *IESO* for *reliability*, *security* or *adequacy* reasons. If the *IESO* cancels an operational commitment, the *registered market participant* for the *generation facility* is eligible to receive certain *settlement* make-whole payments. See the Market Settlements detailed design document for more information.

### 3.6.2.3 Determination of Hydroelectric Generation Facility Schedules in Pre-Dispatch

In the future market, the PD calculation engine will be capable of evaluating the same set of *dispatch data* parameters as the DAM calculation engine which are:

- Minimum daily *energy* limit (Min DEL);
- Maximum daily *energy* limit (Max DEL)*;*
- *Forbidden regions*;
- Minimum hourly output;
- Hourly must run;
- *Maximum number of starts per day*; and
- Linked resources, time lag and MWh ratio.

Each hourly run of the PD calculation engine will determine advisory schedules for the remainder of the PD look-ahead period. The PD calculation engine will determine advisory schedules for hydroelectric resources while respecting all of the *dispatch data* parameters that a *registered market participant* is eligible to submit. As described in Section 3.5.4.2, the PD calculation engine will respect each of the parameters listed above in the same manner as the DAM calculation engine.

**Initialization of the Pre-Dispatch Run for Hydroelectric Generation Facility Schedules**

As it pertains to the scheduling of hydroelectric resources, each successive run of the PD calculation engine will start with a set of initial conditions upon which the determination of advisory schedules for the look-ahead period can be based. New methods for determining initial conditions are described below:

**Tracking Actual Energy Produced**

In the current market, the PD calculation engine tracks the hourly *energy* schedules for a hydroelectric resource by summing the *pre-dispatch schedules* from past hours. The tracked *energy* schedules are subtracted from the most recent value of Max DEL submitted by the *registered market participant* to determine how much remaining *energy* can be scheduled by the PD calculation engine for future hours.

In the future market, the PD calculation engine will track the actual *energy* produced by a hydroelectric resource instead of tracking past *pre-dispatch schedules*. Actual *energy* production gathered from operational telemetry will be recorded at the start of each *dispatch interval* in the real-time scheduling process and added to the running total of actual *energy* produced *for* the *dispatch day*. *Registered market participants* will have visibility of this running total through confidential reports.

Each run of the PD calculation engine will take the difference between the running total of actual *energy* production and the most recent Max DEL submitted by the *registered market participant* value to determine the amount of remaining *energy* available to be scheduled for a given hydroelectric resource for the remaining *dispatch hours* of the *dispatch day.*

Similarly, each run of the PD calculation engine run will take the difference between the running total of actual *energy* production and the most recent Min DEL submitted by the *registered market participant* to determine if the Min DEL has been satisfied for the *dispatch day*. If the Min DEL has not been satisfied, this calculation will determine how much remaining *energy* must be scheduled to satisfy the Min DEL for the remaining *dispatch hours* of the *dispatch day*.

For hydroelectric resources registered with a shared forebay and therefore a shared daily *energy* limit, the PD calculation engine will use the summed *energy* production from each resource to ensure that *pre-dispatch schedules* for these resources satisfy Min DEL and Max DEL. Refer to the PD Calculation Engine document, section 3.6.1.5 for details on *pre-dispatch scheduling* to respect shared daily *energy* limits.

### Tracking Actual Number of Starts

Currently the PD calculation engine does not track or limit the number of times a hydroelectric resource can be started during a *dispatch day.* In the future, the PD calculation engine will use the *maximum number of starts per day* value submitted by the *registered market participant* to limit the number of times a hydroelectric resource can be started during a *dispatch day.*

The same operational telemetry gathered and used at the start of each *dispatch interval* to track actual *energy* production against Max DEL and Min DEL will also be used to track the actual number of starts per day. Each time the output of a hydroelectric resource reaches a registered start indication value during a *dispatch day*, the running total for actual number of starts per day will be incremented.

Each run of the PD calculation engine will take the difference between the number of starts running total and the *maximum number of starts per day* value to determine the number of starts that a given hydroelectric resource has remaining for the *dispatch day.* The PD calculation engine will schedule the hydroelectric resource for the remaining hours of the *dispatch day* such that the most recent value for *maximum number of starts per day* submitted by the *registered market participant* is not exceeded. *Registered market* *participants* will have visibility of the tracked number of starts per day variable through confidential reports.

**Scheduling Linked Resources at the Boundaries of the PD Look-Ahead Period**

The PD calculation engine will use a similar approach to the DAM for managing linked resources from one pre-dispatch run to the next.

A key difference will be in the initial hours of the *pre-dispatch* look ahead period, where pre-dispatch will respect intertemporal cascade dependencies. The PD calculation engine will use the actual *energy* output of an upstream resource in prior *dispatch hours* to determine the schedule of a linked downstream resource in accordance with the submitted time lag and MWh ratio values. This will apply for the first *h*-1 hours of the *pre-dispatch* look-ahead period[12], where *h* is the value of the time lag parameter submitted.[13]

A linked upstream resource will be independently evaluated in the last *h* hours of the pre-dispatch look-ahead period*.* The number of *h* hours that linked resources will be independently evaluated at the end of the pre-dispatch look-ahead period will be determined by the time lag value submitted.

During real-time *dispatch*, *registered market participants* may submit an hourly must run quantity for the downstream resource to respect the MWh ratio if a must run condition has developed to pass the water received from the upstream resource that actually produced *energy* in prior *dispatch hours.* A minimum hourly output value may be submitted for the downstream resource if it has the ability to spill the water but spill restrictions are expected to prevent it from being partially scheduled. An *outage* should be submitted for the downstream resource if it becomes unavailable or has limited availability, because either no water or a limited amount was used by the upstream resource in the previous hours.

Figure 3-31 below demonstrates the above using an example in which a downstream resource that is linked to an upstream resource has a time lag of 3 hours. The downstream resource schedule in the first two (*h-1)* hours of the *pre-dispatch* look-ahead period will be based on the actual output of the upstream resource in prior *dispatch hours*. The PD calculation engine will schedule the downstream resource in the first two hours of the look-ahead period to align with the water received from the upstream resource that actually produced *energy* in the two hours prior to the pre-dispatch run.

[12] This differs from the DAM calculation engine where the first *h* hours of the DAM forecast period will evaluate downstream resources independent of the time lag and MWh ratio.

[13] For additional information on the pre-dispatch scheduling of resources that have submitted linked resource, time lag and MWh ratio parameters, see section 3.4.1.6 of the Pre-Dispatch Calculation Engine detailed design document.

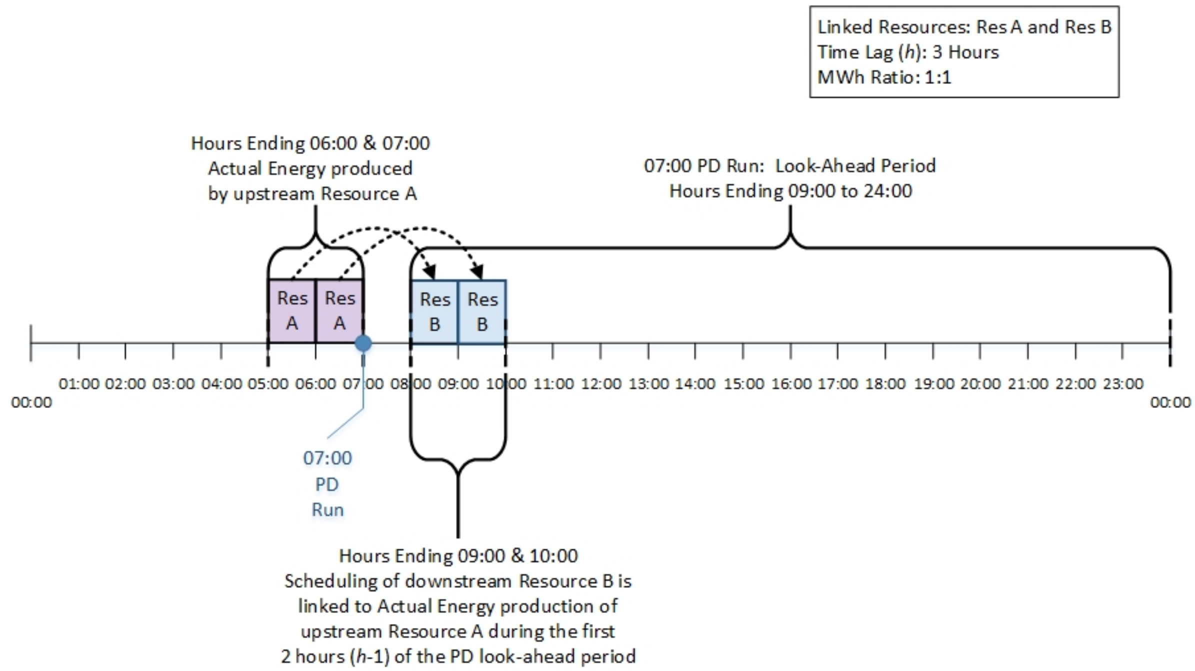


**Figure 3-31: Linked Resources for the Start of the PD Look-Ahead Period**

Consistent with the DAM, the following logic will be used when scheduling upstream resources in the last hours of the *dispatch day*:

- An upstream resource that is linked to a downstream resource with a time lag of *h* hours will be independently evaluated in the last *h* hours of the *dispatch day*. This allows the PD calculation engine to evaluate any available *energy* on the upstream resource. Schedules produced during these hours can inform the *registered market participant* whether they will have intertemporal dependencies to carry over into the next *dispatch day.*

### 3.6.2.4 Determination of PD Intertie Schedules

In the current market, all *intertie* transaction *bids* and *offers* are evaluated in all runs of the PD calculation engine.

In the future *pre-dispatch scheduling* process, each run will economically schedule both DAM-scheduled and non-DAM scheduled *intertie* transaction *offers* and *bids* for the first two forecast hours of the given PD calculation engine run. This timeframe is illustrated in Figure 3-32 as “Forecast Hours T+1 and T+2” for the pre-dispatch run that initializes at 05:00 EST.

For forecast hours beyond the first two, only the *offers* and *bids* associated with DAM-scheduled *intertie* transactions will be re-evaluated and economically scheduled by PD. As a result, changes to *bid/offer* prices or changes to market conditions may result in a schedule that deviates from the DAM MW schedule. This is illustrated in Figure 3-32 as “Forecast Hours beyond T+2”. In these forecast hours, the pre-dispatch calculation engine will evaluate import and export *offers* and *bids* up to their DAM-scheduled MW quantity.

This applies to all import and export *energy offers* and *bids*, as well as all import *offers* for *operating reserve*.

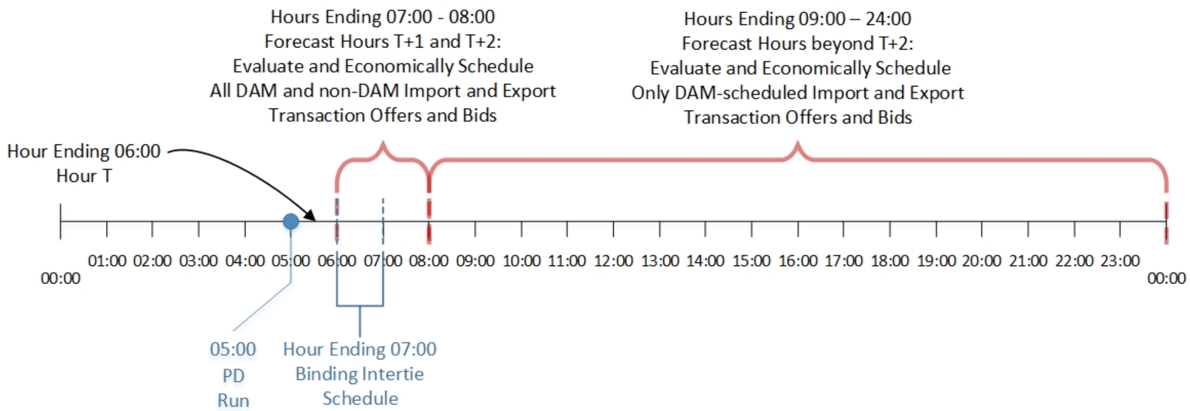


**Figure 3-32: Imports and Exports Evaluated for the 05:00 EST PD Calculation Engine Run**

### Intertie Scheduling Treatment Under Unique Conditions

In the future market, the PD calculation engine will apply specific treatment for certain *intertie* transaction types to determine schedules. Specifically, these are:

- Scheduling of capacity backed exports not scheduled in DAM;
- Scheduling of *energy* for IESO/Hydro-Quebec: Capacity Sharing Agreement;
- Scheduling of *intertie* transactions not scheduled in DAM during system *adequacy* events; and
- Scheduling of an *intertie* unavailable for commercial scheduling.

#### *Scheduling of Capacity Backed Exports Not Scheduled in DAM*

The *IESO* has obligations under *capacity export agreements* to deliver scheduled export *bids* associated with a *called capacity export*, above and beyond those of a typical export *bid*. In order to fulfill these obligations, the *IESO* must be able to identify exports *bids* for *called capacity exports* to ensure that they are scheduled as required.

The *IESO* will no longer require export *bids* for a *called capacity export* to be submitted with "ICAP" in the e-Tag ID. Export *bids* for a *called capacity export* will instead need to submit a capacity transaction hourly *dispatch data* parameter for each *dispatch hour* in which the *bid* is submitted. The capacity transaction *dispatch data* parameter is further described in the Offers, Bids and Data Inputs detailed design document.

The *IESO* will continue to require the external *control area* requesting Ontario-backed capacity to notify the *IESO* of its need for a *called capacity export* as per its *capacity export agreement*. This notification will continue to include the amount of capacity that will be called upon and the *dispatch hours* of the *dispatch day* in which it will be required.

The *IESO* will enable the evaluation of *called capacity exports* in the PD calculation engine by ensuring all validated export *bids* submitted with the capacity transaction *dispatch data* parameter to be accepted. This will apply in all *dispatch hours* of the *dispatch day* that were provided in the notification submitted to the *IESO* by the external *control area*. *Called capacity exports* shall not be limited to their DAM scheduled MW quantity for forecast hours beyond T+2, unlike other export *bids*.

### *Scheduling of Energy for IESO/Hydro-Quebec: Capacity Sharing Agreement*

Today, the *IESO* and Hydro-Quebec have the ability to call upon each other's capacity through a capacity sharing agreement for the delivery of *energy*. Export *bids* representing a call for Ontario capacity by Quebec or import *offers* representing a call for Quebec capacity by Ontario are scheduled as per the existing capacity sharing agreement. A capacity call is initiated once a *reliability* declaration has been made by the *IESO* or Hydro-Quebec to indicate that either balancing authority is experiencing an *adequacy* shortfall. An advisory notice is *published* once the call has been initiated.

An export *bid* supporting a capacity call by Hydro-Quebec without a financially-binding DAM schedule will be evaluated economically without restriction for the entire PD look-ahead period when:

- Hydro-Quebec issues a *reliability* declaration[14] that indicates the *dispatch hours* in which capacity will be called upon, the Tie Line ID corresponding to the *tieline* over which *energy* will be delivered and the quantity of *energy* that is being called upon by Hydro-Quebec; and
- The export *bid* is submitted with the Capacity Transaction Flag hourly *dispatch data* parameter, for each *dispatch hour* as dictated by Hydro Quebec's *reliability* declaration; and
- The export *bid,* with the Capacity Transaction Flag is validated by *IESO control area operators* against the Tie Line ID and quantity of *energy* as dictated by *Hydro-Quebec*'s *reliability* declaration.

An import *offer* supporting a capacity call by the *IESO* without a financially-binding DAM schedule will be economically evaluated without restriction for the entire PD look-ahead period when:

- The *IESO* issues a *reliability* declaration[15], that indicates the *dispatch hours* in which capacity will be called upon, the Tie Line ID corresponding to the *tieline* over which

[14] In accordance with Market Manual 7.1: IESO-Controlled Grid Operating Procedures, Appendix B.1 Actions in Advance of and During the IESO Controlled Grid Emergency Operating State.

[15] In accordance with Market Manual 7.1: IESO-Controlled Grid Operating Procedures, Appendix B.1 Actions in Advance of and During the IESO Controlled Grid Emergency Operating State.

*energy* will be delivered and the quantity of *energy* that is being called upon by the *IESO*; and

- The import *offer* is submitted with the Capacity Transaction Flag hourly *dispatch data* parameter, for each *dispatch hour* as dictated by the *IESO*'s *reliability* declaration; and
- The import *offer* with the Capacity Transaction Flag is validated by *IESO control area operators* against the Tie Line ID and quantity of *energy* as dictated by the *IESO reliability* declaration.

### *Scheduling of Intertie Transactions Not Scheduled in DAM During System Adequacy Events*

The PD calculation engine will be able to forecast *reliability* events that can lead to an *emergency operating state* in all hours of the *dispatch day* up to the *dispatch hour*. In order to address system *adequacy* shortfalls, the *IESO* will be able to implement a new control action that will allow import *offers* without DAM financially-binding schedules to be evaluated in all hours of the PD look-ahead period.

This control action will be implemented as early as reasonably possible once the *IESO* is unable to commit or constrain on additional dispatchable non-quick start *generation facilities* to address the *adequacy* shortfall.

The *IESO* will enact the control action by issuing an advisory notice that indicates the start and end time of the *reliability* event. The advisory notice will also indicate the *dispatch hours* of the *dispatch day* in which import *offers* without a previous financially-binding DAM schedule will be evaluated. Such import *offers* will be evaluated by the PD calculation engine.

The *IESO* will issue additional advisory notices to reflect new *dispatch hours* in which import *offers* without a financially-binding DAM will be evaluated by the PD calculation engine if the *adequacy* shortfall persists.

### *Scheduling of an Intertie Unavailable for Commercial Scheduling*

The current DA and *pre-dispatch scheduling* process includes provisions for scheduling transactions on an *intertie* when that *intertie* has been declared unavailable for commercial activity by a neighbouring jurisdiction. The process involves curtailing any unauthorized *import* or *export* schedules on the *intertie* with an appropriate *settlement* code. This process will not change in the future market.

In the current market, an *intertie's* congestion component as determined in the *pre-dispatch scheduling* process is set to zero when the *intertie* is on *outage* and the transmission transfer capability is zero for a given *dispatch hour*. This is to reflect that there is no congestion present on the *intertie* when it is on *outage*. The *IESO* will continue to adjust the *intertie* congestion component to zero for unavailable *interties* in the future *pre-dispatch scheduling* process.

## 3.6.3. Post Pre-Dispatch Calculation Engine Run Processes

To align the PD *intertie* schedule results with *intertie* schedules and restrictions from neighbouring jurisdictions, the following processes will occur after each hourly run of the PD calculation engine:

- Checkout of Intertie Schedules with Neighbouring Jurisdictions;
- Pre-Emptive Curtailment of Intertie Schedules; and
- Settlement Code Application for Intertie Schedule Adjustments and Curtailments.

Each of these processes is discussed below.

### 3.6.3.1 Checkout of Intertie Schedules with Neighbouring Jurisdictions

The *IESO* has established checkout processes during the *pre-dispatch day* to confirm that *intertie* transactions scheduled in the *real-time market* have corresponding schedules in neighbouring jurisdictions. Checkout occurs every hour and is for *intertie* transactions scheduled by the PD calculation engine for the next *dispatch hour*. The PD checkout process will not change in the future market.

### 3.6.3.2 Pre-Emptive Curtailment of Intertie Schedules

The current *pre-dispatch scheduling* process includes procedures for the curtailment of *intertie* schedules when restrictions on *intertie* schedules are not recognized by the *IESO* market tools. Transactions scheduled without recognizing the restrictions will need to be curtailed before the *dispatch hour*.

When *intertie* transactions that will need to be curtailed before the *dispatch hour* are scheduled in subsequent hours, curtailments are required to be made pre-emptively before the final PD calculation engine run (T+1) issues binding schedules for the next *dispatch hour*. These curtailments are made to ensure that the PD calculation engine produces viable *intertie* schedules and commitments for future hours.

The practice of pre-emptive curtailment will not change in the future market.

### 3.6.3.3 Settlement Code Application for Intertie Schedule Adjustments and Curtailments

*Intertie* transactions will continue to be scheduled by the last PD calculation engine run before the *dispatch hour*. They are then fixed for the *dispatch hour* at the quantity determined one hour ahead.

In the current PD and RT scheduling processes, there are many situations that can arise that result in the *IESO* having to curtail *intertie* transaction schedules after the last pre-dispatch calculation engine run to a value below what was scheduled. When this occurs, the *IESO* assigns curtailed *intertie* schedules a specific *settlement* code to reflect the appropriate *settlement* treatment of the schedule based on the nature of the misalignment. A number of curtailment *settlement* codes currently exist that are meant to address situations where the curtailed portion of the schedule attracts CMSC payment, failure charges and guarantees.

In the future market, CMSC payments will no longer be generated. However, when a fixed *intertie* schedule is curtailed, *settlement* codes remain necessary to identify make whole payment eligibility and failure charge application or exemption.

*Settlement* codes will also include an identifier which will specify how the curtailment affected the *intertie* transaction schedule. This additional identifier will differentiate make-whole eligibility between scenarios where the *IESO* reduced, fixed or increased the *intertie* transaction schedule. The adjustment types MAX, FIX, and MIN, to represent whether the transaction is reduced, fixed, or increased, respectively, are appended to the existing curtailment *settlement* codes to differentiate make-whole eligibility under different scenarios.

More specifically:

- A transaction that was reduced (adjustment type of MAX) by the *IESO* may be eligible for compensation relative to balancing charge due to a reduction, but would not be eligible for compensation applicable to transactions which were increased out-of-merit. These transactions will be exempt from RT *intertie* failure charges;
- A transaction that was fixed (adjustment type of FIX) by the *IESO* pre-emptively for one or more hours may be eligible for compensation relative to balancing charges due to a reduction, and may be eligible for compensation applicable to transactions which were increased out-of-merit. Exports with a fixed adjustment type that are compensated for being increased out-of-merit, due to a redundancy in compensation will not be eligible for compensation due to PD pricing discrepancies. These fixed transactions will be exempt from RT *intertie* failure charges; and
- A transaction that was increased (adjustment type of MIN) by the *IESO* would not be eligible for compensation relative to day-ahead buy back cost, but may be eligible for compensation applicable to transactions which were increased out-of-merit. These transactions will be exempt from RT *intertie* failure charges.

Table 3-1 describes the make whole payment eligibility and failure charge for each combination of the *settlement* code and adjustment type.

**Table 3-1: Make Whole Payment Eligibility and Failure Charges**

| Scheduling Scenario | New Settlement Code | RT Intertie Failure Charge Exempt | Day-Ahead Market Balancing Credit | RT Export Make-Whole for PD Pricing[16] Discrepancy | RT Export Make-Whole for Manual Dispatch Out-of-Merit |
|---|---|---|---|---|---|
| **Economic Schedule** | AUTO | N/A | No | Yes | No |
| **Reduced** | NY90 - MAX | N/A | No | Yes | No |
| | MrNh - MAX | Yes | No | Yes | No |
| | OTH - MAX | No | No | Yes | No |
| | TLRe - MAX | Yes | No | Yes | No |
| | TLRi - MAX | Yes | Yes[17] | Yes | No |
| | ADQh - MAX | Yes | Yes[17] | Yes | No |
| **Increased** | ADQh - MIN | Yes | No | Yes | Yes[17] |
| | ORA - MIN | Yes | No | Yes | Yes[17] |
| | TLRi - MIN | Yes | No | Yes | Yes[17] |
| **Fixed** | ADQh/TLRi FIX | Yes | Yes | No | Yes |

Note:

- Curtailments induced by the *market participant* are not exempt from the real-time *intertie* failure charge, and curtailments initiated by the *IESO* are eligible for a make whole payment.
- All import *energy* transactions that are scheduled above zero megawatts in real-time are eligible to receive the RT Intertie Offer Guarantee.
- Similarly, all import *operating reserve* transactions that are scheduled above zero megawatts in real-time are eligible to receive RT Import Make Whole Payment for Operating Reserve.

[16] The make whole payment only applies when an export was scheduled without the influence of any operator adjustments that served to fix or increase the export schedule.

[17] Eligibility is subject to a verification step that confirms that the transaction was scheduled for an amount equal to the *IESO* adjustment.

Linked wheel transactions are currently subject to specific *intertie* curtailment principles, such as during surplus baseload generation events. Linked wheels are also assigned specific curtailment *settlement* codes as they are not eligible for make whole payments.

### 3.6.4. Pre-Dispatch Reports

Refer to the Publishing and Reporting Market Information detailed design document for more information on the content and timing of PD related reports to support the Grid & Market Operation Integration detailed design.

## 3.7. Real-Time Scheduling and Dispatch

The real-time (RT) calculation engine runs every 5-minutes to produce *dispatch instructions* for the next 5-minute *dispatch interval* and *dispatch* advisories for future *dispatch intervals*. The RT calculation engine will use many of the same *market participant* and *IESO* inputs as the DAM and PD calculation engines.

While the DAM and PD calculation engines produce a single hourly schedule for each dispatchable *facility,* the RT calculation engine needs flexibility to *dispatch* with additional granularity*.* Flexibility is required to account for *demand* and *variable generation* trends throughout the *dispatch hour*, to ramp interchange over a 10-minute period and to respond to changing system conditions in real-time. Please refer to the RT Calculation Engine detailed design document for additional details on how data inputs will be used to determine and optimize schedules and *dispatch* for the *dispatch hour*.

While the future process for *real-time scheduling* and *dispatch* will remain very similar to the current process, some enhancements will be made to enable:

- incorporation of new *dispatch data* parameters for hydroelectric *generation facilities*;
- *pseudo-unit* scheduling and *dispatch*; and
- coordinated de-commitment of NQS *generation facilities.*

This section describes *real-time scheduling* and *dispatch* and is organized in the following subsections:

- Timing of the Real-Time Scheduling Process;
- Integration between PD and RT Scheduling Processes;
- Determination of NQS Facility Real-Time Dispatch;
- Determination of Hydroelectric Generation Facility Real-Time Dispatch Instructions;
- Variations to NQS Generation Facility Real-Time Dispatch for Pseudo-Units; and
- RT Reports.

### 3.7.1. Timing of Real-Time Scheduling Process

The real-time dispatch engine runs every five minutes and optimizes 5-minute *dispatch* of dispatchable generation and *load facilities* over the next eleven 5-minute intervals. These are rolling *dispatch intervals* and cross real-time *dispatch hours*.

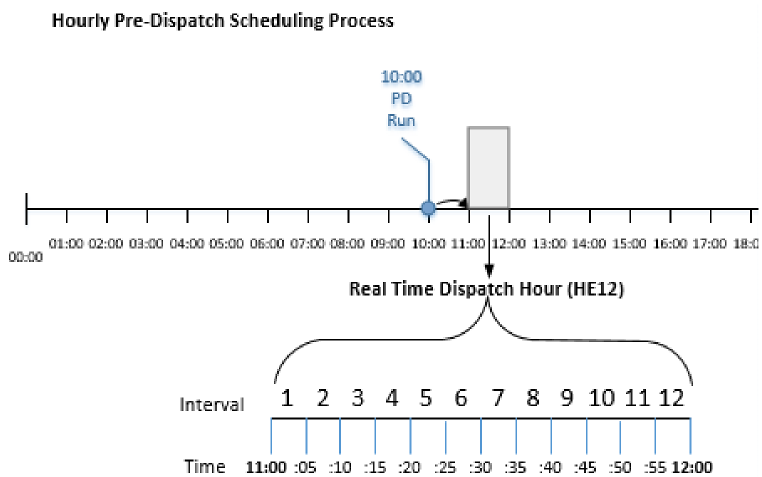


**Figure 3-33: RT Dispatch Hour Showing Integration with the PD Scheduling Process**

Figure 3-33 above shows that the pre-dispatch calculation engine run at 10:00 determines the final *pre-dispatch schedule* for the 11:00 to 12:00 *dispatch hour* (HE12). This pre-dispatch calculation engine run sets *interchange schedules* for the *dispatch hour* and makes final decisions to extend or de-commit NQS *generation units* for the *dispatch hour*. The *dispatch hour* is composed of twelve 5-minute *dispatch intervals*. The RT calculation engine determines *dispatch instructions* for each 5-minute interval.

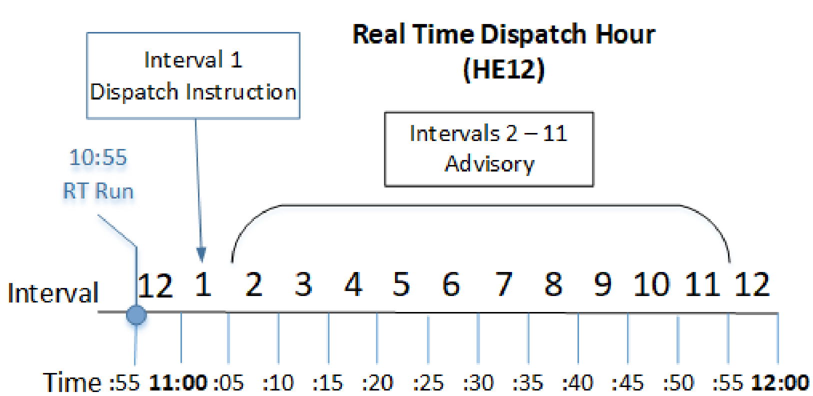


**Figure 3-34: RT Calculation Engine Process**

Figure 3-34 above illustrates the RT calculation engine process within the hour and the process timing to create a 5 minute *dispatch instruction*. Within the *dispatch hour*, the RT calculation engine runs every five minutes to produce *dispatch instructions* for the next 5-minute interval and *dispatch* advisories for the following eleven 5-minute intervals.

In this example, the RT calculation engine run at 10:55 produces *dispatch instructions* for interval 1 and *dispatch* advisories for intervals 2-12 of the 11:00 to 12:00 *dispatch hour*. Interval 1 schedules are *dispatch instructions* sent to *registered market participants*. Intervals 2-11 are optimized 5-minute schedules for the hour and provide advisories on how dispatchable *generation* and *load facilities* are expected to be *dispatched* through the hour.

### 3.7.2. Integration Between PD and RT Scheduling Processes

In the future market, the RT calculation engine will continue to respect DAM and PD commitments for NQS *generation facilities*, *intertie* transaction schedules for *boundary entity* resources and activated *hourly demand response* (HDR) resources.

DAM and PD operational commitments for NQS *generation facilities* will be respected by the RT calculation engine in the form of minimum scheduling constraints as it does today. The RT calculation engine will not *dispatch* a NQS *generation unit* below this minimum scheduling constraint for *dispatch intervals* where the constraint is present.

The PD calculation engine will continue to determine *intertie* transaction schedules for the next *dispatch hour*. *IESO* validates these *intertie* transaction schedules with neighbouring jurisdictions to limit each transaction to the quantity scheduled in both markets. The RT calculation engine uses these cleared transactions as fixed *boundary entity* schedules for every interval of the next *dispatch hour*. In the future market, there is no change.

If economic, the *pre-dispatch scheduling* process will activate *hourly demand response* resources three hours before the *dispatch hour*. Activated *hourly demand response* resources are communicated to the RT calculation engine through a constraint on the resource for the *dispatch hour*. The RT calculation engine will schedule activated HDR resources within the *dispatch hour* to the quantity specified in the constraint. *Registered market participants* remove bids for HDR resources that have not been placed on standby, so these resources are not available for scheduling by the RT calculation engine. There is no change to the way *hourly demand response* (HDR) is scheduled by the RT calculation engine.

In the current market, all other dispatchable *generation facilities* and *load facilities* are available for 5-minute *dispatch* by the RT calculation engine without constraints imposed by the DAM or *pre-dispatch scheduling* processes. In the future market, additional integration will exist between PD and RT for the following:

- NQS de-commitment;
- Hydroelectric hourly must run;
- Hydroelectric minimum and maximum daily *energy* limit; and
- Tracking hydroelectric starts and *energy* usage.

These are described in more detailed within applicable sections below which describe how *generation facilities* are dispatched in real-time.

#### 3.7.2.1 Determination of NQS Facility Real-Time Dispatch Instructions

The future process for determining *dispatch instructions* for NQS *generation facilities* is expected to remain similar to the current process.

NQS *generation units* are dispatched like all other dispatchable *generation facilities* when they are scheduled above MLP. The RT calculation engine uses current output, *offered* ramp rates and *energy offer* price to determine *dispatch instructions* for the next interval.

NQS *generation units* have unique operating characteristics below MLP that require consideration by the RT calculation engine. Once synchronized, NQS *generation units* have specific ramp profiles they must follow to ensure equipment safety as they ramp up to MLP. Similarly, once a NQS *generation unit* has begun its shutdown procedures it must follow a specific ramp profile as it ramps down from MLP and desynchronizes.

The RT calculation engine therefore does not evaluate economics for NQS *generation units* as they are *dispatched* below MLP. Instead, the RT calculation engine will *dispatch* a NQS *generation unit* to MLP using submitted ramp rates as soon as the synchronization breaker closes. Likewise, once a NQS *generation unit* is de-committed and *dispatched* down below MLP, the RT calculation engine will continue to *dispatch* the unit down to 0 MW at the rate specified through ramp rates.

This process to determine real-time *dispatch instructions* for NQS *generation units* will not change in the future market, however additional *offer* submission rules, procedures and tools are required to facilitate:

- Ramp to Minimum Loading Point (MLP); and
- De-Commitment of NQS Generation Facilities.

**Ramp to Minimum Loading Point (MLP)**

In the future market, the RT calculation engine will continue to use *energy* ramp rates submitted as part of the hourly *offer* to *dispatch* NQS *generation units.* As soon as the synchronization breaker on an NQS *generation unit* has closed, the RT calculation engine will *dispatch* the NQS *generation unit* up to MLP at the rate specified in the *energy* ramp rates.

NQS *generation units* may have different ramp capabilities below MLP and above MLP. In the current market, *registered market participants* are able to update ramp rates outside of the mandatory window to reflect ramp capability during ramp hours.

In the future market, NQS *generation units* with a short lead time may be committed where ramp hours are within the mandatory window. It is therefore necessary to permit *registered* *market participants* to update *energy* ramp rates for ramp hours within the mandatory window so that their actual ramp capability is reflected for real-time *dispatch*.

### De-Commitment of NQS Generation Facilities

In the future market, NQS *generation units* will continue to be de-committed when both the PD and RT calculation engines determine that the *generation unit* is no longer economic. Once the MGBRT is satisfied, the PD calculation engine economically evaluates the NQS *generation unit* and may continue to schedule or de-commit the *generation unit*. The PD de-commitment decision is passed to the RT calculation engine to allow the NQS *generation unit* to be *dispatched* below MLP in real-time. The RT calculation engine will not *dispatch* an NQS *generation unit* below MLP until it is de-committed by the PD calculation engine.

The RT calculation engine then economically evaluates the NQS *generation unit* based on *energy* price. It will *dispatch* the NQS *generation unit* below MLP when it is no longer economic to keep in-service. This may occur in any 5-minute *dispatch interval* in either the same *dispatch hour* where the PD calculation engine decided to de-commit the *generation unit* or in a future *dispatch hour*. This interaction between the PD and RT calculation engines to de-commit NQS *generation units* will not change in the future market.

#### *De-Commitment when NQS Generation Facility has Two Commitments in a Dispatch Day*

In both the current and future market, the PD calculation engine does not factor in how the RT calculation engine has dispatched an NQS *generation unit* when it assigns schedules for future hours.

In the future market, the PD calculation engine will evaluate additional parameters to optimize commitment and de-commitment of NQS *generation units*. It may de-commit an NQS *generation unit,* respecting the MGBDT prior to a second commitment. The PD calculation engine will issue the binding start-up instruction for the second commitment assuming the NQS *generation unit* de-synchronized as per the PD de-commitment decision.

If after the first commitment the RT calculation engine determines that the NQS *generation unit* is economic to remain in-service in real-time, the RT calculation engine will continue to keep it online and not *dispatch* it below MLP. In this situation, the *market participant* will not be put in a position in which they are unable to respect both MGBDT and their future commitment.

If *dispatch* advisories indicate that the 5-minute *dispatches* will overlap with the MGBDT such that the *generation unit* will not be able to comply with a future commitment, the *IESO* will perform a *reliability* assessment.

If there is an immediate *reliability* need, the *IESO* will keep the *generation unit* in-service until the future commitment starts by applying a *reliability* constraint. Otherwise it will enforce the PD de-commitment decision and the RT calculation engine will ramp the *generation unit* down, allowing the NQS *generation unit* to respect both MGBDT and the future commitment.

When a *reliability* constraint is applied to bridge the commitments, it is considered a new *reliability* commitment. Refer to Market Settlements sections 3.7.5 and 3.7.9 and Market Power Mitigation section 3.8.3 for more details on the *settlement* of *reliability* commitments.

#### 3.7.2.2 Determination of Hydroelectric Generation Facility Real-Time Dispatch Instructions

In the current market, registered *forbidden regions* are the only physical operating constraint the RT calculation engine is capable of evaluating for hydroelectric resources*.* All other hydroelectric operating constraints are managed by the *registered market participant* in the *real-time market* by adjusting *offer* prices for *energy*, using compliance aggregation, or by submitting *outage* requests.

Where the *registered market participant* is unable to use these mechanisms to receive a feasible *dispatch instruction*, the *IESO* is able to apply manual constraints for the resources on behalf of the *registered market participant*.

In the future market, the DAM and PD calculation engines will use all of the new hydroelectric *dispatch data* parameters to produce hourly schedules that respect additional operating constraints. Respecting the new *dispatch data* parameters will produce hourly DAM and PD schedules that hydroelectric *generation facilities* would be feasibly able to respond to if those schedules were to materialize as *dispatch instructions* in the *real-time market*.

To manage changes in real-time conditions, the RT calculation engine will be permitted to *dispatch* hydroelectric resources for more or less *energy* than scheduled for that *dispatch hour* by the DAM and PD calculation engines. As *quick start facilities,* dispatchable hydroelectric *generation facilities* must be capable of responding to five-minute *dispatch instructions.*

For these *dispatch instructions* to remain feasible, new and existing mechanisms will be used to inform the RT calculation when the dispatchable range of a hydroelectric resource is no longer available. New mechanisms include the ability for *registered market participants* to reflect must run conditions in advance of the *dispatch hour.* Existing mechanisms include the ability for *registered market participants* to adjust *offer* prices for *energy*, use compliance aggregation, and submit *outages.* The *IESO* will also retain the ability to apply manual constraints for the resource on behalf of the *registered market participant*.

The following sections describe how each of the hydroelectric *dispatch data* parameters that are being evaluated by the DAM and PD calculation engines will be managed by the RT calculation engine.

### Forbidden Regions

In the future market, the RT calculation engine will continue to respect *forbidden regions* as it does today. *Registered market participants* will submit *forbidden regions* as *dispatch data* and no longer be required to align the *energy* quantities for their *energy offers* with *forbidden regions.*

Similar to the DAM and PD calculation engines, the RT calculation engine will only *dispatch* a hydroelectric resource outside of its *forbidden regions.*

### Maximum Daily Energy Limit (Max DEL)

As with the current *real-time market*, the future RT calculation engine may *dispatch* a hydroelectric *generation facility* for more *energy* than projected by the PD calculation engine for that hour such that the Max DEL is exceeded.

*Registered market participants* will continue to submit an *outage* for the RT calculation engine to *dispatch* a hydroelectric *generation unit* to 0 MW when they expect the Max DEL to be reached during the *dispatch hour*.

### Minimum Daily Energy Limit (Min DEL)

The PD calculation will inform the RT calculation when to *dispatch* a hydroelectric *generation facility* in the *real-time market* to respect the most recent Min DEL value submitted by the *registered market participant.*

The RT calculation engine will *dispatch* a *generation facility* to no less than its *pre-dispatch* schedule for the first *dispatch hour* of any *pre-dispatch* look-ahead period. This condition will apply when the sum of the *generation facility's* tracked actual *energy* production and the *facility's* remaining hourly *energy* schedules for any pre-*dispatch* look-ahead period is equal to the Min DEL*.*

The RT calculation engine will accept minimum constraints from the PD calculation engine to avoid situations where the resource may continue to be dispatched below its *pre-dispatch schedules*, forcing the resource to meet the entire Min DEL requirement at the end of the *dispatch day*.

Figure 3-35 illustrates an example how a resource may be forced to meet its entire Min DEL at the end of the *dispatch day* if a minimum generation constraint was not applied as input to the RT calculation engine*.* In this example the hydroelectric *generation unit* has a Min DEL of 200 MWh and the PD calculation engine is scheduling *generation unit* for 100 MW in HE18 and HE19 to respect the Min DEL constraint.

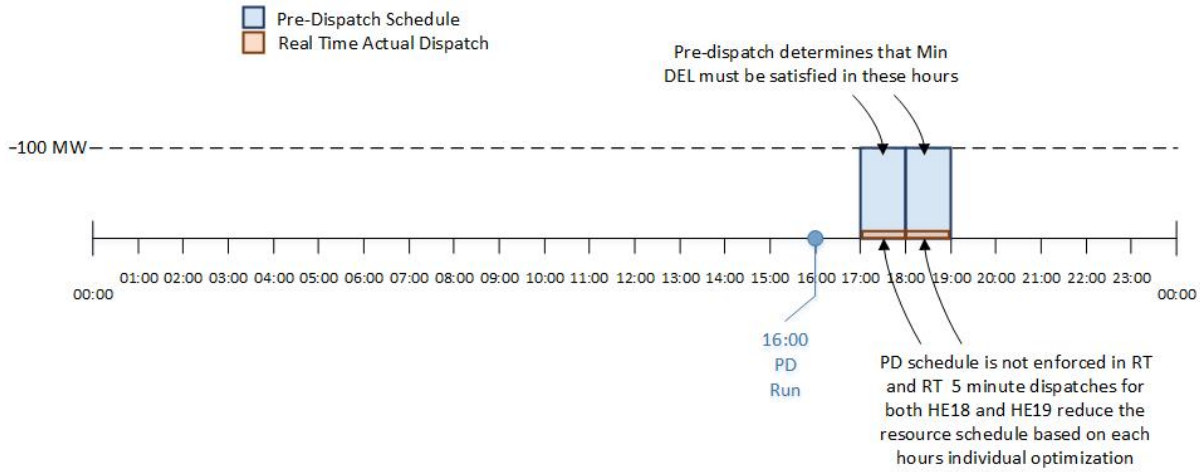


**Figure 3-35: PD Calculation Engine Respects Min DEL Constraint While RT Calculation Engine Does Not**

In the absence of a minimum generation constraint, the RT calculation engine dispatches the *generation unit* below the Min DEL scheduled by the PD calculation engine, and the Min DEL constraint is violated in RT. The next run of PD is then forced to schedule the *energy* to later hours of the day.

In the future, a minimum generation constraint will prevent the shifting of *energy* to the end of a *dispatch day* where it may exacerbate surplus conditions or violate Min DEL requirements of the hydroelectric resource. A constraint for HE18 after the 16:00 run of PD and a constraint for HE19 after the 17:00 run of PD would be implemented in RT respectively.

#### Hourly Must Run

The RT calculation engine will *dispatch* a hydroelectric *generation facility* to no less than the hourly must run value submitted for a particular *dispatch hour* for the duration of that *dispatch hour*. The *generation facility* can receive additional *dispatch instructions* above the hourly must run value submitted.

If must run conditions increase during the *dispatch hour,* the *IESO* will be able to manually apply a minimum generation constraint for the *generation facility* on behalf of the *registered market participant.* If must run conditions decrease during the *dispatch hour,* the *IESO* will manually override the hourly must run value submitted by the *registered market participant* with a lower minimum generation constraint.

#### Minimum Hourly Output

In the DAM and *pre-dispatch scheduling* timeframe, *registered market participants* should submit minimum hourly output quantities for *dispatch hours* in which spill conditions are expected to prevent the *generation unit* from responding to *dispatch instructions* between 0 MW and the minimum hourly output*.*

If spill restrictions are expected to persist into the actual *dispatch hour* and prevent the *generation unit* from following partial *dispatch instructions,* the *registered market participant* should in advance of the *dispatch hour*:

- Submit an hourly must run value for that *dispatch hour* if a must run condition is expected to develop; or
- Submit an *outage* for the duration of that *dispatch hour* if spill restrictions are expected to make the resource unavailable.

If spill restrictions develop during the actual *dispatch hour*, the *registered market participant* should:

- Request that the *IESO* apply a minimum generation constraint for the remainder of the *dispatch hour* if a must run condition has developed; or
- Submit an *outage* request to *dispatch* the resource to 0 MW for the remainder of the *dispatch hour* if the resource is unavailable.

#### Maximum Number of Starts Per Day

The RT calculation engine will continue to *dispatch* a hydroelectric resource to use more or less starts during a *dispatch hour* than projected for that *dispatch hour* by the most recent run of the PD calculation engine.

If the RT calculation engine exhausts the *maximum number of starts per day* for a resource during the *dispatch hour,* the *registered market participant* must submit a *forced outage* to inform the RT calculation engine that additional starts are unavailable.

#### Linked Resources, Time Lag and MWh Ratio

The RT calculation engine will *dispatch* hydroelectric resources independent of any linked resource, time lag and MWh ratio values submitted for DAM and *pre-dispatch scheduling*. Upstream and downstream resources can be dispatched for *energy* quantities that vary from their DAM and PD schedules. *Dispatch instructions* in the *real-time market* provide an opportunity for upstream and downstream resources to respond to intra-hour prices signals as long as those *dispatch instructions* fall within the dispatchable range of the *generation units*.

The extent to which cascade hydroelectric resources have flexibility to respond to *dispatch instructions* that vary from their DAM and *pre-dispatch schedules* can depend on the storage or spill capabilities of the upstream and downstream resources.

When an upstream resource generates in real-time and there is no flexibility at downstream resources, *registered market participants* should submit an hourly must-run value to reflect must run conditions on downstream resources for future *dispatch hours*. When must run conditions develop within the *dispatch hour*, *registered market participants* will request that the *IESO* apply a minimum generation constraint to downstream resources.

#### 3.7.2.3 Variations to NQS Generation Facility Real-Time Dispatch for Pseudo-Units (PSU)

In the current market, NQS *generation facilities* submit *offers* into the *real-time market* on their *generation units* and are scheduled and *dispatched* as individual *generation units*.

In the future market, NQS *generation facilities* may elect to submit *offers* into the *real-time market* on their *pseudo-units* (PSU) and be scheduled as *pseudo-units*. PSU *real-time schedules* will be translated into physical unit *dispatch instructions*. Since *dispatch* will remain on the physical *generation unit*, some enhancements to NQS *generation facility* real-time scheduling and *dispatch* is required for *pseudo-units*.

This includes modifications to the following:

- *Dispatch Instructions*;
- *Operating Reserve* Activations (ORA);
- Compliance to *Dispatch*;
- Ramp to *Minimum Loading Point* (MLP);
- *Outages*;
- Constraints; and
- Initial Conditions.

These modifications are discussed in the following sections.

**Dispatch Instructions**

In the current market, *dispatch instructions* for the combustion turbine (CT) and the steam turbine (ST) are sent to *registered market participant* at their *dispatch workstations*.

In the future market, *registered market participants* will continue to receive *dispatch instructions* for the CT and the ST on their *dispatch workstation* whether they elect to *offer* their combined cycle *facility* into the market as PSU or as physical *generation units*. If the combined cycle *facility* is *offered* into the market as PSU, the RT calculation engine will economically schedule the PSU. In both the current and future market, the PD calculation engine does not factor in how the RT calculation engine has dispatched an NQS *generation unit* when it assigns schedules for future hours.

*Energy* will be scheduled on the PSU and translated into *dispatch instructions* on the physical units based on translation logic identified in the Calculation Engine detailed design documents. The PSU *dispatch* will be provided in confidential *market participant* reports for informational purposes to assess scheduling outcomes.

Similarly, *operating reserve* will be scheduled on the PSU and translated into CT and ST schedules. The physical unit *operating reserve* schedules will continue to be sent to the *dispatch workstation.* The PSU schedule will be provided in confidential *market participant* reports for information only.

### Operating Reserve Activations (ORA)

In the current market, *operating reserve* is activated on the physical unit. The physical unit ORA *dispatch instructions* are sent to *market participant dispatch workstations*.

In the future market, *operating reserve* will be activated on the PSU and translated into ORA *dispatch instructions* for each physical unit. The physical unit ORA *dispatch instructions* will continue to be sent to *market participant dispatch workstations*.

### Compliance to Dispatch

In the current and future market, *generation units* are expected to follow *dispatch instructions* within their compliance dead-band[18]. In the future market, NQS *generation facilities* offering as PSU in the market may continue to use compliance aggregation if the generation facilities are registered for compliance aggregation. They will continue to be evaluated for compliance to *dispatch* based on the combined *dispatch instructions* of the physical units and their total output.

There is one modification. Today NQS *generation facilities* are only permitted to use compliance aggregation when they are scheduled above MLP. In the future market, NQS *generation facilities* registered as PSU will be permitted to use compliance aggregation over their entire operating range. While the PSU model allows the relationship between the CT and ST to be reflected in *dispatch instructions*, it is an approximation. Permitting PSU to use compliance aggregation over their entire operating range provides additional flexibility to meet *dispatch instructions* accounting for operating limitations not fully captured in the approximation.

In the current and future market, the *IESO* may revoke compliance aggregation when unit specific *dispatch* is required to address a *reliability* concern. When this occurs, each *generation unit* must follow its own *dispatch instructions* and not use compliance aggregation to meet the combined *dispatch instructions*. For PSU, this means that each physical unit must follow the *dispatch instructions* for that physical unit.

Similarly, PSU that are not registered for compliance aggregation will be evaluated for compliance to physical unit *dispatch instructions* based on the physical unit output and dead-band.

### Ramp to Minimum Loading Point (MLP)

In the current market, CT and ST are *dispatched* up to their respective MLP based on *energy* ramp rates provided for each physical unit. In the future market, the *IESO* will

[18] Compliance deadbands are discussed in the Market Rule Interpretation Bulletin - "Compliance with Dispatch Instructions Issued to Dispatchable Facilities" (*MR* Ch. 7, Sec. 7.5.2)

*dispatch* PSUs to the PSU MLP based on *energy* ramp rates provided for the PSU. PSU *energy* ramp rates will be submitted by the *registered market participant* as part of their hourly *dispatch data* and will reflect the combined ramp capability of both the CT and the ST portion mapped to the PSU.

The *registered market participant* will continue to provide synchronization times for both the CT and the ST in the future market as described in Section 3.8.1. Synchronization times are used to inform RT scheduling for *dispatch* advisory intervals. *Dispatch* advisories are provided to *registered market participants* to indicate how their *generation facilities* will likely be *dispatched* in future intervals. The CT synchronization time will be used to indicate when the PSU will be considered synchronized and *dispatchable*. The *dispatch* advisory will show PSU schedules starting at the CT synchronization time with the entire schedule assigned to the CT. Advisory intervals after the ST synchronization time will show the PSU schedule translated to both CT and ST schedules.

As in the current market, a *dispatch instruction* will only be sent to either the CT or the ST when their respective synchronization breaker is closed and the *generation unit* is synchronized. As soon as the CT synchronization breaker closes, the RT calculation engine will assume the PSU is in-service and will *dispatch* the PSU up to its MLP using the PSU *energy* ramp rates. The RT calculation engine will assign the entire PSU *dispatch* to the CT until the ST synchronization breaker has closed. Once both units are synchronized to the grid, the PSU *dispatch* will be translated to CT and ST *dispatch instructions* based on the proportional relationship defined by the PSU model.

**Outages**

In the current and future market, *registered market participants* will submit derates and *outages* on the physical unit to reflect reduced capability. When a *generation unit* is forced from service in real-time due to equipment malfunction, *registered market participants* will continue to submit an *outage* slip reflecting the expected duration of the *forced outage*.

For combined cycle *facilities* that elect to *offer* into the market as PSU, derates and *outages* on the physical unit will be translated to corresponding derates and *outages* on the PSU. Translation logic is defined in the Calculation Engine detailed design documents. *Registered market participants* will have visibility on the impact of a physical unit derate or *outage* to the corresponding PSU through confidential *market participant* reports.

In the future market, the RT calculation engine will *dispatch* a PSU to 0 MW when there is an *outage* on the CT. When there is an *outage* on the ST, the RT calculation engine will assign the entire PSU schedule or *dispatch instruction* to the CT.

*Outages Triggering Single Cycle Operation*

*Registered market participants* are responsible for updating operational parameters when the ST experiences a *forced outage* to allow calculation engines to continue to produce feasible schedules and *dispatch instructions.* PSU *energy* ramp rates should be updated to reflect just the CT ramp capability. Daily *dispatch data* parameters for lead time and ramp up *energy* to MLP may also need to be updated to provide accurate information for future DAM and PD commitments.

*Registered market participants* will also have the ability to update the single cycle mode parameter in their daily *dispatch data.* When the single cycle mode parameter is updated to indicate single cycle operation, each subsequent run of the PD and RT calculation engines will evaluate and schedule the PSU for that *dispatch day* using just the CT operational parameters.

Furthermore, PSU schedules and *dispatch instructions* will be assigned just to the CT when the single cycle mode parameter is set to indicate single cycle operation. When the ST returns to service from an *outage*, the Single Cycle Flag can be updated to indicate combined cycle operation, and allow calculation engines to schedule the PSU using both CT and ST operational parameters. This is subject to the restrictions described in section 3.3.7.6 Real-Time Market Restricted Window for Daily Dispatch Data.

Incremental *energy offer* prices can also be updated to reflect single cycle operation. Exemptions to *offer* price restrictions due to a *forced outage* on the ST apply for combined cycle plants that have elected to *offer* into the market as PSU or as physical units.

**Constraints**

In the future market, *registered market participants* will continue to verbally report minimum generation output required on the physical unit to prevent endangering the safety of any person, equipment damage or the violation of an *applicable law* (SEAL). The *IESO* will continue to apply minimum generation constraints on the physical unit. These will be translated to corresponding minimum generation constraints on the PSU using translation logic described in the Calculation Engine detailed design documents.

In the current market, *registered market participants* can also request a minimum generation constraint on the ST if it has not been scheduled and they do not intend to have their ST participate in the RT-GCG program. The minimum generation constraint is applied on the ST at its operational *minimum loading point* based on the number of CTs that have been committed.

In the future market, the PD calculation engine will economically evaluate commitment costs of NQS *generation units* to commit these resources in the *real-time market,* replacing the RT-GCG program that is used today. If a *combined cycle facility* elects to submit *dispatch data* into the market as physical units, the ST will be economically evaluated for commitment like all other NQS *generation units.*

If the ST is not economically committed for the same *dispatch hours* as the related CT(s), a minimum generation constraint will only be applied to the ST if it is required to prevent endangering the safety of any person, equipment damage or the violation of an *applicable law* (SEAL). *Offering* into the market as a PSU provides combined cycle *facilities* a mechanism in the future market to ensure the ST will always be committed with related CT(s) at its operational *minimum loading point*.

#### Initial Conditions

NQS *generation units* are economically *dispatched* up or down based on telemetered output and submitted *energy* ramp rates. For PSU, operational telemetry will continue to be measured on the physical unit and translated to the PSU as described in Calculation Engine detailed design documents.

### 3.7.3. Real-Time Reports

Refer to the Publishing and Reporting Market Information detailed design document for more information on the content and timing of RT scheduling and *dispatch* reports that support the Grid & Market Operations Integration detailed design.

## 3.8. System Operation Processes and Control Actions

During the course of an operating day, changing system conditions will affect the requirements associated with the *reliability* and *security* of the *IESO-controlled grid* as mandated by *NERC* and *NPCC,* and governed by the *market rules*. This section identifies the operational processes and control actions that the *IESO* will use to ensure *reliable* operation of the *IESO-controlled grid* during the *pre-dispatch day, dispatch day* and *dispatch hour*[19].

As described in Section 3.4 of this document, the *IESO* will provide a set of inputs to the DAM calculation engine in advance of the initiation of the day-ahead market. The *IESO* can change the associated parameters any time after 10:00 EPT for use by the *pre-dispatch scheduling* process or for use by the *real-time dispatch process* as appropriate.

In the future market, these processes and control actions are not expected to change significantly. Changes that have been identified to support integration with DAM and *pre-dispatch scheduling* processes and to support appropriate price signals and *settlement* treatment, are described in more detail below.

### 3.8.1. NQS Generation Synchronization and Desynchronization

In the current market, non-quick start (NQS) *generation unit* synchronization procedures are based on NQS *generation facilities* identifying commitment opportunities and advising the *IESO* of their intentions to synchronize under the RT-GCG program.

In the current market, *market participants* self-assess DA-PCG commitments, eligibility for the RT-GCG program and *generation unit* lead times to determine when they will synchronize their units and reach MLP. The *IESO* first requires notification of the intention to

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[19] Principles for manual intervention are found in Market Rules Chapter 5 Section 1.2.1, Market Manual 7.1 sections 2.1 and 2.4, and Market Manual 7.4 Sections 1.4, 2.7.1, 3.1, and 4.1

synchronize under the RT-GCG program or to meet a DA-PCG commitment, followed by a two-hour start-up call and finally a five-minute request to synchronize.

The current desynchronization process is similar. NQS *generation facilities* notify the *IESO* one hour before they shut down based on their *pre-dispatch schedule*. This notification allows the *IESO* to transfer the shutdown responsibility from the PD to the RT calculation engine. During the *dispatch hour*, *market participants* notify the *IESO* when they are *dispatched* below MLP to request final approval to shut down, and again five-minutes prior to desynchronizing their units.

In the future market, the notification of a commitment or de-commitment will be initiated by the *IESO* and not the *market participant.* The *IESO* will issue binding start-up instructions for DAM and PD commitments and notifications of de-commitment to NQS *generation units* during the *dispatch day*. *Market participants* will respond to binding start-up instructions and notifications of de-commitment and will no longer be required to provide the two-hour start-up or one-hour shutdown calls. Timelines and communication procedures for synchronization and desynchronization are further addressed below.

#### 3.8.1.1 Notification of Commitment

The *IESO* will issue an automated notification of commitment in the form of a binding start-up instruction. The PD calculation engine will evaluate *generation unit* lead times and issue the notification following the last run PD calculation engine before a *generation unit* must start-up in order to meet the commitment, as described in section 3.6.2.2 Determination of NQS Generation Facility Schedules and Commitments.

The notification will include the times at which the *generation unit* is expected to synchronize, based on submitted ramp hours to MLP, and reach MLP at the start of the commitment period. Both times will be at the start of a *dispatch hour*. *Market participants* must electronically confirm receipt of the notification and their ability to comply with the start-up instruction no later than 15 minutes prior to the start of the next *dispatch hour*. The *IESO* must continue to be notified promptly if a *generation unit* is unable to meet the commitment.

*Market participants* will have the ability to verbally request a change to the synchronization time, but are expected to reach MLP at the indicated time. Like today, the requested synchronization time may be at any five-minute *dispatch interval*, but no earlier than the beginning of the hour before the first *dispatch hour* in which the NQS *generation unit* is scheduled by the PD calculation engine. For *pseudo-unit* (PSU) commitments, *registered market participants* will have the ability to provide a synchronization time for both the combustion turbine and the steam turbine *generation units*.

Prior to synchronizing NQS *generation units*, *market participants* will continue to make a five-minute request to synchronize. This allows the *IESO* to assess *reliability* since system conditions may have changed since the notification of commitment was issued. Timelines and communication procedures for synchronization are shown in Figure 3-36.

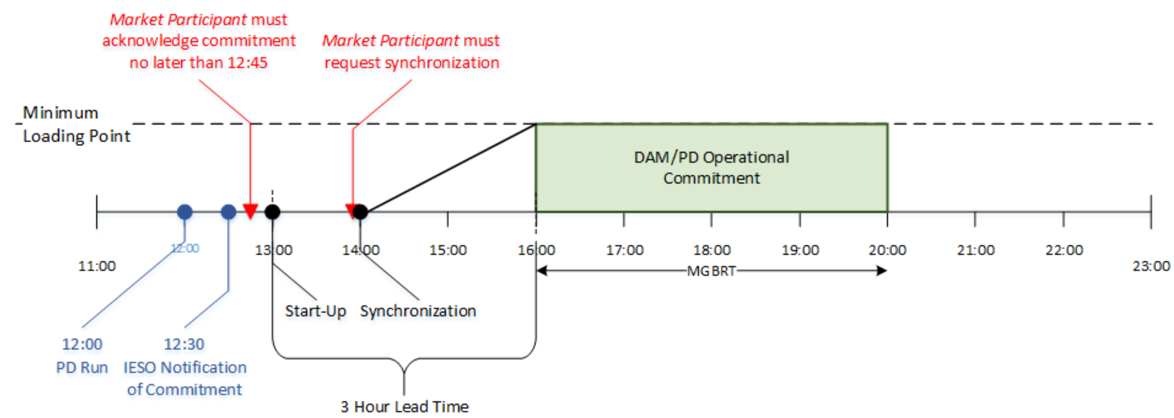


**Figure 3-36: NQS Synchronization Timelines in the Future Market**

Figure 3-36 illustrates example timelines and communication for a NQS *generation unit* that receives a binding start-up instruction from the 12:00 *pre-dispatch scheduling* run. Red text indicates required communication from the *market participant* to the *IESO*.

### 3.8.1.2 Notification of De-Commitment

The *IESO* will issue an automated notification of de-commitment when the PD calculation engine has no longer scheduled the NQS *generation unit* in the following hour. *Market participants* will need to electronically confirm receipt of the notification and their ability to comply with the de-commitment no later than 15 minutes prior to the start of the next *dispatch hour*.

As in the current market, *market participants* will continue to request final approval to shut-down when they are dispatched below MLP. However, the five-minute de-synchronization notice from the *registered market participant* is no longer required. Timelines and communication procedures for desynchronization are shown in Figure 3-37.

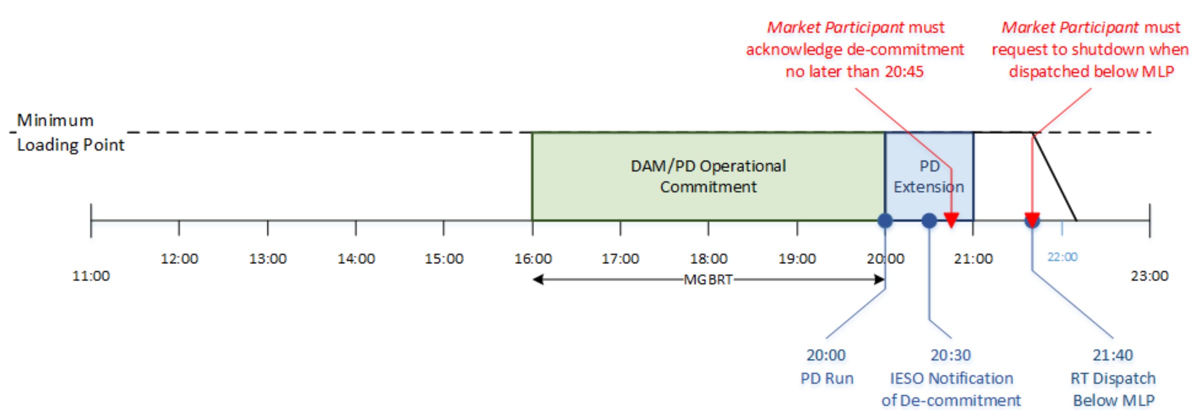


**Figure 3-37: NQS Desynchronization Timelines in the Future Market**

Figure 3-37 illustrates example timelines and communication for a NQS *generation unit* that is de-committed in the 20:00 *pre-dispatch scheduling* run and is *dispatched* below MLP in real-time at 21:40. Red text indicates required communication from the *market participant* to the *IESO*.

#### 3.8.1.3 Non-Quick Start (NQS) Commitment Modifications

A non-quick start (NQS) *generation unit* DAM or PD commitment may need to be altered to reflect unanticipated equipment limitations or *reliability* concerns. In both the current and future markets, *market participants* are required to notify the *IESO* promptly if they are unable to meet their commitment. The *IESO* will also continue to initiate changes to commitments for *reliability*.

Reasons for altering a commitment include:

- *Market participant* initiated change to indicate a later MLP time due to unanticipated equipment failures;
- *Market participant* initiated withdrawal of a commitment due to equipment failures;
- *Market participant* initiated change to MLP or MGBRT due to SEAL concerns; and
- *IESO* initiated withdrawal, delay, advancement or extension of a commitment for *reliability*.

### 3.8.2. Replacement Energy Offers Program

This program allows *market participants* to use a related unit to replace the *energy* from a unit that is experiencing a *forced outage*. A related unit is:

- a hydro-electric *generation unit* that can utilize the water of the unit experiencing the *forced outage* without delay; or
- a gas turbine that can make up the loss in steam production to the steam turbine unit that would otherwise have been produced by the gas turbine unit experiencing the *forced outage.*

The *IESO* accepts revised *dispatch data* for the related *generation facility* within the mandatory window. This provides *market participants* with an opportunity to reduce the *offer* price on the replacement unit for future hours to allow it to become the economic unit *dispatched* to replace the *energy*. Provided there is no adverse impact on *reliability*, the *IESO* will apply a minimum generation constraint on the replacement unit to the value of *energy* that the unit experiencing the *forced outage* was scheduled for. The RT calculation engine will *dispatch* the replacement unit no less than that value until the replacement *offers* take effect. This part of the replacement *offer* program will not change in the future market.

In addition, the Replacement Energy Offers program currently also allows a replacement unit to qualify for the real-time generation cost guarantee (RT-GCG) originally awarded to the forced unit and transfer the commitment to the replacement unit.

In the future market, the RT-GCG program will be retired. The *pre-dispatch scheduling* process will now evaluate start-up offers, speed-no-load offers and *energy offers* to economically commit NQS *generation units.* As a result, the *IESO* will no longer need to transfer a PD commitment[20] from a *generation unit* experiencing a *forced outage* unit to a replacement unit.

### 3.8.3. Surplus Baseload Generation Management

In the current market, schedules indicating surplus baseload generation (SBG) events may occur during the *pre-dispatch day*, *dispatch day*, or *dispatch hour*. In response to these events, the *IESO* has SBG management procedures specific for each time period.

These SBG management procedures will not change in the future market. Any SBG control actions taken will be reflected in resource schedules in DAM, PD or RT where applicable. Future *settlement* following these actions will be revised to reflect two *settlement* considerations and infeasible day-ahead financially binding schedules will be addressed. Please see the Market Settlement detailed design document for more details.

### 3.8.4. Operating Reserve Activation (ORA)

In the current market, when *operating reserve* is activated for a *contingency event* in Ontario, the *IESO* reduces the *operating reserve* requirement used as an input into the RT calculation engine. During *operating reserve* activation, the *IESO* will only schedule additional reserve up to the 10-min reserve requirement as permitted by *reliability standards*. This will not change in the future market.

### 3.8.5. Manual Procurement of Operating Reserve

Under certain conditions in the current market, the *IESO* manually procures *operating reserve* (OR). These conditions include outages of *IESO* software, hardware or communication systems, forcing temporary disruption of market activities such as electronic scheduling and dispatching.

On a reasonable effort basis, the *IESO* will attempt to procure *operating reserve* in amounts that are proportional with each *market participant*'s share in the total available *operating reserve* capacity. This process will remain the same in the future market.

### 3.8.6. Operating Reserve Shortfall Control Actions

Control actions to address *operating reserve* shortfalls are documented in the Emergency Operating State Control Action (EOSCA) list and will not change in the future market with one exception. The exception is for the removal of actions involving Control Action Operating Reserve (CAOR).

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[20] In both the current and future market, a day-ahead commitment is not transferred from a forced *generation unit* to a replacement *generation unit*.

CAOR represents the *IESO's* ability to use the following control actions to meet *operating reserve* requirements:

- 3% and 5% voltage reductions; and
- Disregarding the *thirty-minute operating reserve* requirement (for up to four hours).

In the current market, CAOR is *offered* into the *operating reserve market* at pre-defined prices and quantities. CAOR is scheduled economically by the RT calculation engine to meet *operating reserve* requirements. In the future, CAOR will not be *offered* into or scheduled in the *operating reserve market*.

Currently when the *IESO* assesses *operating reserve* shortfalls it is clear that when CAOR is scheduled it does not constitute a reserve shortfall. In the future, the *IESO* will continue to rely on voltage reductions towards meeting the reserve requirement, and disregard the 30-minute reserve requirement for up to four hours as permitted by the *reliability standards*. Since CAOR will no longer be scheduled to meet the *operating reserve* requirement, the market will indicate a reserve shortfall when there are still available control actions that can be used to meet the reserve requirement. The *IESO* will continue to assess shortfall indications and determine actual *operating reserve* shortfalls.

### 3.8.7. Control Actions for ACE Excursions

In the current market, control actions made in response to *area control error (ACE)* excursions may require the *IESO* to manually intervene in the automated *dispatch* until inputs can be modified to allow the RT calculation engine to automatically *dispatch* resources appropriately. Examples of *IESO* manual intervention methods include:

- Blocking *dispatch instructions*;
- Verbally *dispatching* a resource up/down;
- One-time *dispatching* of resources;
- Activating *operating reserve* and requesting simultaneous activation of reserve (SAR); and
- Implementing voltage reductions or load shedding (in extreme cases).

In the future market, the *IESO* will continue to manually intervene to respond to *ACE* excursions using the same intervention methods.

### 3.8.8. IESO Interaction with Hourly Demand Response Resources

The *IESO* has processes to interact with *hourly demand response* resources in two ways;

- Schedule *hourly demand response* tests to verify that the registered *demand response capacity* of the resource is deliverable; and

- Manually place *hourly demand response* resources on standby when there is an anticipated *adequacy* concern.

Normally, *hourly demand response* resources are placed on standby and activated when they are scheduled by the PD calculation engine to a quantity less than their *bid* quantity. When the *IESO* schedules *hourly demand response* resources for testing or to address *adequacy* concerns, the *hourly demand response* schedule is provided by the *IESO* as an input into the PD calculation engine. All activated *hourly demand response* resources, whether they are provided by the *IESO* as a manual input or are a result of *pre-dispatch scheduling*, are passed to the RT calculation engine as described in Section 3.7.2. *IESO* processes to schedule *hourly demand response* resources for testing or *adequacy* concerns will not change in the future market.

## 3.8.9. Off-Market Transactions

Off-market transactions are interchange transactions that are arranged and implemented by the *IESO*. They allow DAM, PD and RT calculation engines to be aware of *energy* flow that has been arranged using out-of-market mechanisms. These are not economically evaluated by the day-ahead or pre-dispatch calculation engines, but are accounted for by calculation engines when producing schedules.

Off-market transactions are used to reflect *energy* flow arranged for the following reasons and are discussed in further detail below:

- Emergency *energy*;
- Simultaneous activation of reserve (SAR);
- Segregated mode of operation (SMO); and
- Inadvertent payback.

### 3.8.9.1 Emergency Energy

Emergency *energy* sales and purchases are arranged between the *IESO* and neighboring *reliability* coordinators to address *reliability* concerns in Ontario or the neighboring area. They are implemented as emergency *energy* transactions on specific *interconnections*. There are three categories of emergency *energy* transactions: a sale, a purchase, and a purchase to support a sale.

In the future market, the *IESO* will continue to have the ability to indicate the amount and *interconnection* over which emergency *energy* is scheduled to flow. These are used as inputs into the PD and RT calculation engines to allow resources to be scheduled within limits.

In the current market, emergency *energy* purchases are not included in the unconstrained run in order to prevent counterintuitive price signals. This adjustment ensures that the price continues to reflect the scarcity condition in Ontario that triggered the emergency *energy* purchase. Emergency *energy* sales are included in the unconstrained run and price reflects the quantity of emergency *energy* provided. An emergency *energy* purchase to support a sale is considered two independent transactions, a purchase and a sale.

In the future market, emergency *energy* purchases to address *reliability* concerns in Ontario will continue to be excluded from the pricing algorithm. Emergency *energy* sales and emergency *energy* purchases to support a sale will be reflected in the pricing algorithm at the *interconnection* over which emergency *energy* is scheduled to flow.

Please refer to the Pre-Dispatch Calculation Engine detailed design, sections 3.4.1.5, 3.6.1.4 and 3.6.2.4, and the Real-Time Calculation Engine detailed design, sections 3.4.1.3 and 3.4.1.4 for more information on how emergency *energy* transactions are accounted for in schedules and prices.

#### 3.8.9.2 Simultaneous Activation of Reserve (SAR)

In the current market, the *IESO* participates in an *NPCC* program in which all members activate *operating reserve* in response to generation contingencies to more quickly relieve stress on the interconnected *transmission system*. The *IESO* will continue to request SAR for generation contingencies in Ontario and a portion of the contingency amount is covered by remaining *NPCC* members. The *IESO* will continue to provide SAR for contingencies in *NPCC* member control areas and activate *operating reserve* to cover the Ontario SAR share.

Unlike emergency *energy*, SAR is not scheduled or delivered at a specific *interconnection*. Implementing a SAR transaction involves changing the Net Scheduled Interchange to reflect *energy* provided or received. The implementation of SAR will not change in the future market.

In the current and future market, SAR *energy* received is subtracted from global *demand* in the pricing run and SAR *energy* provided is added to global *demand* in the pricing run. In the current market, the *operating reserve* that is activated could set price and the price could increase when providing SAR because of the higher *demand*. In the future market, the reserve activated will not set price since it will represent an operating restriction. Please refer to the Real-Time Calculation Engine detailed design document for more details on *demand* adjustments for SAR.

#### 3.8.9.3 Segregated Mode of Operation (SMO)

Certain hydroelectric *generation facilities* in Ontario have the ability to segregate their *generating units* from the *IESO-controlled grid* and connect them to the Quebec transmission grid. In some cases, transferring the units to Quebec requires a change to the

*IESO-controlled grid*. This topology change is effectively an *outage* to a critical transmission element[21] and results in reduced transmission limits.

In the current market, requests to operate a *facility* in SMO or to cancel a SMO request can be made up to two hours before the first delivery hour. In the future market, timelines for SMO submission and cancellation will change to ensure consistent scheduling between day-ahead market and *real-time market*. System topology changes due to SMO must be identified and supplied as an input into DAM, and must not change in real-time except to address real-time *reliability* needs or SEAL concerns.

Changes to SMO submission and cancellation timelines are compared in the current and future market:

- In the current market:
  - Requests to operate a *facility* in SMO can be submitted up to two hours before the first *dispatch hour*;
  - *Generators* who wish to be scheduled in SMO in DACP must submit the request by 09:00 EST. The *IESO* assesses requests submitted between 09:00 and 10:00 EST on a reasonable effort basis;
  - SMO requests can be cancelled at any time by the *generator* and does not require conditions related to the safety of any person, damage to equipment, or violation of any applicable law (SEAL); and
  - Transmission limit changes are published by the *IESO* after SMO requests and cancellations are approved.
- In the future market, for SMO that does not require an *outage* to a critical transmission element:
  - There is no change to submission and cancellation timelines except that *generators* who wish to be scheduled in SMO in the day-ahead market must meet DAM timelines (09:00 EPT instead of EST).
- In the future market, for SMO that requires an *outage* to a critical transmission element:
  - Requests to segregate must be submitted by 08:00 EPT for the following *dispatch day*. This will provide the *IESO* with sufficient time to assess the SMO request for *reliability* and publish associated transmission limit changes; and
  - SMO requests can only be cancelled by the *generator* to address concerns related to the safety of any person, damage to equipment, or violation of any applicable law (SEAL).

[21] Critical transmission elements are defined in Market Manual 7.3 as those that have a material impact on the reliability and/or operability of the *IESO-controlled grid* or the interconnection when removed from service.

The *IESO* may continue to request a resource to operate in SMO or may recall an ongoing SMO request to address *reliability* needs.

#### 3.8.9.4 Inadvertent Payback

In the current market, inadvertent payback transactions are arranged between the *IESO* and a neighbouring *control area* to pay back inadvertent (unscheduled) *energy* flow that has accumulated in one direction. The *IESO* has the ability to indicate the amount and *interconnection* over which inadvertent *energy* is scheduled to flow. These are used as inputs into the DA, PD and RT calculation engines to allow resources to be scheduled within limits. This will not change in the future market.

In the current market, inadvertent payback is added to global *demand* when Ontario is paying back and subtracted from global *demand* when Ontario is being paid back so that the inadvertent *energy* is reflected in Ontario. In the future market, the *demand* is added to the specific *interconnection* over which the inadvertent is scheduled to flow.

### 3.8.10. Emergency Operating State Control Actions

The Emergency Operating State Control Actions (EOSCA) list, indicates the order in which emergency control actions will be considered based on *IESO* operating policies. The *IESO* uses the EOSCA list to guide decisions on which control actions to use to resolve *adequacy* and *security* concerns. While the order of actions in the EOSCA list may change to reflect changing financial impact in the future market, actions taken to address *reliability* today will continue to be needed in the future.

Additional emergency control actions related to changes introduced in the future market will be identified and added to the EOSCA list at appropriate locations. One new emergency control action that has been identified is to allow import *offers* without DAM financially-binding schedules to be evaluated in all hours of the PD look-ahead period.

### 3.8.11. Limit Exceedances

A *contingency event* may lead to a system operating limit (SOL) exceedance. Re-preparation to restore *reliability* after a *contingency event* may require the *IESO* to implement different limits, arm special protection schemes, and/or operate to *emergency* condition limits to reflect the new configuration of the *IESO-controlled grid*. Further manual actions are sometimes required as part of re-preparation and include:

- Blocking *dispatch instructions*;
- Verbally *dispatching* a resource up/down;
- One-time *dispatching* of resources;
- Applying minimum, maximum or fixed generation constraints; and
- Curtailment of *intertie* transactions.

In the future market, the *IESO* will continue to take all actions necessary to re-prepare the *IESO-controlled grid* within re-preparation times required by *NERC*, *NPCC* and *IESO* policy.

### 3.8.12. Voltage Reductions and Load Shedding

To resolve an *adequacy* or *security* concern, the *IESO* implements voltage reduction or load shedding if other less severe control actions have already been exhausted. Both actions are used to reduce the load either globally, in specific regions or at specific load stations as needed to address the *reliability* concern. Similar to the *demand* adjustment used to avoid counter-intuitive pricing signals during emergency *energy* purchases, a *demand* adjustment is applied to the unconstrained sequence to account for reduced *demand* due to voltage reductions and load shedding. The *demand* adjustment is applied globally to adjust the unconstrained price.

In the future market, the *demand* adjustment will continue to be a single value applied manually based on observed *demand* reduction. The *demand* adjustment will be automatically apportioned to the four *demand* zones discussed in Section 3.4.5 Demand Forecast Assessment and Adjustment. The adjusted *demand* will be used in the next interval to determine the LMPs.

Refer to the Real-time Calculation Engine detailed design document for additional details on the calculation of LMPs with *demand* adjustments.

### 3.8.13. Security and Adequacy Assessments

Information used by the *IESO* to perform *security* and *adequacy* assessments is currently *published* to provide *market participants* with anticipated *reliability* conditions. These reports will need to be modified to include additional information that will be used in the future market to perform *security* and *adequacy* assessments.

Refer to the Publishing and Reporting Market Information detailed design document for more information on the content and timing of *security* and *adequacy* assessment reports.

## 3.9. Market Remediation

The *IESO* is responsible for maintaining appropriate market controls to address potential market tool failures and errors that may impact the operability of the *IESO-administered markets*.

A market failure is when one of the DAM, PD, or RT calculation engine runs experience an interruption. A software interruption can occur due to regularly scheduled maintenance with advanced notification, or can occur without advanced warning and only be identified once results are considered invalid for posting.

Following a market failure event, the *IESO* follows a set of operating procedures to mitigate the impact of the failure on system operations and on *market participants*. In the future day-ahead market and *real-time market, market participants* will continue to be notified of these conditions depending on the level of impact, and the *IESO* will also continue to resolve incorrect data using *administrative prices*.

The *IESO* may also declare a market suspension under exceptional cases that involve multiple and widespread market failures as well as complex operating conditions. Under a market suspension, the grid may be operated in real-time without using market based signals while the *IESO* regain stable grid operations.

*Published* results may also be deemed invalid due to a number of factors and corrective actions may be required after-the-fact.

This section is organized by the following subsections:

- DAM Remediation;
- Pre-Dispatch Remediation;
- Real-Time Remediation; and
- Market Suspension and Resumption.

## 3.9.1. DAM Remediation

The DAM will produce prices, financially binding schedules and commitments that reflect expected operations for a subsequent *dispatch day.* The future DAM validation will include a number of processes to verify *IESO* input data before the DAM runs, and subsequent validations of interim results during the DAM calculation engine run. Compared to the current process, this future process is significantly more rigorous. These processes are designed to identify and prevent errors and to reduce the likelihood of a DAM failure due to invalid inputs. However, it is conceivable that the DAM may fail to produce prices and schedules or that DAM errors are identified after the DAM calculation engine run has completed and results are *published*.

Errors that have been *published* following the DAM run may have been caused by inputs determined after-the-fact to be incorrect or invalid. These errors would affect the output of the day ahead scheduling algorithm.

DAM failures can occur if the DAM cannot be completed and validated within the timelines identified as described in Section 3.5.3.3 DAM Calculation Engine Failure on the *pre-dispatch day*. DAM failures may occur as a result of failure or *planned outage* of the software, hardware or the communications systems that supports the operation of the day ahead market.

### 3.9.1.1 Market Remediation Under DAM Errors

In the event that a DAM error caused by an *IESO* input, or process is identified after the results are *published*, the *IESO* will issue a public notification. This notification will indicate the impacted trade date, which hours are affected and, to the extent it is determinable, the cause of the error.

DAM price and schedule changes identified after DAM publishing but before the first run of the pre-dispatch calculation engine at 20:00 EPT, will be treated as described in Section 3.5.5.3 Use of DAM Results in Pre-Dispatch

The *IESO* will retroactively correct DAM prices in instances where the error has been determined to be isolated to the DAM price calculation or *publishing.* In the event that an identified error has caused a material discrepancy between the implemented DAM schedules and associated prices, DAM prices may be recalculated and/or republished after-the-fact to ensure that pricing and scheduling in the day-ahead market align to the best extent practicable. After the first run of the PD calculation engine for the applicable *dispatch day*, DAM schedules that are used as input to PD will be used as the DAM schedules for *settlement*.

Administered DAM prices must be corrected within four *business days* of the affected trade date. Should an error be discovered beyond the administration deadlines, the *IESO* will issue a public notification to declare a *dispatch scheduling error.*

**Dispatch Scheduling Errors**

In the current market, the declaration of a *dispatch scheduling error* event is applicable when an error is made by the *IESO* in the *real-time dispatch process* that is unable to be corrected by normal administration methods. The *IESO* will not adjust *market price*, but may compensate any *market participant* that has been negatively impacted by the *dispatch scheduling error*. The determination of impact is made through the Market Settlement process.

In the future market, the declaration of a *dispatch scheduling error* event will be extended to include errors in the DAM that have been determined to have impacted prices and schedules, including commitments, that are identified after the results are *published*.

If an error impacting both DAM prices and the associated schedules is identified after the first run of the PD calculation engine, the *IESO* will not retroactively correct DAM schedules and prices. These DAM schedules and prices were used by the PD and RT calculation engines which determined prices, and *dispatch instructions* for next-day operations. The prices that were generated with the implemented schedules are, in this case, the best representation of what the price should be under the expected conditions of the *dispatch day,* given the implemented schedules. Under these circumstances, the *IESO* will issue a public notification indicating that a *dispatch scheduling error* has occurred, the impacted trade date and hours, and the cause of the error, if known.

#### 3.9.1.2 Remediation Under a DAM Failure

In the current market, if a DACP failure has been declared, the *IESO* will issue a public notification. The *IESO* also has the option to include an expected date for the DACP to resume within the notification. DACP results will not be *published*, no day-ahead NQS commitments will be made, and no generator cost guarantee payments will be granted.

In the future market, following the determination of a DAM failure, the *IESO* will issue a notification that identifies that no DAM financially binding schedules or prices will be created or *published*, and no operational commitments will be generated based on DAM outcomes. Operational outcomes for the *dispatch day* will be settled solely based on *real-time market dispatch* and pricing and appropriate PD advisory data and commitments that are used in *settlement*. There will be no DAM to RT balancing *settlement*.

The *IESO* will continue to conduct a *reliability* assessment based on the latest system conditions for the following *dispatch day* as is done for DACP failures today. *Reliability* assessments will continue to be used to determine if any control actions are required in order to ensure the *secure* and *reliable* operation of the ICG for the following *dispatch day*. These control actions may include implementing manual *reliability* commitments for NQS resources. These commitments will be communicated to the affected *market participants* prior to the first run of the PD calculation engine at 20:00 EST. When more than one resource is able to satisfy the *reliability* needs, the *IESO* will perform, to the extent possible, a least-cost evaluation to determine the resource(s) that should be committed prior to the first PD calculation engine run.

As a result of the DAM failure, the following inputs will need to be incorporated into the regularly scheduled 20:00 EST PD calculation engine run for the *dispatch day*:

- Any *reliability* commitments for NQS resources as determined by the *IESO* through the *reliability* assessment; and
- All the latest *dispatch data* submissions and *IESO* data inputs submitted for the applicable *dispatch day*. *Dispatch data* revisions and submissions normally restricted by DAM outcomes will not apply. There will be no changes to normal condition PD and RT revision and submission rules which will still be applicable.

All *intertie* schedules will be determined through the *pre-dispatch scheduling* process during the RT mandatory window. As a result, no DA *intertie* coordination with neighbouring jurisdictions will be conducted prior to the RT checkout. If the *IESO* identifies *adequacy* concerns in future hours, the *IESO* may elect to include incremental imports in the PD evaluation for all remaining hours of the day for system *reliability*.

### 3.9.2. Pre-Dispatch Remediation

The PD calculation engine run can fail due to planned or forced system interruptions, tool outages, or identification of missing or incorrect results. When any of these occur, the associated processes will not change in the future market. Scheduled PD tool outages will continue to be automatically *published* on the *IESO* website. When PD tool failures occur outside of scheduled *outage*s, communications on the IESO website will continue to be posted at the discretion of the *IESO* and as soon as practicable. PD failure communications will continue to indicate that PD results will not be *published* for the hour(s) affected.

PD data is used to issue NQS binding start up notifications, apply commitment constraints and produce advisory schedules and prices for all participating resources. During a PD failure, the *IESO* may use the following information as a basis for the real-time scheduling and *dispatch* process, while giving consideration to timing and system conditions:

- The last-good PD advisory schedules supplemented with manual NQS commitments or commitment updates for *reliability*; or
- DAM financially binding schedules supplemented with manual NQS commitments or commitment updates for *reliability*; or
- Best available data to determine appropriate scheduling of NQS resources and determination of *intertie* transactions.

During failed PD hours, previously committed NQS resources will continue to be responsible for informing the *IESO* of commitment status updates, such as expected synchronization and shutdown times. In response, the *IESO* will be required to notify *market participants* on how to proceed as conditions warrant.

#### PD Advisory Schedules and Prices

Consistent with today, no corrections to *pre-dispatch schedules* or pricing will occur.

#### Intertie Treatment under PD failure

In the future, pre-dispatch will only consider DAM scheduled *intertie* transactions for hours T+3 and later. For hours T+1 and T+2, pre-dispatch will schedule all *intertie* transactions, both DAM scheduled transactions plus additional transactions that are *offered* after the DAM has cleared.

For scheduling *intertie* transactions under single-hour PD failures, the *IESO* can use the last-good set of PD results for the next RT *dispatch hour* as per the current process. However, if PD fails for two hours or more, the *IESO* will use the last successful pre-dispatch results for hours T+3 and beyond to implement *intertie* transactions schedules that align with transactions present in neighbouring jurisdictions for the RT *intertie* checkout. These results will only include DAM scheduled *intertie* transactions in its evaluation. No new incremental transactions that are scheduled in neighbouring *control areas* will be included in RT.

### 3.9.3. Real-Time Remediation

The *IESO* will continue to resolve data inconsistencies that can result from market failures or other issues prior to *settlement*. Today, the *IESO* uses *administrative price* rules to resolve any incorrect or missing *market schedules* or prices. *Administrative price* rules will continue to be used as an after-the-fact correction process following the *real-time market*.

Real-time failures can occur due to a failure or *planned outage* of the software, hardware or the communications systems that supports the operation of the *real-time market* resulting in the *IESO* being unable to *publish* updated *real-time schedules* and prices.

Errors in real-time may result from inputs determined to be incorrect or invalid after-the-fact. These errors would affect the output of the real-time scheduling algorithm.

#### 3.9.3.1 Guiding Principles for Ex-Post Administration of Prices

Real-time price correction will continue to adhere to the principle of producing *market prices* that would have otherwise been produced had the event causing the *market prices* to be administered been absent. The *IESO* will continue to assess pricing and scheduling errors to determine which *administrative pricing* methods will apply.

Real-time price corrections may be required:

- due to failure or *planned outage* of the software, hardware or the communications systems that supports the operation of the *dispatch algorithm*; or
- when the *IESO* determines that a *published market price* for *energy* or *operating reserve has* an error due to incorrect inputs which affected the outcome of the *dispatch algorithm;* or
- in circumstances where the formation of an electrical island has occurred.

#### 3.9.3.2 Real-Time Failures

When a real-time failure occurs in the current market, the calculation engines do not calculate updated real-time 5-minute *dispatch instructions* and prices that would otherwise reflect the most recent system conditions and *dispatch data*. This will be consistent in the future market, and all the functions discussed below will continue but the timing will change for *administrative prices*.

- Currently, a default action is generated by the market information systems through the auto-fill feature. This default action automatically copies the previous valid interval prices and schedules for all resources forward into the intervals impacted by the failure. This action takes place in order to reduce the instances of missing *real-time market* data, provide a basis for after-the-fact review and assessment of real-time conditions, and facilitate the determination of *prudential support obligation* for *market participants*;
- Once a RT failure is identified, the *IESO* will continue to issue RT failure communications and updates on the RSS feed page[22], and take the appropriate corrective actions as required to maintain system *reliability*. In the future market, the *IESO* will continue to have several options for applying corrective actions on an interval or a prolonged basis in RT;
- Prices and schedules during failed intervals must be reviewed after-the-fact to validate that the defaulted prices align with actual conditions and that schedules reflect any RT corrective actions implemented by the *IESO*; and

[22] http://www.ieso.ca/Sector-Participants/RSS-Feeds/Day-0-Advisory-Notices-Summary

- *Settlement* will continue using *administered prices* in the event of a *real-time market* failure resulting in missed prices.

*Electrical Islands*

Electrical islands[23] do not require separate *administrative price* treatment in the current market since all resources are *settled* on the single Ontario price. In the future, LMPs are not calculated for resources in an electrical island because the island is disconnected from the reference location. When an electrical island is formed, the *IESO* will be required to use *administrative prices* for resources in the island. The *IESO* will determine a price using any of the methodologies listed in table 3-2 of section 3.9.3.4. The determination of which methodology to apply will be based on the best available *dispatch data* and the resulting island conditions to best reflect the LMP in the electrical island.

#### 3.9.3.3 Real-Time Pricing Errors

The *IESO* will apply *administered prices* in instances where the error has affected the pricing calculation and does not reflect the schedules implemented in real-time. Real-time prices may be recalculated and/or republished after-the-fact to ensure that pricing and scheduling in the *real-time market* align to the best extent practicable.

When real-time pricing errors are identified, after-the-fact analysis is required to determine the extent of the error. This analysis will determine what caused the invalid price as well as the duration of the error. The analysis will also perform studies to determine materiality and the appropriate course of action.

When the *market price* is corrected in the current market, all prices are impacted since the *market price* that is corrected is a component in all *settlement* prices. In the future market with locational marginal pricing, *administrative prices* could be applied either to a specific location on the system where prices in that location are incorrect, or for all LMPs when the incorrect price is widespread.

In the current market, the corresponding unconstrained schedules (*market schedules*) which produce the uniform market clearing price are corrected for the *dispatch intervals* subject to *administrative prices*. In the future single schedule market, the unconstrained schedule is not generated and accordingly does not require correction when *administrative prices* are applied.

The *IESO* will continue to correct prices according to the *IESO Board* established guidelines for price error materiality and acceptable causal events. The current market allows pricing corrections to be made within two *business days* after the affected operating day. In the future market, a change to allow pricing corrections to be made within four *business days*

[23] NPCC glossary of terms defines an electrical island as: A portion of a power system or several power systems that is electrically separated from the *interconnection* due to the disconnection of transmission system elements. https://www.npcc.org/Standards/Directories/NPCC%20Glossary%20of%20Terms_20191002.pdf

after the affected operating day is required as the number of prices and data associated with those prices significantly increases with the introduction of LMPs.

#### 3.9.3.4 Real-Time Market Administrative Pricing Methods

Incorrect prices meeting materiality thresholds or *real-time market* failure resulting in missing prices will require *administrative prices*. The best available *dispatch data* should be used for pricing corrections to establish prices that best reflect the prices that would have occurred.

In the current market, there are three methods available for pricing correction that can be used individually or in combination. In the future market, changes to these methods plus an additional three methods will be introduced. In the future, all approaches can be used individually or in combination. These methods are described in Table 3-2.

**Table 3-2: RT Pricing Correction Methods in the Current and Future Markets**

| Current Method | Future Method |
|---|---|
| Use prices from the closest preceding *dispatch interval* that have not been administered, up to 24 *dispatch intervals*. | Use prices from the closest preceding *dispatch interval* that have not been administered, up to a total of 24 *dispatch intervals* combined. |
| Use prices from the closest subsequent *dispatch interval* that have not been administered, up to 24 *dispatch intervals*. | Use prices from the closest subsequent *dispatch interval* that have not been administered, up to a total of 24 *dispatch intervals* combined. |
| Use the hourly average prices from the corresponding hour from the four most recent *business days* or non-*business days* that have not been administered. | Use the hourly average locational prices from the corresponding hour from the four most recent *business days* or non-*business days* that have not been administered. |
| Not an existing methodology. | Use recalculated prices that are recalculated using an offline study tool that replicates the real-time calculation engine. |
| Not an existing methodology. | Use prices that cleared in the day-ahead market from the corresponding hour and operating day. |
| Not an existing methodology. | Use prices from an electrically similar node in the same *dispatch interval* that has not been administered. |

### 3.9.4. Market Suspension and Resumption

The *IESO* will maintain current market suspension and resumption criteria and procedures in the future market. In the current market, the DACP does not run when the RTM is suspended, in the future the DAM scheduling process will similarly need to stop while the RTM is suspended.

In the future market, the *IESO* will also continue to require *administrative prices* following a market suspension. In the rare event of a market suspension, the *IESO* will adhere to current *administrative price* principles. The corrected prices should:

- be fair and reasonable to suppliers and loads;
- only try to reflect current *market prices* if grid operations are based, to some extent, on market-based information signals; and
- be understandable, transparent, and administratively simple.

As applicable, per the existing guidelines, *administrative prices* will be determined by averaging the RTM prices from the corresponding hour(s) of the four most recent *business days* or non-*business days*.

**– End of Section –**

# 4. Market Rule Requirements

The *market rules* govern the *IESO-controlled grid* and establish and govern the *IESO-administered markets*. The *market rules* codify obligations, rights and authorities for both the *IESO* and *market participants*, and the conditions under which those rights and authorities may be exercised and those obligations met.

This section is intended to provide an inventory of the changes to *market rule* provisions required to support the Grid and Market Operations Integration detailed design, and is intended to guide the development of *market rule* amendments.

This inventory is not meant to be an exhaustive list of required rule changes, but is a "snapshot" in time based on the current state of design development of this specific detailed design document. Resulting *market rule* amendments will incorporate the integration of the individual design documents.

New and amended Chapter 11 defined terms: These terms will be consolidated in a single document at a later time as part of the *market rule amendment* process, and will support multiple design documents.

The inventory is developed in the following tables, which describe the impacts to the *market rules* and classify them into the following three types:

- Existing – no change: Identifies those provisions of the existing *market rules* that are not impacted by the design requirements;
- Existing – requires amendment: Identifies those provisions of the existing *market rules* that will need to be amended to support the design requirements; and
- New: Identifies new *market rules* that will likely need to be added to support the design requirements.

**Table 4-1: Market Rules Chapter 4 Impacts**

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| Section 7.3.5 and 7.3.6 | Existing - no change | Centralized Forecast for Variable Generation Facilities | Sections 7.3.5 and 7.3.6:<br>• These sections specify *IESO* obligations in providing confidential centralized forecasts prepared by the *forecasting entity* to each *registered market participant* for each of their *variable generation facilities.* |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | | • Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document.<br>OVERLAP: Offers, Bids and Data Inputs |
| Appendix 4.15 to 4.23 | Existing - no change | IESO Monitoring Requirements | Appendices 4.15 to 4.23<br>• These appendices specify *IESO* monitoring requirements.<br>• Provisions are unaffected by the Grid and Market Operations Integration design document. |

**Table 4-2: Market Rules Chapter 5 Impacts**

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| Section 1 | Existing - no change | Purposes, Interpretation and General Principles | Section 1:<br>• Chapter 5 of the *market rules* describes the scope and operation of the *IESO-controlled grid*, and the various responsibilities, obligations and authorities of the *IESO* and each *market participant* in order to maintain the *reliability* of the *IESO-controlled grid*. Section 1 describes the purpose, interpretation and general principles of Chapter 5.<br>• Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document.<br>OVERLAP: Offers, Bids and Data Inputs |
| Section 2 | Existing - no change | IESO-Controlled Grid and Operating States | Section 2:<br>• This section specifies the scope of the *IESO-controlled grid* including normal operating state, emergency operating state and high-risk operating state.<br>• Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document.<br>OVERLAP: Offers, Bids and Data Inputs |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| Section 3 | Existing - no change | Obligations and Responsibilities | Section 3:<br>• This section specifies the responsibilities, obligations and authorities placed on the *IESO* and each *market participant* to assist in supporting power system *reliability.*<br>• Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document.<br>• For the MRP project, not related to Grid and Market Operations Integration, *amendments* may be required to sections 3.3.1 and 3.3.2 pending decisions on staging of the *market rules* for MRP and pending decisions as to when *reliability* related information must be *published* by the *IESO* following the coming into force of MRP *market rule amendments*.<br>OVERLAP: Offers, Bids and Data Inputs |
| Section 4.1 | Existing - no change | System Reliability: Objectives | Section 4.1:<br>• This section specifies the requirements to ensure availability of sufficient *generation capacity* and *ancillary services* to the *IESO-administered markets.*<br>• Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document.<br>OVERLAP: Offers, Bids and Data Inputs |
| Section 4.2 | Existing - no change | System Reliability: Standards for Ancillary Services | Section 4.2:<br>• This section specifies IESO obligations to ensure ancillary services are available to maintain reliability of the IESO-controlled grid.<br>• Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document.<br>OVERLAP: Offers, Bids and Data Inputs |
| Section 4.3 | Existing - no change | System Reliability: Generic Performance | Section 4.3:<br>• This section specifies the generic requirements for provision of *ancillary services* by *registered facilities.* |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | Requirements for Ancillary Services | • Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document.<br>OVERLAP: Offers, Bids and Data Inputs |
| Section 4.4 | Existing - no change | System Reliability: Regulation | Section 4.4:<br>• This section specifies the *IESO* obligation to define AGC requirements and respond to *area control error* excursions in order to maintain *reliability* of the *IESO-controlled grid.*<br>• Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document.<br>OVERLAP: Offers, Bids and Data Inputs |
| Section 4.4A | Existing - no change | System Reliability: Assistance to Other Control Areas | Section 4.4A:<br>• This section specifies *IESO* requirements to provide *emergency energy* to another *control area.*<br>• Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document. |
| Section 4.5.6 | Existing - no change | System Reliability: Operating Reserve: Simultaneous Activation of Reserve | Section 4.5.6:<br>• This section specifies that the *IESO* may simultaneously activate with nearby systems its *ten-minute operating reserve* to respond to *contingency events*.<br>• Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document. |
| Section 4.5.6A | Existing - requires amendment | System Reliability: Operating Reserve: Control Action Operating Reserve | Section 4.5.6A:<br>• This section specifies that the *IESO* may include voltage reductions and reductions in *thirty-minute operating reserve* as standing *offers* in the *operating reserve markets*.<br>• *Amend* section 4.5.6A and subsections to indicate that voltage reductions and reductions in the *thirty-minute operating reserve* requirement will no longer be |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | | represented by standing *offers* in the *operating reserve market*. |
| Section 4.5.6B | Existing - no change | System Reliability: Operating Reserve: Regional Reserve Sharing | Section 4.5.6B:<br>• This section specifies that the *IESO* may participate in regional reserve sharing programs with neighbouring *control areas*.<br>• Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document. |
| Section 4.5.7 to 4.5.21 | Existing – no change | System Reliability: Ten-Minute and Thirty-Minute Operating Reserve | Sections 4.5.7 to 4.5.21:<br>• These sections specify requirements for *ten-minute operating reserve* and *thirty-minute operating reserve*.<br>• Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document.<br>OVERLAP: Offers, Bids and Data Inputs |
| Section 5.1 | Existing - no change | System Security: Objectives and General Obligations | Section 5.1:<br>• This section specifies procedures necessary to enable the *IESO* to ensure the *security* of the *IESO-controlled grid*, including, for example, the establishment of *security limits.*<br>• Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document.<br>• Chapter 5 Sections 5.1.2.5 and 5.1.2.6, with respect to *security limits*, will apply as inputs into the *real-time market* (currently in Appendix 7.5 Section 2.2.1.14, which will be replaced by new appendices for the pre-dispatch and real-time engines) and the day-ahead market (new Chapter 7A Section 3.3 and applicable appendix) to direct operation and maintain *reliability*.<br>OVERLAP: Offers, Bids and Data Inputs |
| Section 5.2 | Existing - no change | System Security: Security Limits | Section 5.2: |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | | • This section specifies *IESO* obligations to establish and *publish security limits* as well as *market participant* obligations regarding thermal ratings.<br>• Provisions unaffected by the design changes specified in the Gird and Market Operations design document.<br>OVERLAP: Offers, Bids and Data Inputs |
| Section 5.3 | Existing - no change | System Security: The Use of Tie-Lines and Associated Facilities | Section 5.3:<br>• This section specifies *IESO* obligations to establish *security limits* for *interties,* as well as *market participant* obligations to follow *reliability* requirements for imports and exports (requirements for *boundary entity bids* and *offers*).<br>• Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document.<br>OVERLAP: Offers, Bids and Data Inputs |
| Section 5.4 | Existing - no change | System Security: Reliability Policy for Area Supply | Section 5.4:<br>• This section specifies that the *IESO* may develop and apply specific *security* criteria in areas of the *IESO-controlled grid.*<br>• Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document.<br>OVERLAP: Offers, Bids and Data Inputs |
| Section 5.5 | Existing - no change | System Security: Interconnection Assistance | Section 5.5:<br>• This section obligates the IESO to use and support interconnected systems in accordance with agreements between the IESO and other *security* coordinators, control area operators or interconnected transmitters to maintain *security* of the *IESO-controlled grid*<br>• Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document. |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| Section 5.6 | Existing - no change | System Security: Inadvertent Interchange | Section 5.6:<br>• This section obligates the *IESO* to address *inadvertent interchange* in any agreement relating to *security* between the *IESO* and other *security coordinators.*<br>• Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document.<br>OVERLAP: Offers, Bids and Data Inputs |
| Section 5.7 | Existing - no change | System Security: The Management of Violations to Security Limits | Section 5.7:<br>• This section obligates the *IESO* to define the sequence of control actions taken by the *IESO* when there is a violation of a *security limit* on the *IESO-controlled grid*<br>• Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document. |
| Section 5.8 | Existing - no change | System Security: Operation Under an Emergency Operating State | Section 5.8:<br>• This section permits the *IESO* to take such action as it determines appropriate during an *emergency operating state.*<br>• Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document. |
| Section 5.9 | Existing - no change | System Security: Operation Under a High-Risk Operating State | Section 5.9:<br>• This section permits the *IESO* to take such action as it determines appropriate during a *high-risk operating state.*<br>• Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document. |
| Section 5.10 | Existing - no change | System Security: Restoration of System Security Following a Contingency Event | Section 5.10:<br>• This section obligates the *IESO* to establish procedures for restoration of the *IESO-controlled grid.* |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | | • Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document. |
| Section 6.4 | Existing - no change | Outage Coordination: Submission of Outage Schedules and IESO Approval of Outage Schedules | Section 6.4:<br>• This section specifies *IESO* and *market participant* obligations and requirements to confirm/approve *outages*, including timing.<br>• Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document.<br>OVERLAP: Offers, Bids and Data Inputs |
| Section 7.3 | Existing - no change | Forecasts and Assessments: Advance Assessments of System Reliability | Section 7.3:<br>• This section obligates the *IESO* to prepare and *publish* reports of its findings in relation to such *reliability* assessments<br>• Provisions unaffected by the design changes specified in the Grid and Market Operations Integration document.<br>OVERLAP: Offers, Bids and Data Inputs, Publishing and Reporting |
| Section 9 | Existing - no change | Voltage Control | Section 9:<br>• This section specifies *market participant* and *IESO* obligations related to voltage control.<br>• Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document. |
| Section 10 | Existing - requires amendment | Demand Control | Section 10<br>• This section specifies *market participant* and *IESO* obligations related to *demand* control.<br>• Provisions are generally unaffected by the design changes specified in the Grid and Market Operations Integration design document.<br>• While this section is intended to primarily deal with *demand response* for *reliability* purposes, the introduction of price responsive loads and their potential |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | | to impact *reliability* will require review of the requirements to correctly capture the new categories. |

**Table 4-3: Market Rules Chapter 7 Impacts**

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| Section 1.6 | Existing - no change | Introductory Rules: Planned Outages for IESO Systems | Section 1.6:<br>• This section obligates the *IESO* to follow process for *planned outages* to its own systems. The generic language is adequate to include day-ahead market systems.<br>• Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document |
| Section 1.7 | Existing - requires amendment | Introductory Rules: IESO Authorities and Obligations Regarding the Operation of the Day-Ahead Commitment Process Functions | Section 1.7:<br>• This section currently describes the *IESO* authorities and obligations with respect to the day-ahead commitment process. With elimination of the day-ahead commitment process this section will be repurposed to specify overarching *IESO* authorities and obligations related to both the day-ahead market and the *real-time market*.<br>• The Offers, Bids and Data Inputs design document *market rules* inventory describes the majority of the changes.<br>• Sections 1.7.4 and 1.7.5 are relevant to the Grid and Market Operations Integration design document.<br>• Sections 1.7.4 and 1.7.5 of Chapter 7 address process and software failures for the day-ahead commitment process, while establishment of *administrative prices* for the *real-time market* due to process and software failures is in Section 8.4A.2 of Chapter 7, and suspension of the *IESO-administered markets* is in Section 13 of Chapter 7.<br>• Going forward, section 1.7 will be amended with new sub-sections to create the overarching obligations and |

<table>
<tr><th>Market Rule Section</th><th>Type</th><th>Topic</th><th>Requirement</th></tr>
<tr><td></td><td></td><td></td><td>provide cross-references to applicable sections. Refer to the applicable sections for further details.<ul><li>Remediation of the day-ahead market calculation engine (provide cross reference to Section 3 of Chapter 7A, and move amended Sections 1.7.4 and 1.7.5 to Section 3 of Chapter 7A).</li><li>Remediation of the pre-dispatch calculation engine (cross reference to new section 4A of Chapter 7).</li><li>Remediation of the real-time market calculation engine (cross reference to section 4D of Chapter 7 with reference to administrative pricing in Section 8.4Aof Chapter 7).</li><li>Suspension of the day-ahead market (cross reference to new Chapter 7A, or amended Section 13 of Chapter 7).</li><li>Suspension of the real-time market (cross reference to Section 13 of Chapter 7).</li><li>Administrative prices (cross reference to Section 8.4A for real-time market and either new Section 4 of Chapter 7A or incorporate into Section 8.4A for day-ahead market alongside the real-time market details.</li></ul>OVERLAP: Offers, Bids and Data Inputs</td></tr>
<tr><td>Section 3</td><td>Existing - requires amendment</td><td>Data Submissions for the Real-Time Markets</td><td>Section 3:<ul><li>This section describes the dispatch data submission process and form of dispatch data for the real-time market.</li><li>Amend to describe submission requirements of new daily and hourly dispatch data and make clear that dispatch data submission into the day-ahead market shall also be considered as an unchanged dispatch data submission into the real-time market (pre-dispatch scheduling and real-time dispatch hour), where applicable, unless the dispatch data is subsequently re-submitted or revised.</li><li>Amend to remove market rules obligations related to the day-ahead commitment process.</li></ul></td></tr>
</table>

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | | OVERLAP: Offers, Bids and Data Inputs |
| Section 3.1 | Existing - requires amendment | Data Submissions for the Real-Time Markets: Applicability of this Section | Section 3.1.2:<br>• This section may require *amendment* to address revisions to *dispatch data* after initial submission in the day-ahead market in accordance with new Chapter 7A.<br>Section 3.1.4 new:<br>• New Section 3.1.4 may be required, to specify that a *dispatch data* submission into the day-ahead market in accordance with new Chapter 7A, shall also be considered as an unchanged *dispatch data* submission into the *real-time market* (*pre-dispatch scheduling* and *real-time dispatch*), where applicable, unless the *dispatch data* is subsequently re-submitted or revised.<br>OVERLAP: Offers, Bids and Data Inputs |
| Section 3.2 | Existing - no change | Data Submissions for the Real-Time Markets: The Data Submission Process | Section 3.2:<br>• Existing provisions by which a *registered market participant* submits *dispatch data* into the *real-time market*, and by which the *IESO* confirms receipt of or rejects such *dispatch data* are unaffected by the design changes specified in the Grid and Market Operations Integration design document.<br>• Provisions unaffected by the design changes specified in the Grid and Market Operations Integration design document.<br>OVERLAP: Offers, Bids and Data Inputs |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| Section 3.3 | Existing - requires amendment | Data Submissions: Dispatch Data Submissions | Section 3.3:<br>• *Amendments* are required to merge the subject matter from Sections 3.3 and 3.3A and new Section 2 of Chapter 7A and to address availability declaration envelope, restricted and unrestricted submission windows for hourly and daily *dispatch data*, and to specify restrictions and requirements to revise various *dispatch data* parameters.<br>• The form of standing *dispatch data* is addressed under the Offers, Bids and Data Inputs design document, while the Grid and Market Operations Integration design document requires *amendments* to the timing of the conversion of standing *dispatch data* into initial *dispatch data*. Standing *dispatch data* is not *offered* for *real-time market* only participation.<br>• Timing of restricted and unrestricted submission windows may require links to timing sections for *pre-dispatch* (Chapter 7 Section 4B.1), *real-time* (Chapter 7 Section 4E.1) and day-ahead (Chapter 7A)<br>OVERLAP: Offers, Bids and Data Inputs |
| Section 3.3A | Existing - requires amendment | *Dispatch Data Submissions for the Day-Ahead Commitment Process* | Section 3.3A:<br>• Provisions in Section 3.3A were introduced to support *dispatch data* submission into the day-ahead commitment process.<br>• New chapter 7A will specify *dispatch data* submission requirements in the day-ahead market. The resubmission window in current Section 3.3A.6 of Chapter 7 will be eliminated. Provisions such as the *dispatch data* requirements to establish the availability declaration envelope in Section 3.3A will be moved into new Chapter 7A. *Registered market participants* will be required to submit *dispatch data* into the day-ahead market for a *dispatchable generation facility*, a *dispatchable load facility*, and an *hourly demand response resource* in order to be eligible to submit *dispatch data* into the *real-time market*. There is no requirement for *dispatch data* |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | | to submitted into the day day-ahead market in order for a *self-scheduling generation facility*, an *intermittent generator,* a *transitional scheduling generator* or a *boundary entity* to be eligible to participate in the *real-time market*. Timing of submissions and revisions to *dispatch data* for the day-ahead market will be included in new Chapter 7A, including provisions for the day-ahead market submission window and the day-ahead market restricted window.<br>• Section 3.3A may be deleted and remaining relevant provisions related to timing of submissions and revisions to *dispatch data* will be moved into Section 3 for the *real-time market* and Section 2 of Chapter 7A for the day-ahead market where applicable.<br>OVERLAP: Offers, Bids and Data Inputs |
| Section 3.6 | Existing - requires amendment | Data Submissions: Operating Reserve Offers | Section 3.6:<br>• *Amendments* are required to add restrictions on *operating reserve offer* price when pre-dispatch commitments or advancements apply.<br>OVERLAP: Market Power Mitigation, Offers, Bids and Data Inputs |
| Section 3.7 | Existing - requires amendment | Data Submissions: Self-Scheduling Generators | Section 3.7<br>• This section specifies form and timing of submission of *dispatch data* for a *self-scheduling generation facility*.<br>• Form to be addressed under the Offers, Bids and Data Inputs design document.<br>• Timing in Section 3.7.3 requires *amendment* to reflect the day-ahead market submission window.<br>OVERLAP: Offers, Bids and Data Inputs |
| Section 3.8 | Existing - requires amendment | Data Submissions: Intermittent Generators | Section 3.8<br>• This section specifies form and timing of submission of *dispatch data* for an *intermittent generator*. |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | | • Form to be addressed under the Offers, Bids and Data Inputs design document.<br>• Timing in Section 3.8.2 requires *amendment* to reflect the day-ahead market submission window.<br>OVERLAP: Offers, Bids and Data Inputs |
| Section 3.8A | Existing - requires amendment | Data Submissions: Transitional Scheduling Generators | Section 3.8A<br>• This section specifies form and timing of submission of dispatch data for a *transitional scheduling generator*.<br>• Form to be addressed under the Offers, Bids and Data Inputs design document.<br>• Timing in Section 3.8A.2 requires amendment to reflect the day-ahead market submission window.<br>OVERLAP: Offers, Bids and Data Inputs |
| Section 3.9 | Existing - no change | Data Submissions: Transmission System Information | Section 3.9:<br>• This section obligates *transmitters* to provide the *IESO* with *transmission system* information.<br>• Timing in Section 3.9.2 requires *amendment*.<br>OVERLAP: Offers, Bids and Data Inputs |
| Section 4 | Existing - requires amendment | The Dispatch Algorithm | Section 4 describes the *dispatch algorithm*, which is currently represented by a single engine used for both *pre-dispatch* and *real-time*.<br>The single engine will be replaced with two new engines and Section 4 will be replaced with two new sections to reflect the new engines. The new pre-dispatch engine will be described under new Section 4A and the new *real-time* engine will be described under new section 4D.<br>Subjects of the main sub-sections of 4A (pre-dispatch calculation engine) and 4D (real-time calculation engine) may include:<br>• Purpose<br>• Optimisation Objective |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | | • Inputs<br>• Description of the Multiple Passes<br>• Outputs<br>The new sections will provide high-level information. Details will be described further in new Appendix 7B for pre-dispatch and new Appendix 7C for *real-time*.<br>A comparable Section 3 of Chapter 7A and associated appendix will be required for the day-ahead market.<br>OVERLAP: Offers, Bids and Data Inputs, Pre-Dispatch Calculation Engine and Real-Time Calculation Engine |
| Section 4.1 | Existing - requires amendment | The Dispatch Algorithm: Purpose of the Dispatch Algorithm | Section 4.1:<br>• Provides an introduction to Section 4.<br>• To be replaced by new Sections 4A.1 (pre-dispatch) and 4D.1 (real-time).<br>OVERLAP: Pre-Dispatch Calculation Engine, Real-Time Calculation Engine |
| Section 4.2 | Existing - requires amendment | The Dispatch Algorithm: Uses of the Dispatch Algorithm | Section 4.2:<br>• Describes the uses of the *dispatch algorithm*<br>• Details will be moved to new Sections 4A and 4D as applicable.<br>• Section 4.2.4 includes the *IESO Board* authority to direct the *IESO* to audit the *dispatch algorithm*. Pending decisions during MRP, the authority to audit the day-ahead, pre-dispatch and real-time calculation engines will be moved to the overarching authorities in Section 1.7.<br>OVERLAP: Pre-Dispatch Calculation Engine, Real-Time Calculation Engine, and Publishing and Reporting |
| Section 4.4 | Existing - requires amendment | The Dispatch Algorithm: Inputs to the Dispatch Algorithm | Section 4.4:<br>• Describes the inputs to the *dispatch algorithm*, which is currently represented by a single engine used for both pre-dispatch and real-time. |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | | • Section 4.4 will be replaced with two new sections to reflect the new engines. Inputs to the new pre-dispatch engine will be described under new Section 4A.3 while inputs to the new real-time engine will be described under new section 4D.3.<br>• The new sections will provide high-level information about inputs which will be described further in the new Appendix 7B for pre-dispatch and new Appendix 7C for *real-time*. Some of the high-level details in current Section 4.4 will be moved to new Sections 4A.3 and 4D.3 of Chapter 7. Other details will be moved to the appendices, and any information related to overall *IESO Board* authorities will be moved to section 1.<br>• A comparable Section 3.3 of Chapter 7A and associated appendix will be required for the day-ahead market.<br>• The Grid and Market Operations Integration impacts to new sections include transition of information between engines.<br>OVERLAP: Offers, Bids and Data Inputs, Pre-Dispatch Calculation Engine and Real-Time Calculation Engine |
| Section 4.5 | Existing - requires amendment | The Dispatch Algorithm: The Constrained and Unconstrained IESO-Controlled Grid Model | Section 4.5:<br>• Describes the constrained *IESO-controlled grid* model and the unconstrained IESO controlled grid model used by the *dispatch* algorithm.<br>• High-level details described in Section 4.5 will be moved to new Sections 4A and 4D of Chapter 7. Inputs will be described further in the new Appendix 7B for pre-dispatch and new Appendix 7C for real-time.<br>• A comparable section in Chapter 7A and associated appendix will be required for the day-ahead market.<br>OVERLAP: Pre-Dispatch Calculation Engine and Real-Time Calculation Engine |
| Section 4.6 | Existing - requires amendment | The Dispatch Algorithm: Outputs of the | Section 4.6:<br>• Describes the outputs of the *dispatch algorithm*. |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | Dispatch Algorithm | • Outputs will be moved to new Sections 4A and 4D of Chapter 7.<br>• A comparable section in Chapter 7A will be required for the day-ahead market.<br>OVERLAP: Pre-Dispatch Calculation Engine and Real-Time Calculation Engine |
| Section 5 | Existing - requires amendment | The Pre-Dispatch Scheduling Process | Section 5:<br>• This section specifies *IESO* obligations and permissions with respect to *pre-dispatch scheduling*.<br>• Delete Section 5 and replace with the following new sections:<br>o 4A: The Pre-Dispatch Calculation Engine<br>o 4A.1: Purpose<br>o 4A.2: Optimisation Objective<br>o 4A.3: Inputs<br>o 4A.4: Multiple Passes<br>o 4A.5: Outputs<br>o 4B: Pre-Dispatch Schedules and Prices<br>o 4B.1: Timelines<br>o 4B.2: Pre-Dispatch Prices<br>o 4B.3: Pre-Dispatch Schedules<br>o 4C: Releasing and Publishing Pre-Dispatch Information<br>o 4C.1: Publishing Pre-Dispatch Information<br>o 4C.2: Releasing MP Specific Pre-Dispatch Information<br>• Section 5 contains duplication of subject matter with Chapter 7 Section 4 and Appendix 7.5. New sections to replace Section 5 will provide high-level information only. Some of the details in current section 5 will be moved to new Sections 4A, 4B and 4C of Chapter 7, Other details will be moved to new Appendix 7.5B detailing the pre-dispatch calculation engine. |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | | • Comparable sections will be required for real-time (4D, 4E and 4F of Chapter 7) and day-ahead (Sections 3, 4 and 5 of Chapter 7A).<br>OVERLAP: Offers, Bids and Data Inputs, Pre-Dispatch Calculation Engine, Publishing & Reporting and Market Settlements |
| Section 5.1 | Existing - requires amendment | The Pre-Dispatch Scheduling Process: Purpose and Timing of Pre-Dispatch Schedules | Section 5.1:<br>• Purpose and timing of *pre-dispatch schedules* will be described in new sections 4A-4C.<br>OVERLAP: Pre-Dispatch Calculation Engine |
| Section 5.2 | Existing - requires amendment | The Pre-dispatch Scheduling Process: Information Used to Determine Pre-Dispatch Schedules | Section 5.2:<br>• includes information used to determine *pre-dispatch schedules* and duplicates information in existing Section 4.4 and Appendix 7.5. This duplication will be eliminated under the new format.<br>• Section 5.2 will be replaced with new Section 4A.3 which will consolidate applicable requirements from Sections 4.4, 5.2, 5.3 and 5.4 to provide a high-level description of the inputs to the pre-dispatch calculation engine and describe details around modification of inputs. The inputs will be described in detail in new Appendix 7.5B.<br>OVERLAP: Offers, Bids and Data Inputs and Pre-Dispatch Calculation Engine |
| Section 5.3 | Existing - requires amendment | The Pre-dispatch Scheduling Process: Determining the Pre-Dispatch Schedule | Section 5.3:<br>• Determining the *pre-dispatch schedule* will be specified in new Sections 4A-4C.<br>OVERLAP: Offers, Bids and Data Inputs and Pre-Dispatch Calculation Engine |
| Section 5.4 | Existing - requires amendment | The Pre-dispatch Scheduling Process: | Section 5.4:<br>• Determining the projected *market prices* and schedules will be specified in new Sections 4A-4C. |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | Projected Market Schedules and Prices | OVERLAP: Offers, Bids and Data Inputs and Pre-Dispatch Calculation Engine |
| Section 5.5 | Existing - requires amendment | The Pre-dispatch Scheduling Process: Release of Pre-dispatch Schedule Information | Section 5.5:<br>• *Market rules* related to the timing of the release of *pre-dispatch schedule* information will be specified in new Section 4C.<br>OVERLAP: Publishing and Reporting |
| Section 5.7 | Existing - requires amendment | The Pre-dispatch Scheduling Process: Pre-Dispatch Scheduling of Generation Facilities Eligible for the Generation Cost Guarantee | Section 5.7:<br>• This section describes *pre-dispatch scheduling* of *generation facilities* eligible for the generation cost guarantee.<br>• Delete Section 5.7 since the existing generation cost guarantee will no longer be used. *Market rules* related to generator *offer* guarantee in pre-dispatch will be moved to Chapter 9 under Settlements.<br>• With respect to notifications of intention to synchronize in Section 5.7, details will be addressed under Section 11 of Chapter 7. In future, *market participants* will not be notifying the *IESO* of the intention to come online under the Real-Time Generator Offer Guarantee.<br>OVERLAP: Market Settlements |
| Section 5.8 | Existing - requires amendment | The Pre-dispatch Scheduling Process: The Day-Ahead Commitment Scheduling Process | Section 5.8:<br>• Section 5.8 describes the timing of the determination of the *schedule of record* under the day-ahead commitment process.<br>• This section will be deleted and timing and scheduling of the day-ahead market will be addressed in new Chapter 7A. |
| Section 6 | Existing - requires amendment | The Real-Time Scheduling Process | Section 6:<br>• This section specifies *IESO* obligations and permissions with respect to *real-time scheduling*. |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | | • Replace Section 6 with the following new sections:<br>o 4D: The Real-Time Calculation Engine<br>o 4E: Real-Time Schedules and Prices<br>o 4E.1: Timelines<br>o 4E.2: Real-Time Prices<br>o 4E.3: Real-Time Schedules<br>o 4F: Releasing and Publishing Real-Time Information<br>o 4F.1: Publishing Real-Time Information<br>o 4F.2: Releasing MP Specific Real-Time Information<br>• Section 6 includes duplication of subject matter with Chapter 7 Section 4 and Appendix 7.5. Section 6 will be replaced with new sections to provide high-level information. Some of the details in current section 6 will be moved to new Sections 4D, 4E and 4F of Chapter 7, Other details will be moved to new Appendix 7.5B detailing the real-time calculation engine.<br>• Comparable sections will be required for pre-dispatch (4A, 4B and 4C of Chapter 7) and day-ahead (Sections 3, 4 and 5 of Chapter 7A).<br>OVERLAP: Offers, Bids and Data Inputs, Real-Time Calculation Engine, Publishing & Reporting and Market Settlements |
| Section 6.1 | Existing - requires amendment | The Real-Time Scheduling Process: The Purpose and Timing of Real-Time Schedules | Section 6.1:<br>• Purpose and timing of *real-time schedules* will be described in new Sections 4D-4F.<br>OVERLAP: Real-Time Calculation Engine |
| Section 6.2 | Existing - requires amendment | The Real-Time Scheduling Process: Information Used to Determine | Section 6.2:<br>• includes information used to determine *real-time schedules* and duplicates information in existing Section 4.4 and Appendix 7.5. This duplication will be eliminated under the new format. |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | Real-Time Schedules | • Section 6. 2 will be replaced with new Section 4D.3 which will consolidate applicable requirements from Section 4.4, 6.2, 6.3 and 6.4 to provide a high-level description of the inputs to the real-time calculation engine and describe details around modification of inputs. The inputs will be described in detail in new Appendix 7.5C.<br>OVERLAP: Offers, Bids and Data Inputs and Real-Time Calculation Engine |
| Section 6.3 | Existing - requires amendment | The Real-Time Scheduling Process: Determining the Real-Time Schedule | Section 6.3:<br>• Determining the *real-time schedule* will be specified in new Sections 4D-4F.<br>OVERLAP: Offers, Bids and Data Inputs and Real-Time Calculation Engine |
| Section 6.3A/6.3B | Existing - requires amendment | The Real-Time Scheduling Process: Real-Time Scheduling of Generation Facilities Eligible for the Generation Cost Guarantee and the Day-Ahead Production Cost Guarantee | Delete Section 6.3A since the existing generation cost guarantee will no longer be used. *Market rules* related to make-whole payments in real-time under the Market Renewal Project will be moved to Chapter 9 under Settlements.<br>Section 6.3A/6.3B:<br>• Section 6.3A *real-time scheduling* of *generation facilities* eligible for the real-time generation cost guarantee. This guarantee will be replaced with the generator *offer* guarantee.<br>• Section 6.3B describes *real-time scheduling* of *generation facilities* eligible for the day-ahead production cost guarantee. This guarantee will be replaced with the day-ahead make-whole payment.<br>• Delete Sections 6.3A and 6.3B since the existing cost guarantees will no longer be used. *Market rules* related to guarantees/make-whole payments will be moved to Chapter 9 under Settlements.<br>• With respect to notifications of intention to synchronize in Section 6.3A/B, details will be addressed under section 11 of Chapter 7. In future, *market participants* will not be |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | | notifying the *IESO* of the intention to come online under the Real-Time Generator Offer Guarantee.<br><br>OVERLAP: Market Settlements |
| Section 6.4 | Existing - requires amendment | The Real-Time Scheduling Process: Market Schedules and Market Prices | Section 6.4:<br>• Determining the *market prices* and schedules will be specified in new Sections 4D-4E.<br>• As described in the Offers, Bids and Data Inputs design document *market rules* inventory, information used to determine *real-time schedules* will be specified in new Section 4D.3. Sections 6.4.2.9A/B establish a high operating limit. These sections can be moved and re-used for the *real-time market*. For the day-ahead market, new sections are required to establish a high operating limit that also takes into account the *IESO* forecast vs a submitted forecast for *variable generation*, to ensure that if the *market participant* submits its own forecast that it will be used in setting the high operating limit for DAM Pass 1 and DAM Pass 3. The IESO forecast will be used for DAM Pass 2.<br><br>OVERLAP: Offers, Bids and Data Inputs and Real-Time Calculation Engine |
| Section 4A | New | The Pre-Dispatch Calculation Engine | Section 4A NEW:<br>• New section to provide an overview of the pre-dispatch calculation engine and detail the *IESO's* obligation to determine *pre-dispatch schedules* and prices using the pre-dispatch calculation engine as described in this section and in new Appendix 7.5B. Subjects may include:<br>o Purpose<br>o Optimisation Objective<br>o Inputs<br>o Description of the passes<br>o Outputs<br>• New section 4A will provide high-level information which will be described in greater detail in new Appendix 7.5B |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | | • Existing section 4 of Chapter 7 which is currently applicable to both pre-dispatch and real-time will be replaced with this new section 4A (pre-dispatch), along with new section 4D (real-time). New section 3 of Chapter 7A will address the day-ahead calculation engine.<br>• This section will include obligations related to market remediation for pre-dispatch calculation engine failures<br>OVERLAP: Offers, Bids and Data Inputs and Pre-Dispatch Calculation Engine |
| Section 4A.1 | New | The Pre-Dispatch Calculation Engine: Purpose of the Pre-Dispatch Calculation Engine | Section 4A.1 NEW:<br>• New section to replace existing Section 4.1 to provide a high-level description of the purpose of the pre-dispatch calculation engine.<br>OVERLAP: Pre-Dispatch Calculation Engine |
| Section 4A.2 | New | The Pre-Dispatch Calculation Engine: Optimisation Objective of the Pre-Dispatch Calculation Engine | Section 4A.2 NEW:<br>• New section to describe the optimization objective of the pre-dispatch calculation engine.<br>OVERLAP: Pre-Dispatch Calculation Engine |
| Section 4A.3 | New | The Pre-Dispatch Calculation Engine: Inputs to the Pre-Dispatch Calculation Engine | Section 4A.3 NEW:<br>• New section to consolidate information from existing Sections 4.4, 5.2, 5.3 and 5.4 to provide a high-level description of the inputs to the pre-dispatch calculation engine. The section will refer to new Appendix 7.5B where the inputs will be described in greater detail.<br>• Inputs are discussed in detail in the Offers, Bids and Data Inputs *market rules* inventory.<br>• The Grid and Market Operations Integration design document specifies applicability of inputs to the pre- |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | | dispatch calculation engine, revisions to inputs, *reliability* constraints applied by the *IESO*, and inputs that are passed from the day-ahead market to the pre-dispatch timeframe of the *real-time market*. Inputs to the pre-dispatch timeframe can be impacted by a failure of the day-ahead market (commitments, treatment of *interties*). These impacts will be documented in this Section 4A.3 with a cross reference to day-ahead market failures in Section 3 of Chapter 7A.<br>OVERLAP: Offers, Bids and Data Inputs and Pre-Dispatch Calculation Engine |
| Chapter 7 Section 4A.4 | New | The Pre-Dispatch Calculation Engine: Passes of the Pre-Dispatch Calculation Engine | Section 4A.4 NEW:<br>• New section to describe the passes of the pre-dispatch calculation engine.<br>OVERLAP: Pre-Dispatch Calculation Engine |
| Section 4A.5 | New | The Pre-Dispatch Calculation Engine: Outputs of the Pre-Dispatch Calculation Engine | Section 4A.5 NEW:<br>• New section to specify the outputs of the pre-dispatch calculation engine<br>• Cross references may be required when outputs of the pre-dispatch calculation become inputs to either the day-ahead market calculation engine or the real-time calculation engine.<br>OVERLAP: Pre-Dispatch Calculation Engine |
| Section 4B | New | Pre-Dispatch Schedules and Prices | Section 4B NEW:<br>• New section to contain high-level provisions related to timelines for the operation of the pre-dispatch and provisions related to schedules and prices.<br>• Information from existing *market rules* Sections 5.1, 5.3 and 5.4 of Chapter 7 may be incorporated in new section 4E.<br>OVERLAP: Pre-Dispatch Calculation Engine |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| Section 4B.1 | New | Pre-Dispatch Schedules and Prices: Timelines | Section 4B.1 NEW:<br>• New section to specify the timelines associated with the pre-dispatch timeframe.<br>• Timing of restricted and unrestricted windows for submission of hourly and daily *dispatch data* is required. Linkages may be required to timing sections for the day-ahead market (Ch7A S4) and real-time (Chapter 7 Section 4E.1).<br>OVERLAP: Pre-Dispatch Calculation Engine |
| Section 4B.2 | New | Pre-Dispatch Schedules and Prices: Pre-Dispatch Prices | Section 4B.2 NEW:<br>• New section to specify *IESO* obligations to determine pre-dispatch prices.<br>• Cross-references to existing Section 8 of Chapter 7 may be required from new Section 4B.2 of Chapter 7 (formerly information in Section 5.4) and Section 4E.2 of Chapter 7 (formerly in Section 6.4).<br>OVERLAP: Market Settlements, Pre-Dispatch Calculation Engine |
| Section 4B.3 | New | Pre-Dispatch Schedules and Prices: Pre-Dispatch Schedules | Section 4B.3 NEW:<br>• New section to specify the determination of *pre-dispatch schedules* and commitments. Cross references to Sections 4E.3 (real-time) and Chapter 7A (day-ahead) may be required.<br>OVERLAP: Pre-Dispatch Calculation Engine |
| Section 4C | Existing - requires amendment | Releasing and Publishing Pre-Dispatch Information | Section 4C NEW:<br>• New section to contain provisions on the *publishing* of pre-dispatch public information and on the release to *market participants* of their individual *confidential information* results.<br>• The Grid and Market Operations Integration design document addresses timing. |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | | • Information from existing *market rules* Sections 5.1 and 5.5 of Chapter 7 may be incorporated in new Section 4C.<br>OVERLAP: Publishing and Reporting |
| Section 4D | New | The Real-Time Calculation Engine | Section 4D New:<br>• New section to provide an overview of the real-time calculation engine and detail the IESO's obligation to determine *real-time schedules* and prices using the real-time calculation engine as described in this section and in new Appendix 7.5C. Subjects may include:<br>o Purpose<br>o Optimisation Objective<br>o Inputs<br>o Description of the passes<br>o Outputs<br>• New Section 4D will provide high-level information which will be described in greater detail in new Appendix 7.5C.<br>• Existing Section 4 of Chapter 7 which is currently applicable to both pre-dispatch and real-time will be replaced with this new Section 4D (real-time) along with new section 4A (pre-dispatch). New Section 3 of Chapter 7A will address the day-ahead calculation engine.<br>• This section will include obligations related to market remediation for real-time calculation engine failures and pricing errors.<br>OVERLAP: Offers, Bids and Data Inputs and Real-Time Calculation Engine |
| Section 4D.1 | New | The Real-Time Calculation Engine: Purpose of the Real-Time Calculation Engine | Section 4D.1 NEW:<br>• New section to replace existing Section 4.1 to provide a high-level description of the purpose of the real-time calculation engine.<br>OVERLAP: Real-Time Calculation Engine |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| Section 4D.2 | New | The Real-Time Calculation Engine: Optimisation Objective of the Real-Time Calculation Engine | Section 4D.2 NEW:<br>• New section to describe the optimization objective of the real-time calculation engine.<br>OVERLAP: Real-Time Calculation Engine |
| Section 4D.3 | New | The Real-Time Calculation Engine: Inputs to the Real-Time Calculation Engine | Section 4D.3 NEW:<br>• New section to consolidate information from existing Sections 4.4 and 6 to provide a high-level description of the inputs to the real-time calculation engine. The section will refer to new Appendix 7.5C where the inputs will be described in greater detail.<br>• Inputs are discussed in detail in the Offers, Bids and Data Inputs *market rules* inventory.<br>• The Grid and Market Operations Integration design document specifies applicability of inputs to the real-time calculation engine, revisions to inputs, inputs that are passed from the day-ahead market to the real-time *market,* and inputs are passed in the *real-time market* from the pre-dispatch calculation engine outputs/constraints to the real-time calculation engine.<br>• Cross references may be required when inputs of the real-time calculation come from outputs of the pre-dispatch calculation engine.<br>• A failure of the pre-dispatch calculation engine will impact inputs to the real-time calculation engine. This section will describe inputs that are applicable to the real-time calculation when the pre-dispatch calculation has failed.<br>OVERLAP: Offers, Bids and Data Inputs and Pre-Dispatch Calculation Engine |
| Section 4D.4 | New | The Real-Time Calculation Engine: Passes of | Section 4D.4 |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | the Real-Time Calculation Engine | • New section to describe the passes of the real-time calculation engine.<br>OVERLAP: Real-Time Calculation Engine |
| Section 4D.5 | New | The Real-Time Calculation Engine: Outputs of the Real-Time Calculation Engine | Section 4D.5 NEW:<br>• New section to specify the outputs of the real-time calculation engine<br>• Cross references may be required when outputs of the real-time calculation become inputs to either the day-ahead market calculation engine or the pre-dispatch calculation engine.<br>OVERLAP: Real-Time Calculation Engine |
| Section 4E | New | Real-Time Schedules and Prices | Section 4E NEW:<br>• New section to contain high-level provisions related to timelines for the operation of the *real-time market* and provisions related to schedules and prices.<br>• Information from existing *market rules* Sections 6.1, 6.3 and 6.4 of Chapter 7 may be incorporated in new Section 4E.<br>OVERLAP: Real-Time Calculation Engine |
| Section 4E.1 | New | Real-Time Schedules and Prices: Timelines | Section 4E.1 NEW:<br>• New section to specify the timelines associated with the real-time timeframe.<br>• Linkages may be required to timing sections for the day-ahead market (Chapter 7A Section 4) and pre-dispatch timeframe (Chapter 7 Section 4B.1)<br>OVERLAP: Real-Time Calculation Engine |
| Section 4E.2 | New | Real-Time Schedules and Prices: Real-Time Market Prices | Section 4E.2 NEW:<br>• New section to specify IESO obligations to determine *real-time market* prices.<br>• Cross-references to existing Section 8 of Chapter 7 may be required from new Section 4B.2 of Chapter 7 (formerly information in Section 5.4) and Section 4E.2 of |

| Market Rule Section | Type | Topic | Requirement |
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| | | | Chapter 7 (formerly in Section 6.4). A comparable new Section 4.2 will be created in Chapter 7A for the day-ahead market prices.<br>OVERLAP: Market Settlements, Real-Time Calculation Engine |
| Section 4E.3 | New | Real-Time Schedules and Prices: Real-Time Market Schedules | Section 4E.3 NEW:<br>• New section to specify the determination of *real-time market schedules*. Cross references to existing Section 7 of Chapter 7 which describes *dispatch instructions* will be required.<br>OVERLAP: Real-Time Calculation Engine |
| Section 7 | Existing - requires amendment | IESO Dispatch Instructions | Section 7:<br>• This section describes *IESO dispatch instructions*, including but not limited to purpose and timing, information used, content, *dispatch* of *operating reserve* and compliance with *dispatch instructions*.<br>• *Amendments* are required to reflect *dispatch* of hydroelectric *generation facilities* and *pseudo-units*. All sections will require review of cross-references. |
| Section 8 | Existing - requires amendment | Determining Market Prices | Section 8:<br>• This section specifies *IESO* obligations to determine uniform *market prices* used in the market *settlement process* pursuant to the provisions in Chapter 9.<br>• Cross-references will be required from new pre-dispatch pricing Section 4B.2 of Chapter 7 (formerly information in Section 5.4) and new real-time pricing Section 4E.2 of Chapter 7 (formerly in Section 6.4).<br>• *Amendments* may be required for administration of *real-time market* prices. Administration of day-ahead market prices may be included alongside Section 8.4A or may be included in new Section 3 of Chapter 7A, with cross-references back to the overarching obligations in Section 1.7 of Chapter 7. |

| Market Rule Section | Type | Topic | Requirement |
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| | | | OVERLAP: Pre-Dispatch Calculation Engine, Real-Time Calculation Engine and Day-Ahead Calculation Engine |
| Section 11 | Existing - requires amendment | Generator Synchronization Procedures | Section 11:<br>• This section specifies procedures for a *generator* intending to synchronize or de-synchronize a *generation unit* to or from the *IESO-controlled grid*.<br>• *Amendments* are required to reflect that in future the notification of a commitment (binding start-up instruction) or de-commitment for *generation facility* that is not a *quick-start generation facility* will be initiated by the *IESO* and not the *market participant.*<br>• *Amendments* are required to allow the ability to provide synchronization times for physical units (combustion turbine and steam turbine) *for pseudo-units.*<br>• *Amendments* are required to reflect that in future the 5 minute de-synchronize notification is not required in Section 11.3.4.<br>• *Amendments* are required to move the current authorities under Section 5.8.6 of Chapter 7 to this Section 11. |
| Section 12 | Existing - requires amendment | Status Reports, Advisories, and Protocols | Section 12:<br>• This section is mainly covered under the Publishing and Reporting design document.<br>• Design changes specified in the Grid and Market Operations Integration document may cause *amendments* to be required to make some clauses inclusive of the day-ahead market or to provide cross reference to new Chapter 7A for day-ahead market requirements.<br>OVERLAP: Publishing and Reporting |
| Section 13 | Existing - requires amendment | Suspension of Market Operations | Section 13:<br>• This section describes *IESO* and *market participant* responsibilities with respect to market suspension and resumption and *IESO-administered markets*. |

| Market Rule Section | Type | Topic | Requirement |
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| | | | • The *real-time market* suspension and resumption criteria will be maintained, with the one exception: The day-ahead market processes will need to be suspended while the *real-time market* is suspended (and until it resumes)<br>• Since the section is inclusive of *IESO-administered markets*, it can be amended to include any requirements for suspension of the day-ahead market<br>• *Amendments* may be required to the *real-time market* suspension and resumption process and timing to support integration with the new day-ahead market.<br>• Cross-references currently exist to administration of prices under Section 8.4A of Chapter 7. *Amendments* may be required to cross-reference administration of prices for the day-ahead market which will be in either Section 8.4A of Chapter 7 or Section 4 of Chapter 7A.<br><br>OVERLAP: Publishing and Reporting |
| Section 19 | Existing - requires amendment | Capacity Market Participants with Capacity Obligations | Section 19:<br>• This section describes delivery of a *demand* response capacity obligation.<br>• *Amendments* may be required to account for treatment of price responsive loads in addition to *non-dispatchable loads*.<br><br>OVERLAP: Offers, Bids and Data Inputs |
| Section 20 | Existing - requires amendment | Capacity Exports in the IESO-Administered Market | Section 20:<br>• This section specifies *IESO* and *market participant* obligations with respect to capacity exports in the *IESO-administered markets*.<br>• This section of the *market rules* contains high-level language and points to the details in the applicable *market manual*. As such, provisions are generally unaffected by the design changes specified in the Grid and Market Operations Integration design document.<br>• Provisions in Sections 20.3 and 20.4 may require *amendment* to utilize the new Capacity Transaction Flag hourly *dispatch data* parameter introduced in the Offers, |

| Market Rule Section | Type | Topic | Requirement |
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| | | | Bids and Data Inputs design document; however, the use of the parameter may instead be included in the *market manuals*.<br>• Provisions may require *amendment* to specify which export *bids* will be evaluated for capacity exports (not limited to day-ahead market scheduled transactions).<br>OVERLAP: Offers, Bids and Data Inputs |
| Appendix 7.5 | Existing - requires amendment | The Market Clearing and Pricing Process | Appendix 7.5:<br>• This section specifies the Market Clearing and Pricing Process details of the calculation engine for the *real-time market*, which is currently comprised of both the *pre-dispatch hour*s (pre-dispatch timeframe) and the *dispatch hour* (known as the real-time timeframe).<br>• Going forward, the *pre-dispatch* and real-time timeframes will be use two engines instead of one. Amendments are required to replace Appendix 7.5 with two new appendices. Refer to Appendices 7.5B and 7.5C for further information.<br>OVERLAP: Pre-Dispatch Calculation Engine, Real-time Calculation Engine, and Offers, Bids and Data Inputs |
| Appendix 7.5A | Existing - requires amendment | The DACP Calculation Engine Process | Appendix 7.5A:<br>• This section provides detail on the existing day-ahead commitment process calculation engine.<br>• *Amendments* are required to delete this appendix since the day-ahead commitment process is being discontinued and replaced with the day-ahead market. The new day-ahead market calculation engine is described in a new appendix 7A.X under new Chapter 7A.<br>OVERLAP: Day-Ahead Market Calculation Engine and Offers, Bids and Data Inputs. |
| Appendix 7.5B | New | The Pre-Dispatch Calculation Engine | Appendix 7.5B New:<br>• Refer to notes under Appendix 7.5, which is being replaced with new Appendices 7.5B and 7.5C. |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | | • Appendix 7.5B is a new appendix required to provide the details of the pre-dispatch calculation engine. The new appendix will be created under the Pre-Dispatch Calculation Engine design document. Aspects of the Grid and Market Operations Integration design document will be incorporated into the new appendix.<br>OVERLAP: Pre-Dispatch Calculation Engine and Offers, Bids and Data Inputs. |
| Appendix 7.5C | New | The Real-Time Calculation Engine | Appendix 7.5C New:<br>• Refer to notes under Appendix 7.5, which is being replaced with new Appendices 7.5B and 7.5C.<br>• Appendix 7.5C is a new appendix required to provide the details of the real-time calculation engine. Aspects of the Grid and Market Operations Integration design document will be incorporated into the new appendix.<br>OVERLAP: Real-Time Calculation and Offers, Bids and Data Inputs. |
| Appendix 7.7 | Existing - requires amendment | Radial Intertie Transactions | Appendix 7.7:<br>• This section specifies IESO and *market participant* obligations related to a *generation facility* operating in segregated mode of operation.<br>• *Amendments* may be required to change the timing for a request for segregation and to authorize the *IESO* to request that a *facility* operating in *segregated mode of operations*.<br>• *Amendments* may be required to ensure the appendix reflects the requirements for the day-ahead market in addition to the *real-time market*.<br>OVERLAP: Market Settlements and Offers, Bids and Data Inputs. |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| Chapter 7A – Day-Ahead Market Operations<br>• Establish a new chapter for day-ahead market operations. Rationale: provides a singular place in the *market rules* where the entirety of the day-ahead market is described. This is consistent with the recommendation by the TP in 2004 as the best means to introduce a significant new mechanism/process into the *market rules*.<br>OBDI requires sections for DAM in parallel with the sections for pre-dispatch (Chapter 7 Section 5), real-time (Chapter 7 Section 6) and the *dispatch algorithm* (Chapter 7 Section 4) Overlap: GMO and DA Calculation Engine | | | |
| Chapter 7A, Section 1 | New | Introduction | Section 1 NEW:<br>• Not exclusive to the Grid and Market Operations Integration design document.<br>• *Market rules* specifying the purpose and application of the new chapter and the scope of the day-ahead market, including reconciliation with *real-time market* operations, generator *offer* guarantee, adherence to schedules and treatment of *dispatch data*, and virtual transactions. |
| Chapter 7A, Section 2 | New | Data Submission for the Day-Ahead Market | Section 2 NEW:<br>New section required to specify the *registered market participant* data submission requirements for the day-ahead market. This section may include some duplication with the *real-time market* data submission requirements in Section 3 of Chapter 7. Refer to the Offers, Bids and Data Inputs design document for details on the form of *dispatch data* in new Section 2. The impact of the Grid and Market Operations Integration design document on new Section 2 relates to the timing of submissions, revisions to *dispatch data* and *IESO* acceptance of *dispatch data*.<br>Sub-sections of new section 2 may include:<br>• Applicability – new section required to specify that participation in the day-ahead market requires data submission in accordance with this new Section 2.<br>• Data submission process – new section to specify the requirement for *dispatch data* to be submitted through the *electronic information system* or such other means as |

| Market Rule Section | Type | Topic | Requirement |
| --- | --- | --- | --- |
| | | | determined by the *IESO*, and specify *IESO* obligations with respect to such data.<br>• *Dispatch data* submissions – new section to specify the timing, use and standing data provisions<br>o Day-ahead timing is currently addressed in Chapter 7 Section 3.3A. Timing for the day-ahead market will be moved into this new Chapter 7A section 2 and modified to reflect the timing of the submission windows: day-ahead market submission window (unrestricted window), day-ahead market restricted window and restrictions on *dispatch data* submissions applicable to the day-ahead market. This section will also include *dispatch data* submissions during *market participant* or *IESO* tool failures.<br>o The day-ahead market will include standing *dispatch data* provisions. Under the Offers, Bids and Data Inputs chapter standing *dispatch data* for *energy* and *operating reserve* will include all applicable daily and hourly *dispatch data* parameters. Refer to Section 3.3 of Chapter 7. Standing *dispatch data* construct for *energy* will be extended for use by new price responsive loads and virtual transactions in the day-ahead market. The Grid and Market Operations Integration design document describes timing and conversion of standing *dispatch data* at 06:00EPT for use in the day-ahead market, with reference to Chapter 7 revised Section 3.3.9 as applicable.<br>o The availability declaration envelope ("must *offer*") provisions in Section 3.3 of Chapter 7 will be moved to new Chapter 7A. *Registered market participants* will be required to submit *dispatch data* into the day-ahead market for a *dispatchable generation facility*, a *dispatchable load facility*, and an *hourly demand response* resource in order to be eligible for participation in the *real-time market*. There is no requirement for *dispatch data* to be submitted into the day-ahead market in order for a |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | | *self-scheduling generation facility*, an *intermittent generator,* a *transitional scheduling generator* or a *boundary entity* to be eligible to participate in the *real-time market*.<br>• The form of *dispatch data* – refer to the Offers, Bids and Data Inputs design document.<br>• *Variable generator* new option to submit own forecast – Sections 6.4.2.9A/B of Chapter 7 establish a high operating limit. These sections will be moved and re-used for the *real-time market*. For the day-ahead market, new sections are required under Section 2 of Chapter 7A to establish a high operating limit that also takes into account the *IESO* forecast vs a submitted forecast for *variable generation*, to ensure that if the *market participant* submits its own forecast that it will be used in setting the high operating limit for DAM Pass 1 and DAM Pass 3. The IESO forecast will be used for DAM Pass 2.<br>• Virtual transaction data – refer to the Offers, Bids and Data Inputs design document for the form of virtual transaction data.<br>• *Offers* and *bids* – refer to the Offers, Bids and Data Inputs design document<br>• *Operating reserve offers* – refer to the Offers, Bids and Data Inputs design document<br>• Update information – refer to the Offers, Bids and Data Inputs design document for information that requires update. Timing of updates to be addressed under the Grid and Market Operations Integration design document.<br>OVERLAP: Offers, Bids and Data Inputs |
| Chapter 7A, Section 3 | New | DAM Calculation Engine | Section 3 NEW:<br>• New section to detail the *IESO* obligation to determine day-ahead *market schedules* and prices using the day-ahead market calculation engine as described in this section and in new Appendix 7A.X. This section will also |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| | | | provide high level description of the day-ahead market calculation engine under the following subject matter:<br>o Purpose<br>o Optimisation<br>o Inputs<br>o Description of the passes<br>o Outputs<br>• Existing Section 4 of Chapter 7 which is currently applicable to both pre-dispatch and real-time will be replaced with new section 4A (pre-dispatch) and new section 4D (real-time), This new Section 3 of Ch7A will be similar, and will provide high-level information which will be described in greater detail in new Appendix 7A.X (day-ahead market calculation engine)<br>• This section will include obligations related to market remediation for day-ahead market calculation engine failures and errors, and describe circumstances under which the calculation engine may be re-run.<br>OVERLAP: Offers, Bids and Data Inputs and Day-Ahead Market Calculation Engine. |
| Chapter 7A, Section 3.1 | New | DAM Calculation Engine: Purpose of the DAM Calculation Engine | Section 3.1 NEW:<br>• New section to provide a high-level description of the day-ahead market calculation engine.<br>OVERLAP: Day-Ahead Market Calculation Engine |
| Chapter 7A, Section 3.2 | New | DAM Calculation Engine: Optimisation Objective of the DAM Calculation Engine | Section 3.2 NEW:<br>• New section to describe the optimization objective of the day-ahead market calculation engine.<br>OVERLAP: Day-Ahead Market Calculation Engine |
| Chapter 7A, | New | DAM Calculation Engine: Inputs to the DAM | Section 3.3 NEW:<br>• New section to provide a summary of the inputs to the day-ahead market calculation engine. The section will |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| Section 3.3 | | Calculation Engine | refer to new Appendix 7A.X where the inputs will be described in greater detail. The form of the inputs is described in the Offers, Bids and Data Inputs design document while the applicability to the day-ahead market calculation engine and revisions to inputs is described in the Grid and Market Operations Integration design document. The *IESO* will be authorized to modify *IESO* inputs during the execution of the day-ahead market only if there is an input error.<br>• Inputs may include but are not limited to:<br>o *Dispatch data* in accordance with new Section 2 of Chapter 7A<br>o *Demand* forecasts and centralized *variable generation* forecast.<br>o Data required to support the *IESO-controlled grid* model (network model, *security limits*, etc.)<br>o Maximum market clearing price, maximum *operating reserve* price and penalty functions for the violation of constraints<br>o Market power mitigation parameters<br>o Virtual transaction zonal trading entities<br>OVERLAP: Offers, Bids and Data Inputs |
| Chapter 7A, Section 3.4 | New | DAM Calculation Engine: Multiple Passes of the DAM Calculation Engine | Section 3.4 NEW:<br>• New section to summarize the passes of the day-ahead market calculation engine:<br>OVERLAP: DAM Calculation Engine |
| Chapter 7A, Section 3.5 | New | DAM Calculation Engine: Outputs of the DAM Calculation Engine | Section 3.5 NEW:<br>• New section to describe the outputs of the day-ahead market calculation engine. The outputs will be described in further detail in the applicable appendix. Timing of *publication*/release of outputs to be specified in new Chapter 7A Sections 4 and 5.<br>• Cross references to Section 4A.3 of Chapter 7 may be required when outputs of the day-ahead market |

| Market Rule Section | Type | Topic | Requirement |
| --- | --- | --- | --- |
| | | | engine become inputs to the pre-dispatch calculation engine.<br><br>OVERLAP: DAM Calculation Engine |
| Chapter7, Section 4 | New | Day-Ahead Market Schedules and Prices | Section 4 NEW:<br>• New section to contain high-level provisions related to timelines for the operation of the day-ahead market and provisions related to schedules and prices.<br>• Administration of day-ahead market prices may be included in Section 8 of Chapter 7 alongside administration of *real-time market* prices or may be included in new Section 4 of Chapter 7A.<br><br>OVERLAP: DAM Calculation Engine, Publishing and Reporting, and Market Settlements |
| Chapter 7A, Section 4.1 | New | Day-Ahead Market Schedules and Prices: Timelines | Section 4.1 NEW:<br>• New section to contain high-level provisions related to timelines for the day-ahead market, including timing of the *dispatch data* submission window, timing of expected day-ahead market execution and *publication*, timing of extended day-ahead market execution and publication (with *IESO* notification of expected delay)<br><br>OVERLAP: Publishing and Reporting with respect to publication of day-ahead market results. |
| Chapter 7A, Section 4.2 | New | Day-Ahead Market Schedules and Prices: Day-Ahead Market Prices | Section 4.2 NEW:<br>• New section to specify *IESO* obligations to determine day-ahead market prices.<br>• Cross references may be required to existing Section 8 of Chapter 7 if the determination of market prices is placed together with the existing *market rules* under Section 8.<br>• The new section will be comparable to new Section 4B.2 of Chapter 7 (formerly information in Section 5.4) and Section 4E.2 of Chapter 7 (formerly in Section 6.4).<br><br>OVERLAP: Market Settlements, Day-Ahead Calculation Engine |

| Market Rule Section | Type | Topic | Requirement |
|---|---|---|---|
| Chapter 7A, Section 4.3 | New | Day-Ahead Market Schedules and Prices: Day-Ahead Market Schedules | Section 4.3 NEW:<br>• New section to specify the determination of day-ahead *market schedules* and commitments. Cross references to Sections 4B.3 (pre-dispatch) and 4E.3 (real-time) may be required. |
| Chapter 7A, Section 5 | New | Releasing and Publishing Day-Ahead Market Information | Section 5 NEW:<br>• New section to contain provisions on the *publishing* of day-ahead market public information results and on the release to *market participants* of their individual confidential information results. This section is primarily applicable to the Publishing and Reporting design document. The Grid and Market Operations Integration design document establishes the timelines of target *publishing* (13:30EPT) and specifies that the *IESO* will notify *market participants* if the *publication* is expected to be late, and provide a new target timeline.<br>OVERLAP: Publishing and Reporting |
| Chapter 7A, Appendix 7A.X | New | Day-Ahead Market Calculation Engine | Appendix 7A.X<br>• New appendix required to provide the details of the day-ahead market calculation engine. The new appendix will be created under the Day-Ahead Market Calculation Engine design document. Aspects of the Grid and Market Operations Integration design document will be incorporated into the new appendix.<br>OVERLAP: Offers, Bids and Data Inputs, Day-Ahead Calculation Engine |

**– End of Section –**

# 5. Procedural Requirements

## 5.1. Market-Facing Procedure Impacts

Existing *market manuals* and training materials related to the Grid and Market Operations Integration processes will be retained to the extent possible. Updates will be made to all applicable *market manuals* that reflect changes to the day-ahead, pre-dispatch and real-time scheduling processes. Reference to CMSC and DA-IOG will be removed from all *market manuals*. The documents most directly related to the Grid and Market Operations Integration detailed design process are the following:

*Market Manuals*:

- Market Manual 1: Connecting to Ontario's Power System, Part 1.5 - Market Registration Procedures
- Market Manual 4: Market Operations, Part 4.2 - Submission of Dispatch data in the RT Energy and Operating reserve markets;
- Market Manual 4: Market Operations, Part 4.3 - Real Time Scheduling of the Physical Markets;
- Market Manual 4: Market Operations, Part 4.4 - Transmission Rights Auction;
- Market Manual 4: Market Operations, Part 4.5 - Market Suspension and Resumption;
- Market Manual 4: Market Operations, Part 4.6 - RT Generation Cost Guarantee Program;
- Market Manual 7: System Operations, Part 7.1 - IESO-Controlled Grid Operating Procedures;
- Market Manual 7: System Operations, Part 7.2 - Near-Term Assessments and Reports;
- Market Manual 7: System Operations, Part 7.3 - Outage Management;
- Market Manual 9: Day-Ahead Commitment, Part 9.0 - DACP Overview;
- Market Manual 9: Day-Ahead Commitment, Part 9.2 - Submitting Operational and Market Data for the DACP;
- Market Manual 9: Day-Ahead Commitment, Part 9.3 - Operation of the DACP;
- Market Manual 9: Day-Ahead Commitment, Part - 9.4 Real-Time Integration of the DACP; and
- Market Manual 9: Day-Ahead Commitment, Part - 9.5 Settlement for the DACP.

Training Material:

- Guide to the Day-Ahead Commitment Process.

The following tables identify sections within *market manuals* and training materials that will not require changes, will require modification and new sections that will need to be added to support the Grid and Market Operations Integration processes in the future market.

**Table 5-1: Impacts to Market Manual 1 Connecting to Ontario's Power System**

| Procedure | Type of change (no change, modification, new) | Section | Description |
|---|---|---|---|
| Part 1.5 – Connecting to Ontario's Power System | Modification | 3.4 Day-Ahead Commitment Process – Registration Requirements<br>3.5 Day-Ahead Commitment Process – Combined Cycle Plants Registration Requirements | Refer to Table 5-1 in the Facility Registration detailed design document. |

**Table 5-2: Impacts to Market Manual 4 Market Operations**

| Procedure | Type of change (no change, modification, new) | Section | Description |
|---|---|---|---|
| Part 4.2 – Submission of Dispatch data in the RT Energy and Operating reserve markets | No change | 1.3 - Roles and Responsibilities | • This detailed design document does not impact this section. |
| | Modification | 2.0 Real-Time Energy and Operating Reserve Markets | • *Dispatch data* definition to be expanded from *offers* and *bids* to include new daily and hourly *dispatch data* parameters that will be used to determine *dispatch instructions* for each *registered facility* and *boundary entity*. |
| | Modification | 2.1 - Offers and bids for Energy and Offers for Operating Reserve in the Real-time Energy Markets | • Reference to CAOR to be removed. The *IESO* will no longer include voltage reductions and reductions in the *thirty-minute operating reserve* requirements as standing *offers* in the *operating reserve* market. |
| | No change | 2.2 - Energy Schedules and Forecasts | • Self-scheduling generation facilities and intermittent *generators* will continue to be required to submit self-schedules or forecasts in the *real-time market*. The *IESO's* centralized *variable generation* forecast will continue to be used for variable *generators*. |

| Procedure | Type of change (no change, modification, new) | Section | Description |
| --- | --- | --- | --- |
| Part 4.2 – Submission of Dispatch data in the RT Energy and Operating reserve markets | Modification | 2.3 - Timing of the Real-Time Energy and Operating Reserve Markets | • Timelines for *dispatch data* submission on the *pre-dispatch day* to be modified to reflect the DAM running in EPT.<br>• Timeline for initial PD calculation engine run to be updated to reflect that evaluation will occur at 20:00EST.<br>• Timelines for *dispatch data* submission, revisions and restrictions to be revised to reflect differences in *dispatch data* submissions for hourly *dispatch data* and daily *dispatch data*.<br>• Manual to indicate that revisions to daily *dispatch data* will be restricted after DAM schedules, commitments and prices are *published*. Revisions for daily *dispatch data* parameters, other than speed-no-load and *start-up offers*, will no longer require *IESO* approval. Instead, *registered market participants* will provide a reason as per those outlined in the *market rules*.<br>• Manual to reflect that *dispatch data* submissions or revisions for a *boundary entity* without a DAM schedule will only be evaluated in the first two forecast hours of pre-dispatch.<br>• *Dispatch data* revisions, by *facilities* designated as dispatchable, that wish to increase an *offer* or *bid* quantity above an ADE must now be submitted with a reason. |
| | Modification | 2.3.1 - Generation Units with Start-Up Delays | • Procedure for *generation unit*s with start-up delays in PD to be removed. New *dispatch data* parameters, Lead Time and Ramp to MLP, will be used to model the time required for a *generation unit* to prepare, synchronize to the *IESO-controlled grid*, and reach its *minimum loading point*. |

| Procedure | Type of change (no change, modification, new) | Section | Description |
|---|---|---|---|
| Part 4.2 – Submission of Dispatch data in the RT Energy and Operating reserve markets | Modification | 2.3.2 - Replacement *Energy* Offers Program | • The Replacement *Energy* Offers program will be modified to indicate that real-time commitments will not be transferred to the replacement unit for NQS *generation units*.<br>• Modifications required to procedural steps in order to distinguish between hourly *dispatch data* and daily *dispatch data*. Timing updates required to reflect use of EPT timeframe for DAM.<br>• Modifications required to reflect new restrictions to hourly *dispatch data* parameters associated with NQS resources following the DAM; or upon receiving a DAM operational commitment and schedule, or a PD operational commitment.<br>• Modifications required to reflect new restrictions to hourly *dispatch data* parameters associated with NQS resources following the DAM; or upon receiving a DAM operational commitment and schedule, or a PD operational commitment. |
| | Modification | 2.3.3 - Procedural Steps for Submitting Dispatch Data and Revisions Until Two Hours Prior to the Dispatch Hour<br><br>2.3.4 - Procedural Steps for Submitting Dispatch Data and Revisions Within Two Hours of the Dispatch Hour | • Addition required to reflect ability of *registered market participants* that operate a dispatchable *facility* to submit an ADE expansion request when revising *dispatch data* for one or more *dispatch hours* through the MP-GUI. Addition also required to reflect that the *IESO* will notify *market participants* of their new ADE if the expansion request is approved.<br>• Procedure for *dispatch data* revisions to be amended to reflect rules and exceptions for daily *dispatch data* revisions. |

| Procedure | Type of change (no change, modification, new) | Section | Description |
|---|---|---|---|
| Part 4.2 – Submission of Dispatch data in the RT Energy and Operating reserve markets | Modification | 2.4 - The Structure of Dispatch Data:<br>2.4.1. Energy Offers and Bids<br>2.4.2. OR Offers<br>2.4.3 Energy Schedules and Forecasts | • Please consult the Offers, Bids and Data Inputs detailed design document for a list of modifications to this *market manual* section. |
| | Modification | 2.4.4. Standing Dispatch Data | • Timelines for the processing of standing *dispatch data* to be modified to reflect the EPT timeframe. |
| | Modification | 2.5 Dispatch Data for Importing and Exporting Energy and Importing Operating Reserve<br>2.5.1 Boundary Entity Resources<br>2.5.2 Ramp Rates<br>2.5.4 Wheeling Through Interchange Schedules | • Please consult the Offers, Bids and Data Inputs detailed design document for a list of modifications to this *market manual* section. |
| | No change | 2.5.3 e-Tagging<br>2.5.5 Validation | • E-Tags will continue to be submitted at least 32 minutes prior to the *dispatch hour*. |
| | Modification | 2.6 Capacity Exports | • Manual to be updated to reflect that submitted e-Tags will no longer be required to contain "ICAP". Instead, the capacity transaction *dispatch data* parameter will be submitted as *dispatch data* for each hour that an export *bid* is submitted for a *called capacity export*. |

| Procedure | Type of change (no change, modification, new) | Section | Description |
|---|---|---|---|
| | Modification | 2.7 Requests for Segregated Mode of Operation | • Update required to reflect the EPT timeframe for the *pre-dispatch day*.<br>• Timelines for SMO submission and cancellation to be updated to reflect that outages to a critical transmission element must now be submitted by 8:00 EPT for the following *dispatch day*. |
| Part 4.2 – Submission of *Dispatch data* in the RT *Energy* and *Operating reserve* markets | Modification | 2.8 Publication of Pre-dispatch Schedules | • Updates required to reflect new timing for *publishing* of the initial *pre-dispatch schedule*.<br>• Updates required to reflect that *pre-dispatch schedules* will not be determined using *dispatch data* from price responsive loads and virtual traders for *energy*. Further, forecast quantities submitted by *registered market participants* for a *variable generator* will also not be used to determine *pre-dispatch schedules*. |
| | Modification | Appendix B: Short Change Notice Criteria | • Updates required to describe the *real-time market* mandatory window for hourly and daily *dispatch data* including criteria for changes within the mandatory window.<br>• *Dispatch data* changes will continue to adhere to criteria set forth in the *market rules*. |
| | Modification | Appendix D: Pre-dispatch Schedule Production and Publication | • This section will be replaced. Items to be replaced include new timelines for the *pre-dispatch day, dispatch day* and *dispatch hour* in Figure D-1. |
| | No change | Appendix E: Boundary Entity Resources<br>Appendix F: Ontario Specific E-Tag Requirements | • This detailed design document will not impact these sections. |

| Procedure | Type of change (no change, modification, new) | Section | Description |
|---|---|---|---|
| Part 4.3 - Real Time Scheduling of the Physical Markets | Modification | 1.3 Roles and Responsibilities | • *Market Participant* responsibilities to be updated to indicate:<br>• *Market participants* will be required to confirm receipt of and ability to comply with binding start-up and de-commitment notifications.<br>• *IESO* responsibilities to be updated to indicate that:<br>• The *IESO* will issue binding start-up and de-commitment notifications to *registered market participants* operating dispatchable NQS *generation facilities*.<br>• The *IESO* will track the amount of *energy* produced by dispatchable hydroelectric *generation units* and the number of starts they have incurred in a *dispatch day*. |
| | No change | 2.0 Participant Workstation and Dispatch Workstation | • *Market participants* will be required to operate a *participant workstation* and *dispatch workstation* for the purposes of supporting the process of determining the *real-time schedule*. |

| Procedure | Type of change (no change, modification, new) | Section | Description |
|---|---|---|---|
| Part 4.3 - Real Time Scheduling of the Physical Markets | Modification | 3.0 Determining Real-Time Schedules | • The list of information used to determine *real-time schedules* will be updated to reflect:<br>o New hourly and daily *dispatch data* parameters that will be used by the RT calculation engine.<br>o *Dispatch data* parameters that will replace registration parameters as inputs into the RT calculation engine; *forbidden regions* and *minimum loading point*.<br>o Adjustments to the 5-min global *demand* forecast will be automatically apportioned to each *demand* area based on the relative *demand* in that area.<br>• The high level description on how this information is used to determine real-time *dispatch* will be updated to reflect:<br>o *Dispatch data* parameters that will be used by the RT calculation engine to determine *real-time schedules* for hydroelectric *generation facilities.*<br>o *Dispatch data* parameters and NQS *generation unit* commitment constraints that will be used to determine *real-time schedules* for NQS *generation facilities.*<br>o The RT calculation engine will evaluate *offers* for PSU to determine economic *dispatch* schedules for PSUs. Schedules for PSUs will be translated into *dispatch instructions* and *dispatch* advisories for the physical *generation units* represented by the PSU. |
| | Modification | 4.0 Determining Market Information | • This section will be updated to reflect the introduction of a single schedule market. Inputs used to determine schedules will also determine price in the future market. The list of exceptions will be updated to indicate the situations where the pricing run may continue to use a different input. |

| Procedure | Type of change (no change, modification, new) | Section | Description |
|---|---|---|---|
| Part 4.3 - Real Time Scheduling of the Physical Markets | Modification | 5.0 Releasing Real-Time and Market Information | • This section will be modified to remove references to the *market schedule* and control action *operating reserve* (CAOR).<br>• Updates to this section pertaining to public and confidential reports are described in the Publishing and Reporting Market Information detailed design document. |
| | New | TBD - Determining Binding Start-up Instructions | • New section required to describe how binding start-up instructions will be determined for non-quick start resources. Subsection will include *dispatch data* parameters that will be used to determine instructions. |
| | New | TBD - Issuing Binding Start-Up Instructions | • New section required to reflect that binding start-up instructions will now be sent to dispatchable non-quick start resources. Subsection will include *IESO* and *market participant* obligations for issuing and acknowledging binding start-up instructions. |
| | Modification | 6.1 Registered Facilities | • To be updated to reflect that the *dispatch algorithm* will be able to produce a *real-time schedule* for combustion turbines and steam turbines by evaluating *pseudo-unit offers* for *combined cycle facilities* offering into the market as a PSU.<br>• To be updated to reflect that the *dispatch algorithm* will use additional *dispatch data* parameters to determine *pre-dispatch schedules* and real-time *dispatch* schedules for dispatchable hydroelectric *generation facilities*. |
| | No change | 6.2 HDR Resources<br>6.3 Boundary Entities | • These sections will not be impacted by this detailed design document. |

| Procedure | Type of change (no change, modification, new) | Section | Description |
|---|---|---|---|
| Part 4.3 - Real Time Scheduling of the Physical Markets | Modification | 6.4.1 IESO/NYISO Protocol: NY90 | • Minor updates required to reflect the new timelines of the day-ahead market and *pre-dispatch scheduling* process. The IESO/NYISO NY90 protocol remains unchanged.<br>• Curtailment codes associated with the NY90 protocol are to be updated to reflect an additional identifier that is to be added to the existing codes. Identifier will differentiate make-whole eligibility between scenarios where the IESO reduced, fixed or increased the *intertie* transaction schedule. |
| | Modification | 6.4.2 Curtailed and Failed Interchange Schedules | • *Curtailment* codes are to be updated to reflect an additional identifier that is to be added to the existing codes. Identifier will differentiate make-whole eligibility between scenarios where the *IESO* reduced, fixed or increased the *intertie* transaction schedule. |
| | Modification | 6.4.4 IESO/Hydro-Quebec: Capacity Agreements | • Section to be updated to reflect that export *bids* or import *offers* submitted by Hydro-Quebec into the *IESO-administered markets* are to be submitted with the capacity transaction hourly *dispatch data* parameter.<br>• This section will be modified to indicate that an export *bid* or import *offer* submitted by Hydro-Quebec in any hour that is more than two hours from the *dispatch hour* will be evaluated by the PD calculation engine. |
| | Modification | 6.5 Pre-Emptive Curtailments | • *Curtailment* codes are to be updated to reflect an additional identifier that is to be added to the existing codes. Identifier will differentiate make-whole eligibility between scenarios where the *IESO* reduced, fixed or increased the *intertie* transaction schedule. |
| | Modification | 6.6 Transaction Coding | • Table 6-1: Application of Interchange Schedule Codes, to be updated to reflect new *curtailment* identifiers for make-whole eligibility. |

| Procedure | Type of change (no change, modification, new) | Section | Description |
|---|---|---|---|
| Part 4.3 - Real Time Scheduling of the Physical Markets | Modification | 6.7 Capacity Export Scheduling and Curtailment | • Delivery and *curtailment* provisions for a *called capacity export* will not change.<br>• Updates required to reflect that an exports bid for a *called capacity export* will be evaluated by the PD calculation engine in hours T+2 and beyond. |
| | Modification | 7.1 Registered Facilities | • Section to be modified to indicate that PSU *real-time schedules* will be based on the most limiting of:<br>• The last *real-time schedule* for the PSU and *offered* PSU ramp rate, or<br>• Calculated MW output for the PSU and the *generation facility's* effective maximum ramp rate.<br>• PSU *real-time schedules* will be translated into *dispatch instructions* issued to the related CT and ST. |
| | No Change | 7.2 Hourly Demand Response Resources | • Timelines for Standby notices and activations for resources will continue as is. |
| | Modification | 7.3 Boundary Entities | • Modifications required to reflect new identifiers required on curtailments for appropriate make-whole *settlement*. *Dispatch instructions*, e-tag evaluation and procedures for confirming *interchange schedules* with *external control areas* will not be impacted by this detailed design document. |
| | No change | 7.4 Dispatch of Operating Reserve | • When issuing *dispatch instructions* to *facilities* providing *operating reserve*, the *IESO* will continue to call first on the *facility* that has *offered* the lowest price. The *IESO* reserves the right to not call in strict order of increasing price if it determines that doing so will inhibit it from responding in a timely fashion to a contingency event. |

| Procedure | Type of change (no change, modification, new) | Section | Description |
|---|---|---|---|
| Part 4.3 - Real Time Scheduling of the Physical Markets | No change | 7.5 Manual Procurement of Operating Reserve during forced or planned tool outages | • No change to existing operating procedures. |
| | Modification | 7.6 Compliance with Dispatch Instructions | • Modification to include information on *dispatch* compliance for *combined cycle facilities* that elect to *offer* as a PSU. |
| | Modification | 7.7 Generation Units Turnaround Time | • Section to be updated to reflect that NQS *generation units* will be scheduled by the PD calculation engine in a manner that respects their submitted MGBDT. Procedures will be added to describe required *market participant* and *IESO* actions when the RT calculation engine does not *dispatch* off the NQS *generation unit* and there is a conflict respecting both MGBDT and a future commitment. |
| | No Change | 8.0 Issuing Dispatch Advisories | • The *IESO* will continue to issue *dispatch* advisories for each *registered facility* that is a *dispatchable load* or dispatchable *generator*, other than a *boundary entity* or HDR resource, prior to each *dispatch interval*. |

| Procedure | Type of change (no change, modification, new) | Section | Description |
|---|---|---|---|
| Part 4.3 - Real Time Scheduling of the Physical Markets | Modification | 9 – Administrative Pricing | Updates required to the Introduction Section as follow:<br>• The *IESO* will not retroactively correct DAM prices and schedules as correcting the DAM prices after the operating day does not necessarily result in a more optimal outcome due to the implications on the *real time market*.<br>• Public communication will advise that DAM financially binding schedules or prices will not be created or posted due to a DAM failure<br>• A fourth reason whereby the *IESO* establishes *administrative pricing* will be added to account for the formation of an electrical island. This will be listed in the introduction to section 9. The *IESO* will use *administrative prices* for resources in the electrical island in the future.<br>• *Administrative prices* could be applied either to a specific location on the system if prices in that location are incorrect, or for all locations if the incorrect price is widespread and *administrative prices* are used for all LMPs<br>Current *administrative price* correction methods listed below will need to be updated:<br>• Prices used from the closest preceding *dispatch interval* and closest subsequent *dispatch intervals* each for up to 24 intervals for a total of 48 intervals will be reduced to up to a total of 24 combined *dispatch intervals.*<br>• Hourly average prices will change to hourly average locational prices from the corresponding hour from the four most recent *business day*s or non-*business day*s that have not been administered. |

| Procedure | Type of change (no change, modification, new) | Section | Description |
|---|---|---|---|
| Part 4.3 - Real Time Scheduling of the Physical Markets | Modification | 9 – Administrative Pricing | Updates required to *administrative price* correction methods. The following methods will be reflected:<br>• Use of recalculated prices derived from an offline study tool that replicates the RT calculation engine.<br>• Use of DAM prices from the corresponding hour and operating day.<br>• Use of prices at an electrically similar node that does not require *administrative pricing* during the same *dispatch interval.*<br>• In the future market, a change to allow pricing corrections to be made within four *business days* from two *business days* after the affected operating day is required as the number of prices and data associated with those prices significantly increases with the introduction of LMPs. |
| Part 4.3 - Real Time Scheduling of the Physical Markets | Modification | 10.0 Compliance Aggregation | • Updates required to reflect that non-quick start *generation units* registered as a PSU will be permitted to use compliance aggregation over their entire operating range. |
| Part 4.4 - Transmission Rights Auction | No change | All Sections | • This detailed design document does not impact this *market manual*. |
| Part 4.5 - Market Suspension and Resumption | No Change | All Sections other than Section 2, 3 and Appendix A | • No changes required to sections other than section 2 market suspension and section 3 market resumption. |
| Part 4.5 - Market Suspension and Resumption | Modification | Section 2 – Market Suspension<br>Section 3 – Market Resumption | • Update to include DAM scheduling process which will need to stop while the RTM is suspended and until it resumes. |

| Procedure | Type of change (no change, modification, new) | Section | Description |
|---|---|---|---|
| Part 4.6 - RT Generation Cost Guarantee Program | Modification | Entire document | • NQS *generation units* will be committed through the *pre-dispatch scheduling* process in the future market, replacing the RT-GCG program. This market manual will be updated and/or replaced to reflect the new commitment mechanism, roles and responsibilities, supporting procedures and associated timelines. |
| Part 4.6 - RT Generation Cost Guarantee Program | Modification | 4.3 Replacement Energy Offer Program (REOP) | • Updates required to reflect that the *IESO* will no longer transfer a commitment from a NQS *generation unit* experiencing a *forced outage* to a replacement unit. |
| Part 4.6 - RT Generation Cost Guarantee Program | Modification | 4.4.1 Combined Cycle Facilities | • If a combined cycle *generation facility* elects to *offer* into the market as physical *generation units*, the steam turbine *generation unit* will no longer be constrained on unless it is required to prevent endangering the safety of any person, equipment damage or the violation of an *applicable law* (SEAL). |

**Table 5-3: Impacts to Market Manual 7 System Operations**

| Procedure | Type of change (no change, modification, new) | Section | Description |
|---|---|---|---|
| Part 7.1 - IESO-Controlled Grid Operating Procedures | Modification | 4.2.2 - Generators | • NQS *generation units* will be committed by the *IESO* in the future market. Notification of commitment and de-commitment will be initiated by the *IESO*. This section will be updated to reflect timelines and procedures for synchronization and desynchronization in the future market. |

| Procedure | Type of change (no change, modification, new) | Section | Description |
|---|---|---|---|
| Part 7.1 - IESO-Controlled Grid Operating Procedures | Modification | Appendix B: Emergency Operating State Control Actions | • The *emergency operating state* control action (EOSCA) list will change to reflect new control actions and refine the order of existing control actions. Modifications that have been identified to date include:<br>o Table B.1: Additional control action to be added to reflect scheduling of import *offers* without DAM schedules in pre-dispatch beyond two hours in the future.<br>o Table B.2: *Demand* adjustments following a *voltage reduction* or load shedding will be applied globally and automatically assigned to the four *demand* forecast areas. |
| Part 7.1 - IESO-Controlled Grid Operating Procedures | No change | All other sections | • This detailed design document does not impact these sections. |
| Part 7.2: Near-Term Assessments and Reports | Removed | 5.0 Control Action Operating Reserve | • Section to be discarded. Control action *operating reserve* will not be implemented in the new market. |
| | Modification | Appendix B: Method to Prepare Ontario Demand Forecast | • Section to be updated to indicate that the *IESO* will produce the existing province-wide *demand* forecast as the sum of four separate *demand* forecast areas. |
| | No change | All sections other than 5.0 and Appendix B | • This detailed design document does not impact these sections. Changes to these sections are described in the Publishing and Reporting detailed design document and Offers, Bids and Data Inputs detailed design document. |

| Procedure | Type of change (no change, modification, new) | Section | Description |
|---|---|---|---|
| Part 7.3: Outage Management | Modification | General | • Minor changes throughout to reflect the EPT timeframe for *outage* submission deadlines when an *outage* is required as input into the DAM scheduling process. |
| | Modification | 4.0 Outage Reporting Requirements | • Updates required to indicate that *combined cycle facilities* that elect to *offer* into the market as a PSU will continue to submit *outages* on the physical *generation units*. |
| | Modification | 4.1.1 Deratings | • Fossil *generation units* with known start-up delays will no longer be required to cancel their *offers* for the hours in which their units are unavailable. Lead time, ramp to MLP and MGBDT parameters will be used in the future market to schedule NQS *generation units* while respecting operational limitations related to start-up. |
| | Modification | 4.1.4 Segregated Mode of Operation | • Updates required to reflect new timelines for SMO submission, which will depend on whether the request for *segregated mode of operation* requires an outage to a critical transmission *facility*. |
| | No change | All other sections | • This detailed design document does not impact other sections of this market manual. |

**Table 5-4: Impacts to Market Manual 9 Day-Ahead Commitment**

| Procedure | Type of change (no change, modification, new) | Section | Description |
|---|---|---|---|
| Part 9.0: DACP Overview | Modification | All Sections | • Market Manual 9 to be replaced. DACP will be replaced with a financially-binding DAM. |
| Part 9.2: Submitting Operational and Market Data for the DACP | Modification | 5.3 Request for Segregated Mode of Operation | • Updates required to reflect that *segregated mode of operation* submissions and cancellations that require an *outage* to a critical transmission element must be submitted by 08:00 EPT. |
| | Modification | 5.4 Submit Regulation Offers | • Updates required to reflect DAM timelines. |
| | Modification | 5.5 Procedure for Submitting Dispatch Data during Contingencies | • Updates required to reflect DAM timelines. |
| | Modification | Appendix A: Reason Codes and Valid Reasons for Change | • Updates required to reflect DAM and updates to market-facing tools. |
| | Modification | All other sections | • Please see details in the Offers, Bids and Data Inputs detailed design document. |
| Part 9.3: Operation of the DACP | Modification | All sections | • All mention of DACP will need to be changed to DAM. |
| | Modification | New | • The ability to schedule flex OR will be incorporated into the day-ahead market.<br>• A new section detailing this and enabling the *IESO* to determine if flex OR is required will be included. |
| | Modification | New | • A new section will need to be created to speak to DAM failures.<br>• A new section will need to be created to speak to DAM delays |

| Procedure | Type of change (no change, modification, new) | Section | Description |
|---|---|---|---|
| Part 9.3: Operation of the DACP | Modification | 4 - Overview of the Operation of the DACP | • Any mention of multiple DACE runs needs to be updated to a single DAM calculation engine run. |
| | Modification | 4.3 - Optimization Process Overview | • Section to be updated with nine passes in the future day-ahead market which includes figure 4-3.<br>• New subsections will be added for each pass for a total of nine subsections.<br>• Three subsections for the current three passes will be removed. |
| | Modification | 4.4 - Scheduling the DACE Runs | • This section will need to be updated to reflect one DAM calculation engine run. All current subsections for this section will need to be removed as they speak to additional DACE runs. |
| | Modification | 4.5 - Completion of DACP and the DACP Schedule of Record | • Any mention of a DACE run after the 10:00 (EPT) submission window deadline will be removed<br>• Any mention of *schedule of record* needs to be removed and replaced with similar private reports containing their financially binding schedules and commitments<br>• Any mention of EELR optimization run will be removed |
| | Modification | 4.6 - IESO Reliability Commitment Actions<br>4.7 - Principles for Applying DACP Commitment Actions | • These sections will be removed. |

| Procedure | Type of change (no change, modification, new) | Section | Description |
|---|---|---|---|
| Part 9.3: Operation of the DACP | Modification | 4.8.3 – DACP Report Descriptions<br>4.9 DACP Failure Reports<br>4.10 DACP Schedule of Record | • All report details will be listed in the Publishing and Reporting detailed design document.<br>• DACP *schedule of record* will cease to exist and will be replaced with other private reports.<br>• Any mention of multiple DACE runs, or DACE runs after 10:00 (EPT) will be removed in addition to any mention of shadow prices. |
| Part 9.4:RT Integration of the DACP | Modification | All sections | • All mention of DACP will need to be changed to DAM. |
| | Modification | 4.1 - Observing Day-Ahead Commitments in Real Time<br>4.1.2 - Passing DACP Commitments to Real Time<br>4.2.1 - Withdraw Dispatch Data<br>4.4.2 - Minimum Loading Point Price Cap | • Any mention of DA-PCG and *schedule of record* will need to be updated with DAM-MWP and similar private reports replacing *schedule of record.*<br>• Updates required to reflect that NQS *generation units* will be scheduled and dispatched no lower than their MLP for the duration of their MGBRT in PD through minimum constraints. Updates required to reflect that MLP and MGBRT will be submitted as daily *dispatch data*.<br>• Updates required to reflect that the initial PD calculation engine run will now be at 20:00EST. |
| | Modification | 4.2 De-commitment and Withdrawal | • Updates required to reflect that the *IESO* will now consider *speed-no-load costs* for the de-commitment of NQS *generation facilities* in the *pre-dispatch scheduling* process. Additionally, the *pre-dispatch scheduling* process will now automatically notify *market participants* of any de-commitment. |
| | Modification | 4.2.3 Day-Ahead Production Cost Guarantee Impact | • This section will need to be removed as it specifically discusses day-ahead production cost guarantee. |

| Procedure | Type of change (no change, modification, new) | Section | Description |
|---|---|---|---|
| Part 9.4:RT Integration of the DACP | Modification | 4.3 - Day-Ahead Intertie Transactions | • This section will be modified to state the additional coordination with other balancing authorities in the day-ahead market timeframe.<br>• This section will be revised to state that additional coordination is for informational purposes and will be performed post-DAM when Ontario is expected to be import dependent the next *dispatch day.*<br>• This section will be updated to reflect that only *intertie* transactions scheduled in the DAM will be evaluated in the PD look-ahead period in hours T+2 and beyond, with some exceptions (emergency *energy*, capacity exports and capacity imports) |
| | Modification | 4.4 - Real-Time Market Integration | • Any mention of *dispatch data* submitted after 10:00 (EPT) will need to be removed.<br>• This section to be updated to reflect that hourly and daily *dispatch data* parameters submitted in DAM will be used for evaluation by the pre-dispatch calculation engine.<br>• Updates also required to reflect that PSU *offer* submissions will now be evaluated on the *dispatch day* and in the *dispatch hour*. |
| | Modification | 4.4.1 - Pseudo Unit Offer Submission - Real Time | • Any mention of the DAM submission windows needs to be in EPT.<br>• Any mention of *dispatch data* submitted after 10:00 am EPT submission window closes will need to be removed.<br>• Updates also required to reflect that PSU *offer* submissions will now be evaluated on the *dispatch day* and in the *dispatch hour*. |
| | Modification | 4.4.2 - IESO De-commitment of Dispatchable Generation Facilities | • Any mention of CMSC needs to be removed. |

| Procedure | Type of change (no change, modification, new) | Section | Description |
|---|---|---|---|
| Part 9.4: RT Integration of the DACP | Modification | 4.5 Submit Dispatch Data | • Updates required to reflect that notification of ADE expansion submission will be made through the MP-GUI instead of phone.<br>• Updates required to reflect ability of *registered market participants* that operate a dispatchable *facility* to submit an ADE expansion request when revising *dispatch data* for one or more *dispatch hours* through the MP-GUI. |
| | No change | 4.5.6 – Submit Outage Requests | • This detailed design document does not impact other sections of this market manual. |
| | Modification | 4.6 Synchronize Units Committed in the Day-Ahead | • Updates required to reflect that constraints to MLP will be applied for hours to satisfy the *minimum generation block run-time* of a resource that was committed in DAM. |
| Part 9.5: Settlement for the DACP | Modification / New | All sections | • This manual will be replaced with a new manual to take into account changes for DAM. Please see details in the Market Settlement detailed design document. |

## 5.2. Internal Procedural Impacts

Most of the internal procedures used currently for the Grid and Market Operations Integration processes will continue to be used in the future day-ahead and *real-time market*. Similar to market facing procedures, changes to internal *IESO* procedures are required as a result of changes from the day-ahead, pre-dispatch and real-time scheduling processes.

In addition, some areas of the current procedures heavily reference applicable *market rules* and supporting tools, most of which will be undergoing changes as a result of the new day-ahead market implementation and other solution enhancements. The existing procedures will be updated to account for the corresponding changes in the *market rules* and tools.

Changes or additions to internal *IESO* procedures are for internal *IESO* use as documented in Appendix B and are not included in the public version of this document. Appendix B details the impacts to internal procedures in terms of existing procedures that support the new market requirements, existing procedures that need to be updated, and new internal procedures that need to be created to support the future *real-time market* and day-ahead market.

**– End of Section –**

# 6. Business Process and Information Flow Overview

## 6.1. Market Facing Process Impacts

This section provides an overview to the arrangement of processes required in order to support the overall Grid and Market Operations Integration processes and the critical information flows between them.

The context diagrams presented in Section 2 of this document are considered as level 0 data flow diagrams and represent the major flows of information into and out of the Grid and Market Operations Integration processes. This section now presents the Grid and Market Operations Integration processes at the next level of detail (Level 1). A further break-down of the processes presented in this section (i.e. levels 2,3,4...) falls into the realm of systems design and is beyond the scope of this document.

The data flow diagram does not illustrate:

- flow of time or sequence of events (as might be illustrated in a timeline diagram);
- decision rules (as might be illustrated in Flowchart); and
- logical architecture and systems architecture (as might be illustrated in a Logical Application and Data Architecture, and/or Physical Application and Data Architecture).

What it does illustrate however, is a logical breakdown of the sub-processes that constitute a large and complex system such as the Grid and Market Operations Integration processes. Specifically, the data flow diagram presented below illustrates:

- the Grid and Market Operations Integration processes as a grouping of several major and tightly coupled sub-processes;
- the key information flows between each of the processes;
- external sources of key information required by the Grid and Market Operations Integration processes;
- external destinations of key information from the Grid and Market Operations Integration processes; and
- the same logical boundary of the Grid and Market Operations Integration processes as illustrated in the Level 0 context diagram presented in Section 2 of this document.

This section is not meant to impart information systems or technology architecture, but rather to capture the entire Grid and Market Operations Integration process as a series of interrelated sub-processes.

The functional design outlined in Section 3 of this document maps to the business process overview presented in this section. In any areas where there are inconsistencies between this section and the description of the business process provided in Section 3, the business process described in Section 3 will take precedence.

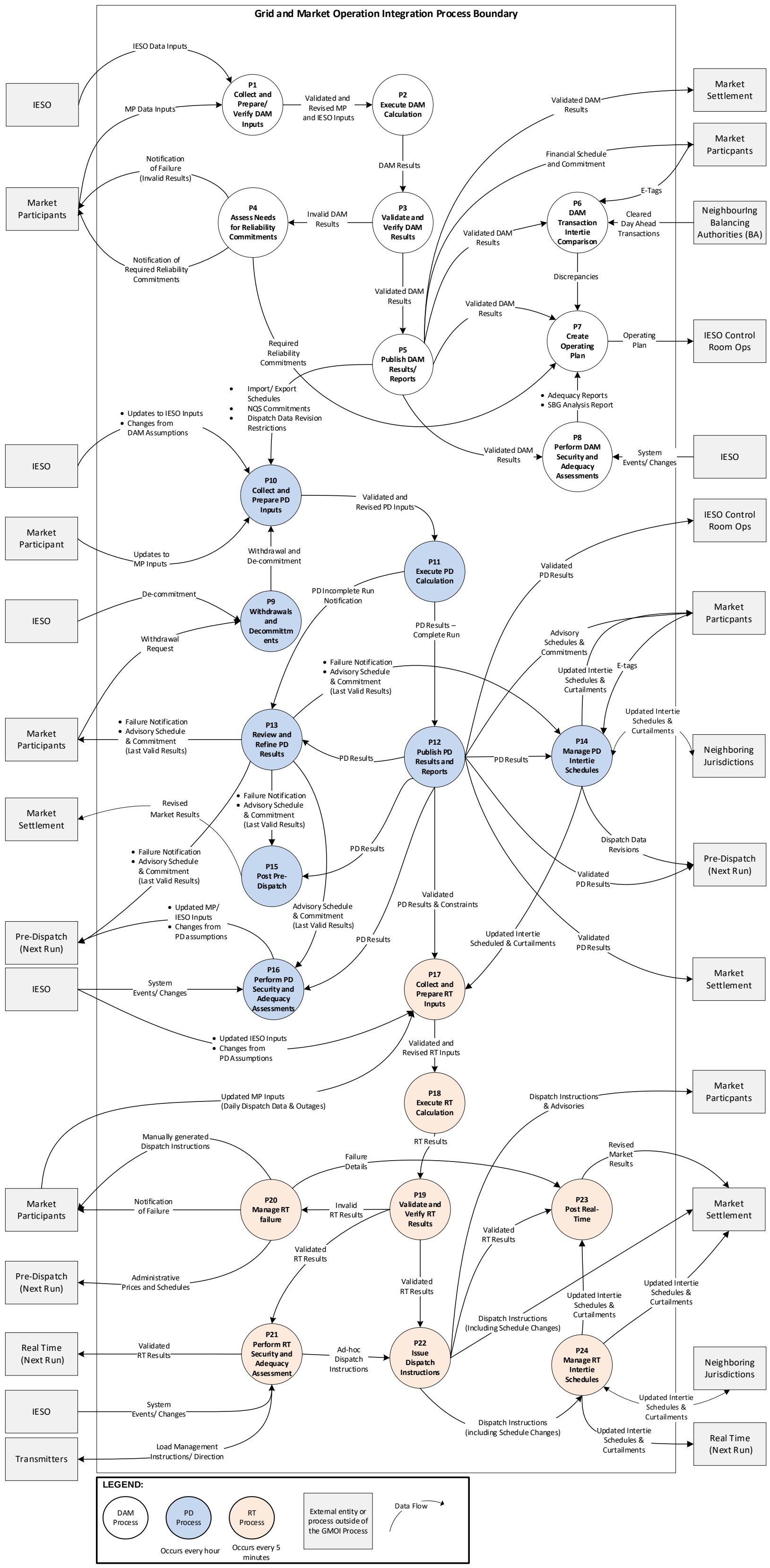
The data flow diagram illustrated in Figure 6-1 presents the Grid and Market Operations Integration processes for the future day-ahead, *pre-dispatch* and *real-time scheduling* process. The following sections of this document will provide an overview to each of the main sub-processes of the Grid and Market Operations Integration process.

### 6.1.1. Grid and Market Operations Integration Process Map

The process map illustrated in Figure 6–1 presents the context and components of the Grid and Market Operations Integration processes.

The process maps and corresponding Input and Output Data Flow tables presented in this section present the information and data descriptions at a summary level. For detailed data descriptions please refer to Sections 6 – Business Process and Information Flow Overview of the related MRP detailed design documents referred to throughout this design document. These documents include:

- MRP Detailed Design: Authorization and Participation;
- MRP Detailed Design: Prudential Security;
- MRP Detailed Design: Facility Registration;
- MRP Detailed Design: Offers, Bids and Data Inputs;
- MRP Detailed Design: Day-Ahead Market Calculation Engine;
- MRP Detailed Design: Pre-Dispatch Calculation Engine;
- MRP Detailed Design: Real-Time Calculation Engine;
- MRP Detailed Design: Market Power Mitigation;
- MRP Detailed Design: Market Billing and Funds Administration
- MRP Detailed Design: Publishing and Reporting Market Information; and
- MRP Detailed Design: Market Settlements.



**Please note that the Day-Ahead Scheduling Processes, Pre-Dispatch Scheduling Processes, and Real-Time Scheduling Processes are displayed as separate diagrams in their respective sub-sections below.**

**Figure 6-1: Grid and Market Operations Integration Market Facing Process**

## 6.1.2. Detailed Description of Processes and Data Flows

### 6.1.2.1 Day Ahead Market Processes

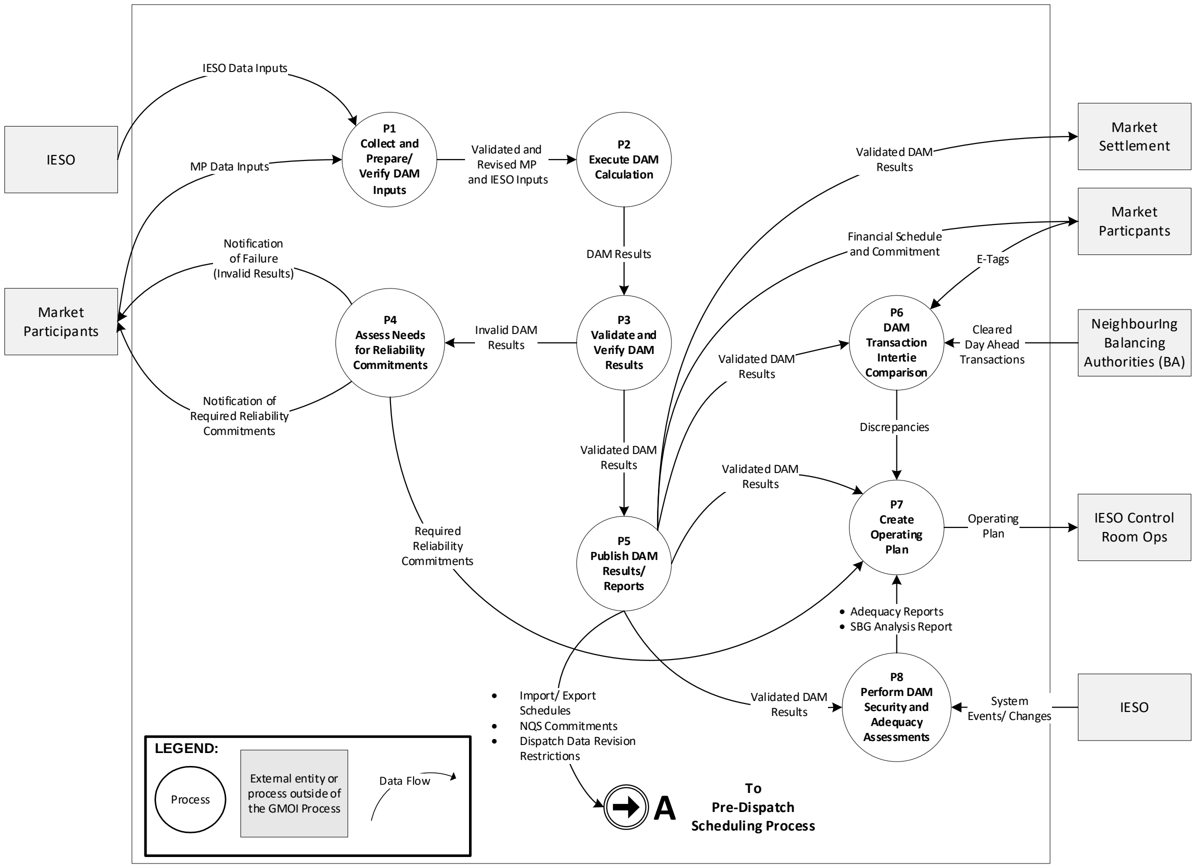



**Figure 6-2: Grid and Market Operation Integration of the DA Scheduling Process**

### Process P1 – Collect and Prepare/Verify DAM Inputs

#### Description

This process describes all the data items that are collected and revised for use in the DAM scheduling process. The revision of data minimizes the frequency of errors in the DAM calculation engine.

### Input and Output Data Flows

**Table 6-1: Process P1 Input and Output Data Flows**

| Flow | Source | Target | Frequency |
|---|---|---|---|
| IESO Data Inputs | IESO | Process P1 | Daily |

**Description:**

The following *IESO* inputs will be used for the future day-ahead market, pre-dispatch and *real-time market:*

- *Reliability* requirements - *Reliability* requirements are operational inputs produced by the *IESO* to satisfy grid *reliability* and *security* standards as per *NERC*, *NPCC* and *IESO market rules*. *Reliability* requirements encompass a number of inputs from the *IESO* such as *operating reserve* requirements, *security limits* and *ancillary services* to name a few;
- *Demand* forecasts - The *demand* forecast produced by the *IESO* will continue to be used as an input for the expected load in the DAM, PD and RT calculation engines. The *IESO* will continue to produce a *demand* forecast at the province-wide level but as the sum of four separate area *demand* forecasts. The following types of *demand* forecasts are used by calculation engines:
    - Hourly *demand* forecast (peak and average) – used for DAM and PD; and
    - Five-minute global *demand* forecast – used for five-minute RT *dispatch.*
- Pricing–Pricing inputs are used to set the pricing constraints to help determine pricing eligibility. These include the following;
    - MMCP - The *maximum market clearing price* (*MMCP*) will continue to define the maximum allowable price for *energy*, and the negative of which will continue to be the minimum allowable price for *energy* (negative *MMCP*);
    - MORP - The *maximum operating reserve price* (*MORP*) will continue to define the maximum allowable price for any class of *operating reserve;* and
    - Constraint violation penalty curves - Constraint violation penalty curves will continue to be defined as the penalty functions for the violation of constraints in the *dispatch algorithm.*
- Market power mitigation– These are new inputs that will be used in the future day-ahead market, pre-dispatch, and the *real-time market* to deter *market participants* from exercising the market power they may have when competition in the *IESO-administered markets* is restricted;
- Network model – The network model contains a detailed topology representation of the *IESO-controlled grid* and a simplified representation of power systems in neighboring jurisdictions. This model is used as input to the *IESO's real-time energy* management system (EMS) and all calculation engines; and
- Centralized *variable generation* forecast - The *IESO* produces a centralized *variable generation* forecast over multiple timeframes, for all *registered facilities* with *variable generation* resources*.* This forecast will continue to be used by the calculation engines to determine the maximum amount of *energy* for which a *variable generator* can be scheduled and *dispatched*. The *IESO* will also retain the ability to adjust the centralized *variable generation* forecast as needed.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Market Participant Data Inputs | Market Participants | Process P1 | Daily |

**Description:**

*Market participants* will submit *dispatch data, ancillary service information* and *outage* information in order to participate in the day-ahead market and *real-time market.* These data items are described below.

Dispatch Data for Energy

- Standing *dispatch data* will be validated as they are received, and reassessed when they are converted to *dispatch data* at the beginning of the day-ahead market data submission window;
- *Dispatch data* for supplying or consuming *energy* will be submitted as hourly and daily *dispatch data* parameters by the *market participants*;
- New hourly and daily *dispatch data* parameters will be introduced or existing parameters will be updated. These additional parameters will be required for dispatchable NQS *generation facilities*, hydroelectric *generation facilities* and *variable generation*;
- The *dispatch data* construct will continue to represent the financial and non-financial parameters that are submitted by *market participants*;
- Once the *dispatch data* mandatory submission window closes, the *dispatch data* submission will not be processed during the DAM restricted window. *Dispatch data* is validated against information provided during the Facility Registration process if submitted within allowable DAM submission window;
- *Dispatch data* is also validated for content, formatting, and acceptable numeric values. In addition, *dispatch data* must be received from the valid *registered market participant* for the resource; and
- *If* a *dispatch data* parameter is approved, it is stored and applied on the appropriate *dispatch day*.

Dispatch Data for Operating Reserve

- Resources associated with a dispatchable *generation facility* or a *dispatchable load* within Ontario will continue to be eligible to provide all three classes of *operating reserve* in the future day-ahead market and the *real-time market*, subject to performance criteria evaluated during the Facility Registration process;
- The three classes of *operating reserve* that will continue to be *offered* into the future day-ahead market and *real-time market* are:
    - 10-minute synchronized *operating reserve* (also known as 10-minute spinning reserve);
    - 10-minute non-synchronized *operating reserve*; and
    - 30-minute *operating reserve*.

- o Imports associated with a *boundary entity* will continue to only be eligible to *offer* 30-minute and 10-minute non-synchronized *operating reserve* subject to performance criteria evaluated during the *Facility* Registration process. *Boundary entities* are not permitted to provide 10-minute spinning *operating reserve*.

Ancillary Service Information

The *IESO* will continue to contract for the following *ancillary services*:

- o *Regulation* service: *Ancillary service providers* who wish to provide *regulation* services will continue to submit schedules that reflect the MWs available for any given *dispatch day* as they currently do to satisfy their contract obligations, prior to the closing of the day-ahead market submission window on the *pre-dispatch day*. These are schedules submitted by *registered market participants* which reflect the MWs available for any given *dispatch day* as they currently do to satisfy their contract obligations, prior to 09:00 EPT on the *pre-dispatch day*;
- o Reactive *support service* and *voltage control service*: These *ancillary services* involve the control and maintenance of prescribed voltages at specific locations, using defined reactive capacity, *energy* and maneuverability to support system operations; and
- o Certified facilities with black start capability: This *ancillary service* involves *generation facilities* that are tested and/or assessed for their ability to be a *certified black start facility*, and from which the *IESO* may direct the delivery of power without assistance from the electrical system.

Outage Information

- *Outage* data will continue to represent the planned or unplanned removal of equipment from service, unavailability for connection of equipment or temporary de-rating, restriction of use, or reduction in performance of equipment for any reason.
- E-Tags - The e-Tag ID is a parameter submitted by the *market participant* to the *IESO* as part of their *dispatch data.* It is an alphanumeric text string that is used to identify the e-Tag ID associated with an interchange transaction.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Validated and Revised Market Participant and IESO Inputs | Process P1 | Process P2 | Daily |

**Description:**

- Following the collection of the *market participant* and *IESO* data inputs, these inputs are reviewed by the *IESO* to assess their suitability for use in the calculation engines. Where required, these data inputs are revised in line with current system conditions.

## Process P2 – Execute DAM Calculation

### Description

This process describes the initialization and execution of the day ahead market (DAM) calculation engine. The DAM calculation engine will evaluate the *dispatch data* submitted by all *dispatchable loads*, dispatchable and *self-scheduling generation facilities*, price responsive loads, virtual traders and importers and exporters and will optimize schedules over a 24-hour period.

### Input and Output Data Flows

**Table 6-2: Process P2 Input and Output Data Flows**

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Validated and Revised Market Participant and IESO Inputs | Process P1 | Process P2 | Daily |
| **Description:**<br>• See description in Process P1 above. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| DAM Results | Process P2 | Process P3 | Daily |
| **Description:**<br>• The results of the DAM calculation engine run provide a set of commitments for non-quick start *generation facilities*, schedules for imports, and financially-binding schedules for all resources necessary to meet forecast *demand* and *reliability* requirements.<br>• DAM results contain the *energy* and *operating reserve* schedules for *market participant* resources for each hour of the next *dispatch day*, as established by the DAM Calculation engine. | | | |

## Process P3 – Validate and Verify DAM Results

### Description

This process assesses the suitability of DAM results for *market participants* and internal *IESO* use.

## Input and Output Data Flows

**Table 6-3: Process P3 Input and Output Data Flows**

<table>
<tr><th>Flow</th><th>Source</th><th>Target</th><th>Frequency</th></tr>
<tr><td>DAM Results</td><td>Process P2</td><td>Process P3</td><td>Daily</td></tr>
<tr><td colspan="4">Description:<ul><li>See description in Process P2 above.</li></ul></td></tr>
<tr><th>Flow</th><th>Source</th><th>Target</th><th>Frequency</th></tr>
<tr><td>Invalid DAM Results</td><td>Process P3</td><td>Process P4</td><td>Event Based</td></tr>
<tr><td colspan="4">Description:<ul><li>Following the completion of the DAM calculation engine run, the DAM results undergo a higher level check of outputs. Identified calculation engine issues and warnings are also addressed.</li><li>There may also be instances where the DAM calculation engine fails to produce prices and schedules or DAM errors are identified by the IESO. If these failures/errors cannot be rectified in time to meet the DAM results publication deadline, then a DAM failure is triggered.</li></ul></td></tr>
<tr><th>Flow</th><th>Source</th><th>Target</th><th>Frequency</th></tr>
<tr><td>Validated DAM Results</td><td>Process P3</td><td>Process P5</td><td>Daily</td></tr>
<tr><td colspan="4">Description:<ul><li>During the DAM calculation engine run, the IESO will have three opportunities to validate the results from the different passes. These three opportunities are as follows:<ul><li>after Stage 1 – Initial Scheduling and Market Power Mitigation;</li><li>after Stage 2 – Reliability Scheduling; and</li><li>after Stage 3 – Day-ahead Market Scheduling and Pricing.</li></ul></li><li>This post DAM validation is generally a higher level check of outputs.</li><li>Following a successful DAM calculation engine run, DAM results will be produced by the engine. The DAM results are based on a single snap shot of known conditions, assumptions, projections and valid dispatch data submitted prior to the close of the DAM submission window.</li><li>All resources will receive a financially binding schedule, NQS resources may also receive a DAM commitment.</li><li>Public and private reports will be published or provided to market participants following a successful DAM calculation engine run. Market participants will receive private reports containing their financially binding schedules and commitments.</li></ul></td></tr>
</table>

### Process P4 – Assess Need for *Reliability* Commitments

#### Description

This process assesses the need for *reliability* commitments following the failure of the DAM calculation engine run.

#### Input and Output Data Flows

**Table 6-4: Process P4 Input and Output Data Flows**

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Invalid DAM Results | Process P3 | Process P4 | Event Based |
| **Description:**<br>• See description in Process P3 above. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| Notification of Failure (Invalid Results) | Process P4 | Market Participants | Event Based |
| **Description:**<br>• This is a public communication issued by the *IESO* if a DAM failure is identified due to invalid results or an incomplete DAM calculation engine run.<br>• This notification confirms to *market participants* that no DAM financially binding schedules or prices will be *published*, and no DAM operational commitments will be generated based on the outcome of the DAM calculation engine.<br>• This information is published on the RSS feed page of the *IESO* website.<br>• This notification also acts as a trigger for *IESO* to determine the required *reliability* commitments for the next day. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| Notification of required reliability commitments | Process P4 | Market Participants | Event Based |
| **Description:**<br>• This is a notification to specific *market participants* advising them of any required *reliability* commitment (or constraints) following a DAM failure. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| Required Reliability Commitments | Process P4 | Process P7 | Event Based |

| |
|---|
| **Description:**<br>• In the event of a DAM failure, the *IESO* will intervene by constraining specific resources to ensure they are scheduled to come online in real-time to ensure *reliability*.<br>• The *IESO* identifies *generation facilities* that can solve the *reliability* issue and notifies them accordingly. The *IESO* will commit the dispatchable *generation facility* by applying minimum constraints to ensure that the *generation facility* is scheduled to at least its MLP and for at least its MGBRT.<br>• Commitments for *reliability* may also include constraints applied to *energy* limited resources. |

### Process P5 – Publish DAM Results/Reports

#### Description

This process provides the preparation and *publication* of valid DAM results to the *market participants* and internally to the *IESO*.

#### Input and Output Data Flows

**Table 6-5: Process P5 Input and Output Data Flows**

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Validated DAM Results | Process P5 | Market Settlement<br>Process P6<br>Process P7<br>Process P8 | Daily |
| **Description:**<br>• See description in Process P3 above for details on the validation process.<br>• Following a successful DAM calculation engine run, all resources will receive a financially binding schedule and NQS resources may receive a DAM commitment. Public and confidential reports will be *published* or provided to *market participants* following a successful DAM calculation engine run. *Market participants* will receive confidential reports containing their financially binding schedules and commitments.<br>• The validated DAM results will also serve as inputs into the following processes:<br>o Market Settlement –The financially binding schedules and commitment within the validated DAM Results will be used for market *settlement* and to establish a resource's ADE amount for PD and RT scheduling;<br>o Process 6 – Validated DAM results will be used to conduct the *intertie* comparison with neighboring balancing authorities to identify any discrepancies;<br>o Process 7 – Validated DAM results will be used to create the Operating Plan for operating and managing the *IESO-controlled grid* on the *dispatch day*; and | | | |

- Process 8 – Validated DAM results will be used as an input to perform Security and Adequacy Assessment post DAM.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Financial Schedule and Commitment | Process P5 | Market Participants | Daily |

**Description:**

- The *dispatch data* submitted by all resources will be used to produce financially binding schedules and operational commitments which provides *market participants* with schedules for their resources, for each hour of the next *dispatch day* as determined by the DAM calculation engine.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Import/Export schedules | Process P5 | Process P10 | Daily |

**Description:**

- DAM results contain import and export schedules. These schedules will serve as an input to the *pre-dispatch scheduling* process to ensure that import and exports are appropriately evaluated in the PD time-frame.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| NQS commitments | Process P5 | Process P10 | Daily |

**Description:**

- DAM results contain the NQS commitments. These will act as an input into the PD calculation engine to ensure that these commitments are maintained during the *pre-dispatch scheduling* process.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Dispatch Data Revision Restrictions | Process P5 | Process P10 | Daily |

**Description:**

- These are restrictions that will be applied to the submission or revision of hourly and daily *dispatch data* in order to facilitate *dispatch*, scheduling and commitments in the pre-dispatch and real-time processes. Revisions to hourly *dispatch data* will still require IESO approval while the *daily dispatch data* revisions will not require *IESO* approval.

## Process P6 – DAM Transaction Intertie Comparison

### Description

This process compares the *intertie* transactions scheduled in the day ahead *market* to corresponding schedules in neighbouring jurisdictions and identifies discrepancies.

### Input and Output Data Flows

**Table 6-6: Process P6 Input and Output Data Flows**

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Validated DAM Results | Process P5 | Process P6 | Hourly |
| **Description:**<br>• See description in Process P5 above. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| E-Tags | Market Participants | Process P6 | Hourly |
| **Description:**<br>• An e-Tag is an electronic record of a transaction submitted *by market participants* to a central repository (not part of *IESO* systems), where balancing authorities such as the *IESO*, the NYISO, the MISO, etc. coordinate *intertie* scheduling activities.<br>• The e-Tag ID is a parameter submitted by the *market participant* to the *IESO* as part of their *dispatch data* (*bid/ offer*). It is an alphanumeric text string that is used to identify the e-Tag. These are not mandatory in the day-ahead market. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| Cleared Day Ahead Transactions | Neighbouring Balancing Authorities (BA) | Process P6 | Daily |
| **Description:**<br>• Neighbouring balancing authorities are responsible for approving and clearing day-ahead transactions submitted by *market participants* in their respective markets.<br>• These cleared day ahead transactions are used as inputs to the DAM Transaction *Intertie* Comparison process in order to identify discrepancies with cleared transactions in Ontario's DAM. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| Discrepancies | Process P6 | Process P7 | Daily |

| |
|---|
| **Description:**<br>• These are transactions identified during the DAM Transaction Intertie Comparison process that do not have a corresponding schedule in a neighbouring balancing authority.<br>• These will be reflected in the Operating Plan to facilitate their investigation and resolution in order to come to a final agreed upon scheduled flow between the two markets for the *dispatch day* during *pre-dispatch scheduling*. |

### Process P7 – Create Operating Plan

#### Description

This is an internal *IESO* process that creates the Operating Plan which is a collection of expected system conditions, operating limits and instructions that the *IESO* uses to manage the power system for each *dispatch day*.

#### Input and Output Data Flows

**Table 6-7: Process P7 Input and Output Data Flows**

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Required Reliability Commitments | Process P4 | Process P7 | Event Based |
| **Description:**<br>• See description in Process P4 above. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| Validated DAM Results | Process P5 | Process P7 | Hourly |
| **Description:**<br>• See description in Process P5 above. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| Discrepancies | Process P6 | Process P7 | Daily |
| **Description:**<br>• See description in Process P6 above. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| Adequacy Reports | Process P8 | Process P7 | Daily |

**Description:**

- These reports *publish* information on Ontario's electricity requirements for the *dispatch day* through to 34 days out. The resources *offered*, forecasted and bid are included for the hours of the *dispatch day* and the next *dispatch day*. The report also identifies the capacity and *energy* excesses or shortfalls in all hours.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| SBG Analysis Report | Process P8 | Process P7 | Daily |

**Description:**

- Surplus Baseload Generation (SBG) occurs when electricity production from baseload *generation facilities* is greater than Ontario *demand*.
- SBG (in MW) is calculated by subtracting the forecast Ontario *demand* from the forecast baseload *energy*. Baseload *energy* is the sum of all available nuclear, must-run hydroelectric, self-scheduling, intermittent and variable (including wind and solar) *generators* and *generation unit*s in the process of commissioning.
- The purpose of the report is to support the *IESO* and *market participants* in making decisions on scheduling resources and other available actions to alleviate the impact of SBG.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Operating Plan | Process P7 | IESO Control Room Ops | Daily |

**Description:**

- Following the execution of the DAM calculation engine run on the *pre-dispatch day*, the *IESO* prepares the Operating Plan for the *dispatch day*, which consists of a number of reports detailing the various *IESO* inputs that will be used by the calculation engines, weather forecast, SBG forecast, and NQS unit commitments determined by DAM.
- The Operating Plan is subsequently used to coordinate PD and RT Operations and can be updated by the *IESO* based on system conditions and to deal with contingencies.
- Expected power system conditions include *demand* forecasts, planned equipment outages, resource commitments and anticipated power flows. Operating limits and instructions describe operational limitations, preparatory control actions and alternatives for re-preparing the power system following unforeseen events (e.g. *forced outages*).

## Process P8 – Perform DAM Security and Adequacy Assessments

### Description

This process assesses *IESO's* ability to meet its obligations to maintain the *reliability* of the *IESO-controlled grid* following the *publication* of DAM results.

*Reliability* assessments will continue to be used to determine if any control actions are required to ensure the *secure* and *reliable* operation of the *IESO-controlled grid* for the following *dispatch day*.

Any information derived from the *security* and *adequacy* assessment process shall be used to provide a basis for informing *market participants* about expected conditions on the *IESO-controlled grid* and in the *IESO-administered markets*.

It is expected that the information will trigger appropriate responses under other market processes, such as *outage* coordination.

### Input and Output Data Flows

**Table 6-8: Process P8 Input and Output Data Flows**

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Validated DAM Results | Process P5 | Process P8 | Daily |
| **Description:**<br>• See description in Process P5 above. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| System Events/ Changes | IESO | Process P8 | Event based |
| **Description:**<br>• These are common occurrences in the day-to-day operation of the *IESO-controlled grid* (ICG) and the *IESO-administered markets* (IAM) and depending on their magnitude, location, timing and duration, may have a material impact on the ICG and IAM. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| Adequacy Reports | Process P8 | Process P7 | Daily |
| **Description:**<br>• See description in Process P7. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| SBG Analysis Report | Process P8 | Process P7 | Daily |
| **Description:**<br>• See description in Process P7. | | | |

### 6.1.2.2 Pre-Dispatch Processes

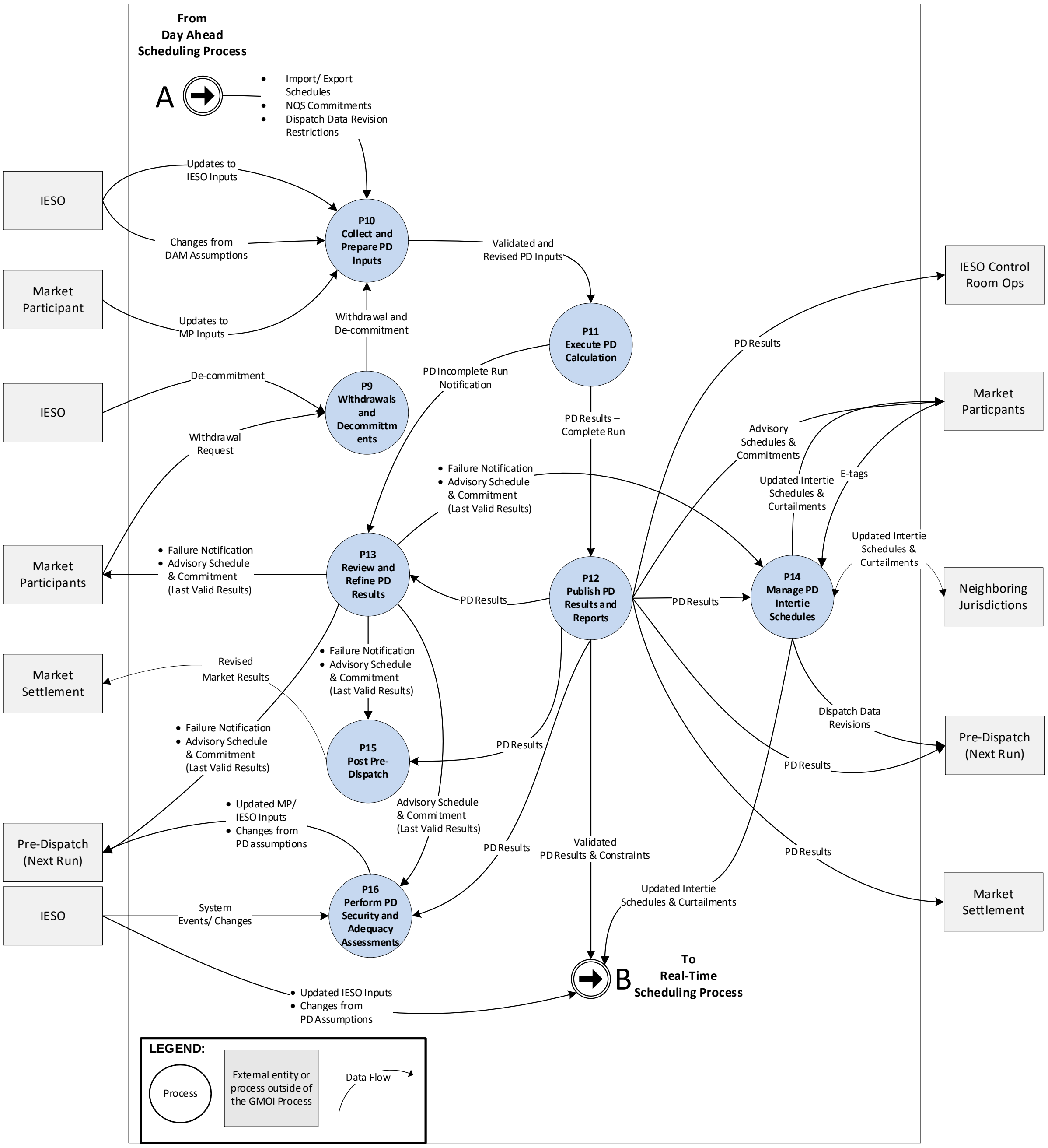



**Figure 6-3: Grid and Market Operation Integration of the PD Scheduling Process**

### Process P9 – Withdrawals and De-commitments

### Description

There may be requirements for the *IESO* to de-commit resources that were given a day ahead commitment and corresponding schedule for *reliability* purposes. When this requirement is identified, the *IESO* would notify the applicable *market participant* that the commitment will be removed. In all cases, the *IESO* will only de-commit resources for *reliability* reasons.

Likewise, a *market participant* may wish to withdraw a resource that was given a day-ahead commitment and corresponding schedule for either a forced de-rating or an *outage*. When this condition is identified by the *market participant*, then they must take appropriate actions by modifying the *bids* or *offers* associated with the resource and/or submitting an *outage* information slip.

### Input and Output Data Flows

**Table 6-9: Process P9 Input and Output Data Flows**

| Flow | Source | Target | Frequency |
|---|---|---|---|
| De-commitment | IESO | Process P9 | As Required |
| **Description:**<br>• De-commitment by *IESO* for *reliability*:<br>o If a *reliability* concern is identified after DAM results are available, the *market participant* is notified by the *IESO*.<br>o The *IESO* will be required to set the appropriate de-commitment flag for *market settlement* purposes; and<br>o The *IESO* must also remove the operational constraint upon de-commitment. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| Withdrawal Request | Market Participants | Process P9 | As Required |
| **Description:**<br>• This request is made to *IESO* by the *market participant* when there is a need to completely withdraw or reduce committed DAM capacity due to an equipment failure. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| Withdrawal and De-commitment | Process P9 | Process P10 | Hourly |
| **Description:**<br>• *Dispatch data* that has been revised due to a withdrawal or de-commitment will be provided as an input to the pre-dispatch and *real-time scheduling* processes.<br>• In the case of an *IESO* decision to de-commit a resource for *reliability*, a *settlement* flag will be set and passed through to the *market settlement* process. Minimum generation constraints associated with the de-committed/withdrawn resource must also be removed because they cannot be used in the *pre-dispatch scheduling* process. | | | |

## Process P10 – Collect and Prepare PD Inputs

### Description

This process collects and prepares the inputs required for each PD calculation engine run. In some cases, the data collected is not necessarily required for the *pre-dispatch schedules*, but must be passed to *market settlement* to correctly *settle* the events of the *dispatch day*.

### Input and Output Data Flows

**Table 6-10: Process P10 Input and Output Data Flows**

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Import/Export schedules | Process P5 | Process P10 | Daily |
| **Description:**<br>• DAM results contain import and export schedules. These schedules will serve as an input to the *pre-dispatch scheduling* process to ensure that import and exports are appropriately evaluated in the PD time-frame | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| NQS commitments | Process P5 | Process P10 | Daily |
| **Description:**<br>• DAM results contain the NQS commitments. These will act as an input into the PD calculation engine to ensure that these commitments are maintained during the *pre-dispatch scheduling* process.<br>• In the event of a DAM failure, pre-dispatch will be run manually to generate NQS commitments which are non- financially binding and required only when no results were produced during DAM. NQS commitments that are made in DAM are passed to pre-dispatch through minimum constraints for the *generation facility's* MLP for a period equal to MGBRT hours for each separate start up, and not the entire duration of the DAM schedule. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| Dispatch Data Revision Restrictions | Process P5 | Process P10 | Daily |
| **Description:**<br>• These are restrictions that will be applied to the submission or revision of hourly and daily *dispatch data* in order to facilitate *dispatch*, scheduling and commitments in the pre-dispatch and *real-time* processes. | | | |

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Updates to IESO Inputs | IESO | Process P10 | Hourly (as required) |

**Description:**

- The *IESO* data inputs that were used in the formulation of the DAM schedules will also be used by the *pre-dispatch scheduling* process.
- These *IESO* data inputs may need to be updated due to changing system conditions e.g. the loss of transmission *facilities* or *generation facilities* or a change in a *market participant's* equipment status e.g. unplanned *outage*, early availability of a *generation facility* following a *planned outage*. There may have been a number of system or market changes that have occurred since initial DAM forecasts, DAM assumptions and DAM inputs were developed.
- On the *pre-dispatch day* and *dispatch day*, the *IESO* will retain the ability to update *ancillary service* information if required to maintain system *reliability*. This could be in the form of an update to the *regulation* capacity requirement, an adjustment to the *regulation* schedules due to unplanned *outages* of selected *regulation* resources, or an adjustment of *automatic generation control* from a *generation facility* that is providing *regulation*.
- The inputs that may need to be adjusted include:
    - *Demand* forecasts;
    - *Variable generation* forecasts;
    - *Operating reserve* requirements;
    - *Outage* data;
    - *Intertie* schedule capability;
    - Net schedule ramp limits;
    - System or network configurations;
    - *Reliability must-run resources*; and
    - Loop flow.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Changes from DAM Assumptions | IESO | Process P10 | Daily |

**Description:**

- Following the successful run of the DAM calculation engine, the first run of the *pre-dispatch scheduling* process where hours for the *dispatch day* will be evaluated will occur at 20:00 EST on the *pre-dispatch day,* which is approximately 5 – 6 hours after the DAM results are published.
- There may have been a number of system or market events that have occurred since the completion of the initial DAM calculation engine run, which could have resulted in changes to DAM inputs and assumptions. These changes may require modifications of inputs to the *pre-dispatch scheduling* process.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Updates to Market Participant Data Inputs | Market Participant | Process P10 | Event-based per MP Updates |

**Description:**

- The *market participant* data inputs that were used in the formulation of the DAM schedule will also be used by the *pre-dispatch scheduling* process.
- Valid *dispatch data* submitted to the DAM will be transferred for use in the *pre-dispatch scheduling* process, unless further revised by *market participants*.
- *Market participants* may revise their *offers* and *bids* at any time up to 2 hours before the *dispatch hour*. All current *dispatch data* parameter validation checks must be met.
- When a *generation facility* is returning early from *planned outage* or *forced outage*, forced de-ratings, or cancellation/delay of a *planned outage*, the *market participant* must update their *outage* request and will be permitted to submit new or revised *dispatch data*.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Withdrawal and De-commitment | Process P9 | Process P10 | Hourly |

**Description:**

- *Dispatch data* that has been revised due to a withdrawal or de-commitment will be provided as an input to the *pre-dispatch* and *real-time scheduling* processes.
- In the case of an *IESO* decision to de-commit a resource for *reliability*, a *settlement* flag will be set and passed through to the *market settlement* process. Minimum generation constraints associated with the de-committed/withdrawn resource must also be removed because they cannot be used in the *pre-dispatch scheduling* process.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Validated and Revised PD Inputs | Process P10 | Process P11 | Hourly |

**Description:**

- All data necessary for the *pre-dispatch scheduling* process must be collected for use in each run of the *pre-dispatch schedule*. In some cases, the data collected will need to be updated due to a change in system conditions or a change in the *market participant's* situation.
- New/revised inputs will need to be validated prior to use as input into the PD calculation engine.

## Process P11 – Execute PD Calculation

### Description

The *pre-dispatch scheduling* process uses the PD calculation engine which provides an iterative, hourly forecasted view of future *dispatch hours*. The PD calculation engine will use multi-hour optimization over a look-ahead period, of up to 27 hours, considering multi part *dispatch data*, will consider resource operational restrictions, and incorporate ex-ante market power mitigation for economic withholding.

### Input and Output Data Flows

**Table 6-11: Process P11 Input and Output Data Flows**

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Validated and Revised PD Inputs | Process P10 | Process P11 | Hourly |
| **Description:**<br>• These are the validated and where necessary revised *market participant* and *IESO* inputs for the PD calculation engine run. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| PD Incomplete Run Notification | Process P11 | Process P13 | Event based |
| **Description:**<br>• The PD calculation engine can fail due to planned or forced system interruptions, tool outages, or identification of missing or incorrect results.<br>• When pre-dispatch tool failures occur outside of scheduled *outages*, communications on the *IESO* website will continue to be posted at the discretion of the *IESO* and as soon as practicable.<br>• Pre-dispatch failure communications will continue to indicate that pre-dispatch results will not be *published* for the hour(s) affected. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| PD Results – Complete Run | Process P11 | Process P12 | Hourly |
| **Description:**<br>• Following a complete and successful run of the PD calculation engine, the pre-dispatch results shall be *published* within a certain amount of time for *interchange schedules* and advisory schedules.<br>• *Interchange schedules* must be published no later than 15 minutes past the *pre-dispatch hour* for the first two *dispatch hours* of the new pre-dispatch look-ahead period, and extensions to operational commitments for the first *dispatch hour* of the pre-dispatch look-ahead period; and | | | |

- Advisory schedules and binding start-up instructions must be provided to *market participants* as confidential notifications no later than 30 minutes past the hour for all resources for the entire pre-dispatch look-ahead period. The information provided at 30 minutes past the hour will not change information already provided at 15 minutes past the hour. *Market participant*s will respond to binding start-up instructions and notifications of de-commitment instead of providing the two-hour start-up or one-hour shutdown calls.

### Process P12 – Publish PD Results and Reports

#### Description

This process *publishes* the pre-dispatch results and reports following the complete run of the PD calculation engine. This engine will use multi-hour optimization over a look-ahead period of up to 27 hours, considering multi-part *dispatch data*, resource operational restrictions, and ex-ante market power mitigation for economic withholding.

#### Input and Output Data Flows

**Table 6-12: Process P12 Input and Output Data Flows**

| Flow | Source | Target | Frequency |
|---|---|---|---|
| PD Results – Complete Run | Process P11 | Process P12 | Hourly |
| **Description:**<br>• See description in Process P11. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| PD Results | Process P12 | Process P13<br>Process P14<br>Process P15<br>Process P16<br>IESO Control Room Ops<br>Pre-Dispatch (Next Run)<br>Market Settlement | Hourly |
| **Description:**<br>• The *pre-dispatch scheduling* process runs hourly to optimize schedules to meet forecast *demand* for the look-ahead period. The *pre-dispatch scheduling* process ensures that adequate supply is available for the *real-time scheduling* process to *dispatch* to reliably meet *demand* in each *dispatch hour*. | | | |

- PD results will be reviewed and validated to ensure that the results are not missing or incorrect.
    - Additional information regarding specific data flows are provided below.
- Process P13 – Pre-dispatch results for import and export schedules will be used to manage *intertie* schedules with neighbouring jurisdictions.
- Process P14 – Pre-dispatch results will be reviewed and validated to ensure that the results are not missing or incorrect. This validation usually takes place after the initial pre-dispatch results are *published*. If the results are invalid, then a failure notification and an advisory schedule and commitment will be issued to *market participants* and internally to the *IESO*.
- Process P15 – Pre-dispatch results will be used as an input into the Ex-Post Operations process in order to ensure that any manual action by the *IESO* is reflected in the final schedules and prices that go to *market settlement*.
- Process P16 – Pre-dispatch results are used to perform *security* and *adequacy* assessments.
- IESO Control Room – Pre-dispatch results are used by the Control Room to manage the ICG during the *dispatch day.*
- Pre-Dispatch (Next Run) – Pre-dispatch results will act as an input into the next instance of the *pre-dispatch scheduling* process to ensure that the most recent information is used.
- Market Settlement– Pre-dispatch results for NQS commitments will be used for *settlement* purposes.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Validated PD Results & Constraints | Process P12 | Process P17 | Hourly |

**Description:**

- The PD calculation engine runs hourly to optimize schedules to meet forecast *demand* for the look-ahead period. The *pre-dispatch scheduling* process ensures that adequate supply is available for the *real-time scheduling* process for *dispatch* to reliably meet *demand* for each *dispatch hour*.
- Pre-dispatch results will be reviewed and validated to ensure that the results are not missing or incorrect.
- This validation usually takes place after the initial pre-dispatch results are *published*.
    - The validated pre-dispatch results and applicable constraints will be used by the RT calculation engine. The RT calculation engine will continue to respect these scheduled resources, as described below.
- Commitments for NQS *generation facilities* issued through the DAM or the *pre-dispatch scheduling* processes are communicated to the RT calculation engine in the form of minimum scheduling constraints.

- *Hourly demand response* is activated by the *pre-dispatch scheduling* process three hours before the *dispatch hour*. Activated *hourly demand response* is communicated to the RT calculation engine through a constraint on the resource.
- Interchange transactions scheduled through the *pre-dispatch scheduling* process and validated through the interchange checkout process are communicated to the RT calculation engine as fixed *boundary entity* schedules for every interval of the next *dispatch hour*.
- Two hydroelectric *generation facility dispatch data* parameters are communicated to the RT calculation engine as minimum generation constraints. These are hourly must run and minimum daily *energy* limit. Hourly must run is passed for every hydroelectric *generation unit* that submitted an Hourly Must Run *dispatch data* parameter for the *dispatch hour*. Minimum daily *energy* limit is only passed when certain conditions are met.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Advisory Schedules & Commitments | Process P12 | Market Participants | Hourly |

**Description:**

- These are parts of the pre-dispatch results that contain advisory schedules and binding start-up instructions for *market participants* which must be *published* as confidential notifications no later than 30 minutes past the hour for operational commitments for all resources for the entire look-ahead period.

### Process P13 – Review and Refine PD Results

#### Description

This process reviews the pre-dispatch results and when the results are invalid, issues a failure notification and an advisory schedule & commitment to *market participants* and internally to the *IESO.*

### Input and Output Data Flows

**Table 6-13: Process P13 Input and Output Data Flows**

<table>
<tr><th>Flow</th><th>Source</th><th>Target</th><th>Frequency</th></tr>
<tr><td>PD Incomplete Run Notification</td><td>Process P11</td><td>Process P13</td><td>Event Based</td></tr>
<tr><td colspan="4">Description:<ul><li>The PD calculation engine can fail due to planned or forced system interruptions, tool outages, or identification of missing or incorrect results.</li><li>When pre-dispatch tool failures occur outside of scheduled outages, communications on the IESO website will continue to be posted at the discretion of the IESO and as soon as practicable.</li><li>Pre-dispatch failure communications will continue to indicate that pre-dispatch results will not be published for the hour(s) affected.</li></ul></td></tr>
<tr><th>Flow</th><th>Source</th><th>Target</th><th>Frequency</th></tr>
<tr><td>PD Results</td><td>Process P12</td><td>Process P13</td><td>Hourly</td></tr>
<tr><td colspan="4">Description:<ul><li>See description in Process P12 above.</li></ul></td></tr>
<tr><th>Flow</th><th>Source</th><th>Target</th><th>Frequency</th></tr>
<tr><td>Failure Notification</td><td>Process P13</td><td>Process P14<br>Process P15<br>Market Participants<br>Pre-Dispatch (Next Run)</td><td>Event Based</td></tr>
<tr><td colspan="4">Description:<ul><li>These are notifications issued to market participants when it has been established that the pre-dispatch calculation engine failed to produce usable results.</li><li>The pre-dispatch calculation engine run can fail due to planned or forced system interruptions, tool outages, or identification of missing or incorrect results.</li><li>Pre-dispatch failure communications will continue to indicate that pre-dispatch results will not be published for the hour(s) affected.</li></ul></td></tr>
<tr><th>Flow</th><th>Source</th><th>Target</th><th>Frequency</th></tr>
<tr><td>Advisory Schedule & Commitment (last valid results)</td><td>Process P13</td><td>Process P14<br>Process P15<br>Process P16<br>Market Participants</td><td>Event Based</td></tr>
</table>

| | | | |
|---|---|---|---|
| | | Pre-Dispatch (Next Run) | |

**Description:**

- During a PD failure, the *IESO* may use the following information as a basis for the *real-time scheduling* and *dispatch* process, while giving consideration to timing and system conditions:
  - Use the last-successful pre-dispatch advisory schedule supplemented with manual NQS commitments or commitment updates for *reliability;*
  - Use DAM financially binding schedules supplemented with manual NQS commitments or commitment updates for *reliability*; or
  - Use best available data to determine appropriate scheduling of NQS resources and determination of *intertie* transactions.

### Process P14 – Manage PD Intertie Schedules

#### Description

This process reviews and aligns the pre-dispatch *intertie* schedule results with *intertie* schedules and restrictions from neighbouring jurisdictions.

#### Input and Output Data Flows

**Table 6-14: Process P14 Input and Output Data Flows**

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Updated Intertie Schedules & Curtailments | Process P14 | Market Participants | As Required |

**Description:**

- In the current *pre-dispatch* and *real-time scheduling* process, there are many market and/or system conditions that can arise that would result in the *IESO* having to curtail *intertie* transaction schedules to a value below what was scheduled by the PD calculation engine. These conditions relate to Ontario *reliability*, external jurisdiction *reliability* and *market participant* resource failures. When any of these occur, curtailed *intertie* schedules are assigned a specific *settlement* code to reflect the appropriate *settlement* treatment of the schedule based on the nature of the misalignment. A number of curtailment *settlement* codes currently exist that are meant to address situations where the curtailed portion of the schedule attracts CMSC payment, failure charges and guarantees.

- The *IESO* could also curtail *intertie* schedules for future hours when restrictions on *intertie* schedules are not recognized by the *IESO* market tools (e.g., a *transmission* restriction in another jurisdiction, persistent failure of *intertie* transactions to navigate other markets). These curtailments will be passed on to future pre-dispatch runs as operational constraints. See Dispatch Data Revisions Flow in Process 14 below.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| E-Tags | Market Participants | Process P14 | As-received |

**Description:**

- See general description in Process P6 above.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Updated Intertie Schedules & Curtailments | Neighbouring Jurisdictions<br>Process 14 | Process P14<br>Neighbouring Jurisdictions | Event-based (As and when necessary) |

**Description:**

- Pre-dispatch will determine *intertie* schedules based on import and export transaction *offers* and *bids* for look-ahead period.
- Where there is a *reliability* concern in Ontario or a neighbouring jurisdictions, either side will issue curtailments.
- Once received, these curtailments will be reviewed accordingly and any necessary adjustments made to ensure that the schedules for both parties are aligned prior to implementation. This is to ensure overall system balance.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Dispatch Data Revisions | Process P14 | Pre-Dispatch (Next Run) | As Required |

**Description:**

- These are necessary changes to the *dispatch data* in response to updated *intertie* schedules (curtailments) for the look-ahead period. The updated *dispatch data* will be used for subsequent PD calculation engine runs to ensure that the more accurate information is utilized by the PD calculation engine.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Updated Intertie Schedules & Curtailments | Process P14 | Process P17 | As Required |

**Description:**

- These are updated *intertie* schedules for the next *dispatch hour* following the receipt and processing of curtailments from neighbouring jurisdictions. These schedules are implemented in the *real-time dispatch process* as fixed schedules for the *dispatch hour*.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Failure Notification | Process P13 | Process P14 | Event Based |

**Description:**

- See description in Process P13 above.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Advisory Schedule & Commitment (last valid results) | Process P13 | Process P14 | Event Based |

**Description:**

- See description in Process P13 above.

### Process P15 – Post Pre-Dispatch

#### Description

This process reviews the pre-dispatch results in order to provide *settlement* ready data. This review includes the validation and administration of prices and corresponding *market schedules* when specific *market rules* criteria are met.

Criteria and rules are also in place to determine the viability of market information in the event of schedule failures in the PD or RT timeframes and to provide guidance for preparing *settlement*-ready data.

#### Input and Output Data Flows

**Table 6-15: Process P15 Input and Output Data Flows**

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Failure Notification | Process P14 | Process P15 | Event Based |

**Description:**

- See description in Process P13 above.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Advisory Schedule & Commitment (last valid results) | Process P14 | Process P15 | Event Based |

**Description:**

- See description in Process P13 above.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| PD Results | Process P12 | Process P15 | Hourly |

**Description:**

- See description in Process P12 above.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Revised PD Market Results | Process P15 | Market settlement | Event based |

**Description:**

- These are updated market results to be used for *settlement*. Post pre-dispatch processes will manually adjust resource schedules and coding to reflect real time, and this will impact the resource's *settlement* as associated with the applied codes.
- The existing ex-post price is calculated immediately following the end of the *dispatch interval.*
  - The ex-post operations process calculates prices for *energy* and *operating reserve* following the *dispatch interval.*
- An ex-post pricing run uses actual *energy* cost data for the period (*energy* consumed and *demand*), rather than forecasted information to determine prices.

### Process P16 – Perform Pre-Dispatch Security and Adequacy Assessments

#### Description

This process assesses *IESO's* ability to meet its obligations to maintain the *reliability* of the *IESO-controlled grid* following the *publication* of pre-dispatch results.

*Reliability* assessments will continue to be used to determine if any control actions are required in order to ensure the *secure* and *reliable* operation of the *IESO-controlled grid* for the *dispatch day* and *dispatch hour*.

Any information derived from the *security* and *adequacy* assessment process will be used to provide a basis for informing *market participants* about expected conditions on the *IESO-controlled grid* and in the *IESO-administered markets*.

It is expected that the information will trigger appropriate responses under other market processes, such as *outage* coordination, and *transmission* investment planning.

## Input and Output Data Flows

**Table 6-16: Process P16 Input and Output Data Flows**

| Flow | Source | Target | Frequency |
|---|---|---|---|
| System Events/Changes | IESO | Process P16 | Event Based |
| **Description:**<br>• These are common occurrences in the day-to-day operation of the *IESO-controlled grid* (ICG) and the *IESO-administered markets* (IAM) and depending on their magnitude, location, timing and duration, may have a material impact on the ICG and IAM. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| PD Results | Process 12 | Process 16 | Hourly |
| **Description:**<br>• See description in Process P12 above | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| Updated MP/IESO Inputs | Process P16 | Pre-Dispatch (Next Run) | As Required |
| **Description:**<br>• These are updates to *market participant* and *IESO* inputs into the next pre-dispatch calculation engine run following a pre-dispatch *security* and *adequacy* assessment.<br>• For a full description of *market participant* and *IESO* inputs, see description in Process P1. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| Changes from PD Assumptions | Process P16 | Pre-Dispatch (Next Run) | As Required |
| **Description:**<br>• There may have been a number of system or market events or changes to system conditions that have occurred since the completion of the last pre-dispatch calculation engine run, which could have resulted in changes to pre-dispatch inputs and assumptions. These changes may require modifications of inputs to the next *pre-dispatch scheduling* process. | | | |

### 6.1.2.3 Real Time Processes

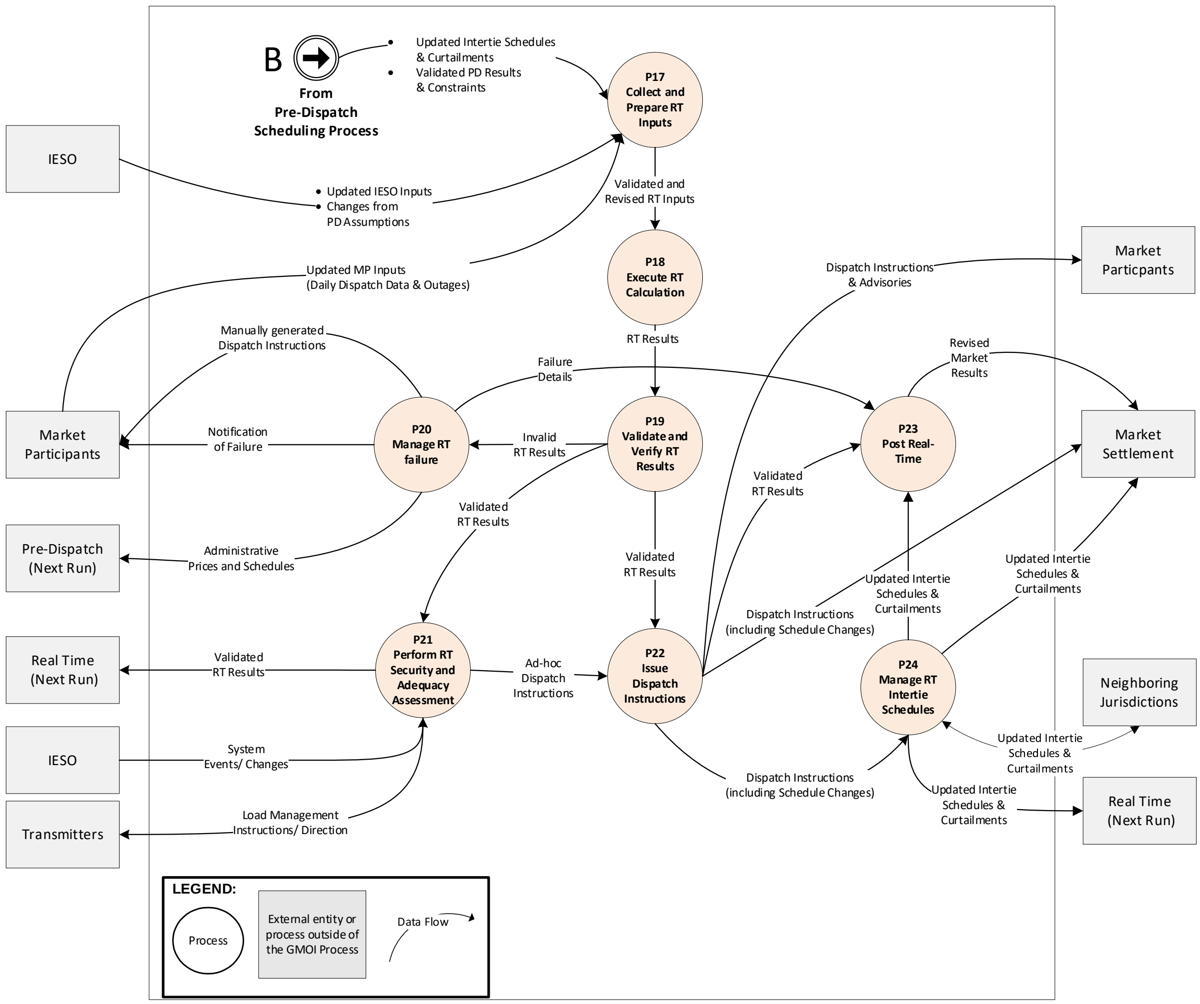



**Figure 6-4: Grid and Market Operation Integration of the RT Scheduling Process**

### Process P17 – Collect and Prepare RT Inputs

#### Description

This process describes the collection and preparation of inputs for the real-time calculation engine.

It uses many of the same *market participant* and *IESO* inputs as the DAM and PD calculation engines. The DAM and PD calculation engines produce hourly schedules for each dispatchable *registered facility* to meet an hourly *demand* forecast and accounting for an hourly *variable generation* forecast. The RT calculation engine needs additional flexibility throughout the *dispatch hour* to *dispatch facilities* in a way that accounts for *demand* and *variable generation* trends, to ramp interchange over a 10-minute period and to respond to changing system conditions in real-time.

## Input and Output Data Flows

**Table 6-17: Process P17 Input and Output Data Flows**

| Flow | Source | Target | Frequency |
| --- | --- | --- | --- |
| Updated Intertie Schedules & Curtailments | Process P14 | Process P17 | As Required |
| **Description:**<br>• Pre-dispatch will determine *intertie* schedules based on import and export transaction *offers* and *bids* for the look-ahead period.<br>• Where there is a *reliability* concern in Ontario or a neighbouring jurisdictions, either side will issue curtailments.<br>• Once received, these curtailments will be reviewed accordingly and any necessary adjustments made to ensure that the schedules for both parties are aligned prior to implementation. This is to ensure overall system balance. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| Validated PD Results & Constraints | Process P12 | Process P17 | Hourly |
| **Description:**<br>• See description in Process P12 above | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| Updated IESO Inputs | IESO | Process P17 | As Required |
| **Description:**<br>• These are the set of *IESO* inputs used for the DAM and PD calculation engines.<br>• The *IESO* will update these data inputs for pre-dispatch and real-time calculation scheduling processes based on changes in system conditions. These updates are made to ensure that the latest information is available for RT calculation engine runs.<br>• Full list of *IESO* inputs are described in Process P1 | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| Changes from Pre-Dispatch Assumptions | IESO | Process P17 | As required |

**Description:**

- There may have been a number of system or market events or changes to system conditions that have occurred since the completion of the last pre-dispatch calculation engine run, which could have resulted in changes to pre-dispatch inputs and assumptions. These changes may require modifications of inputs to the next *pre-dispatch scheduling* process.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Updates to MP Inputs | Market Participant | Process P17 | As Submitted |

**Description:**

- As required, *market participants* will be able to modify their *outage* information and hourly and daily *dispatch data.*
- The full list of *market participant* inputs is described in Process P1.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Validated and Revised RT Inputs | Process P17 | Process P18 | Every 5 Minutes |

**Description:**

- The RT calculation engine uses many of the same *market participant* and *IESO* inputs as the DAM and PD calculation engines. However, these inputs are updated where necessary for real-time calculation to include more accurate information when possible e.g. updated *demand* forecast and to reflect current system conditions such as *outages* (mostly unplanned).

### Process P18 – Execute RT Calculation

#### Description

This process executes the RT calculation engine every 5 minutes to produce *dispatch instructions* for the next 5-minute *dispatch interval* and *dispatch* advisories for next 11 intervals.

#### Input and Output Data Flows

**Table 6-18: Process P18 Input and Output Data Flows**

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Validated and Revised RT Inputs | Process P17 | Process P18 | Every 5 Minutes |

**Description:**

- See description in Process P17 above.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| RT Results | Process P18 | Process P19 | Every 5 Minutes |

**Description:**

- The RT calculation engine runs every 5-minutes to produce *dispatch instructions* for the next 5-minute *dispatch interval* and *dispatch* advisories for future *dispatch intervals*. It uses many of the same *market participant* and *IESO* inputs as the DAM and PD calculation engines.

### Process P19 – Validate and Verify RT Results

#### Description

This process reviews the result of the RT calculation engine run and either confirms its suitability for use as *dispatch instructions* or triggers specific remedial activities to establish suitable results.

#### Input and Output Data Flows

**Table 6-19: Process P19 Input and Output Data Flows**

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Invalid RT Results | Process P19 | Process P20 | Event Based |

**Description:**

- The *IESO* will assess the 5-minute *dispatch* produced by the RT calculation engine before it is sent to *market participants*. If the results are unacceptable due to its inability to address *reliability* requirements or use of invalid inputs, then all or some of the *dispatch instructions* are declared as invalid. This triggers a set of remediation activities to issue adequate *dispatch instructions* to affected *market participants*.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Validated RT Results | Process P19 | Process P21<br>Process P22 | Every 5 Minutes |

**Description:**

- The *IESO* will continue to assess market results and take real-time actions to address *reliability* requirements. Actions can include blocking *dispatch instructions*, issuing verbal *dispatch instructions*, issuing one-time *dispatch instructions*, issuing *operating reserve* activations, issuing mid-hour *intertie* transaction curtailment, applying generation constraints and load management procedures.

### Process P20 – Manage RT Failure

#### Description

This process notifies *market participants* of a failed RT calculation engine run and follows a set of operating protocols and procedures to perform any required corrective actions.

#### Input and Output Data Flows

**Table 6-20: Process P20 Input and Output Data Flows**

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Failure Details | Process P20 | Process P23 | Event Based |
| **Description:**<br>• This is a record of the RT calculation engine failure event which includes the failure time stamp for post-operations review and administration.<br>• This record is reviewed after the fact and any applicable schedules and prices are corrected for *market settlement* purposes. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| Invalid RT Results | Process P19 | Process P20 | Event Based |
| **Description:**<br>• See description in Process P19 above | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| Manually Generated Dispatch Instructions | Process P20 | Market Participants | Event Based |
| **Description:**<br>• These are *dispatch instructions* generated manually by the *IESO* following a RT calculation engine failure. These are verbally communicated to *market participants* to meet the *reliability* needs for the *dispatch interval*. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| Administrative Prices and Schedules | Process P20 | Pre-Dispatch (Next Run) | Event Based |

| **Description:**<br>• Once a set of real-time results have been deemed invalid, the system automatically copies the previous valid interval prices and schedules for all resources forward into the intervals impacted by the failure. | | | |
|---|---|---|---|
| **Flow** | **Source** | **Target** | **Frequency** |
| Notification of Failure | Process P20 | Market Participants | Event Based |
| **Description:**<br>• Once a real-time failure is identified, the *IESO* will continue to issue real-time failure communications and updates to *market participants* via an advisory notice, and take the appropriate corrective actions as required to maintain system *reliability*. | | | |

### Process P21 – Perform RT *Security* and Adequacy Assessment

#### Description

This process assesses *IESO's* ability to meet its obligations to maintain the *reliability* of the *IESO-controlled grid* following the completion of the RT calculation engine run.

*Reliability* assessments will continue to be used to determine if any control actions are required in order to ensure the *secure* and *reliable* operation of the *IESO-controlled grid.*

Any information derived from the *security* and *adequacy* assessment process shall be used to provide a basis for informing *market participants* about expected conditions on the *IESO-controlled grid* and in the *IESO-administered markets*.

It is expected that the information will trigger appropriate responses under other market processes, such as *outage* coordination.

#### Input and Output Data Flows

**Table 6-21: Process P21 Input and Output Data Flows**

| **Flow** | **Source** | **Target** | **Frequency** |
|---|---|---|---|
| Validated RT Results | Process P19 | Process P21<br>Real Time (Next Run) | Every 5 Minutes |
| **Description:**<br>• See description in Process P19 above. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| Ad-hoc Dispatch Instruction | Process P21 | Process P22 | Event based |

**Description:**

- These are specific *dispatch instructions* issued to *market participants* due to invalid set of real-time results or a change in system conditions. These *dispatch instructions* could be provided in any of the following forms;
  - Verbal *dispatch*;
  - *Operating reserve* activation;
  - Blocked *dispatch*; or
  - One-time *dispatch*.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| System Events/ Changes | IESO | Process P21 | Event Based |

**Description:**

- These are common occurrences in the day-to-day operation of the *IESO-controlled grid* (ICG) and the *IESO-administered markets* (IAM) and depending on their magnitude, location, timing and duration, may have a material impact on the ICG and IAM.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Load Management Instructions/Direction | Process P21 | Transmitters | Event Based |

**Description:**

- The *IESO* will continuously monitor important power system variables such as power flows and voltages at different locations on the *IESO-controlled grid* and continually update Operating Plans to deal with contingencies.
- These are situations where directions or instructions are provided to *transmitters* to manage *energy* consumption. These instructions are:
  - Voltage reduction; and
  - Load shedding.

### Process P22 – Issue Dispatch Instructions

#### Description

This process issues *dispatch instructions* to *market participants* and relevant internal business units.

## Input and Output Data Flows

**Table 6-22: Process P22 Input and Output Data Flows**

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Ad-hoc Dispatch Instructions | Process P21 | Process P22 | Event Based |

**Description:**

- See description in Process P21 above.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Validated RT Results | Process P19 | Process P22 | Every 5 Minutes |

**Description:**

- The *IESO* will continue to assess market results and take real-time actions to address *reliability* requirements. Actions can include blocking *dispatch instructions*, issuing verbal *dispatch instructions*, issuing one-time *dispatch instructions*, issuing *operating reserve* activations, issuing mid-hour *intertie* transaction curtailment, applying generation constraints and load management procedures.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Dispatch Instructions & Advisories | Process P22 | Market Participants | Every 5 Minutes |

**Description:**

- Following the successful run of the RT calculation engine every 5-minutes, *dispatch instructions* for the next 5-minute *dispatch interval* and *dispatch* advisories for future *dispatch intervals* are sent to *market participants*.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Validated RT Results | Process P22 | Process P23 | Every 5 Minutes |

**Description:**

- The *IESO* will continue to assess market results and take real-time actions to address *reliability* requirements. Actions can include blocking *dispatch instructions*, issuing verbal *dispatch instructions*, issuing one-time *dispatch instructions*, issuing *operating reserve* activations, issuing mid-hour *intertie* transaction curtailment, applying generation constraints and load management procedures.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Dispatch Instructions (including schedule changes) | Process P22 | Process P24<br>Market Settlement | Every 5 Minutes |

**Description:**

- One of the outputs of the RT calculation engine is the *dispatch instructions* which are issued to *market participants* for a *dispatch interval*. This contains the required *energy* output or consumption for *market participants* for the next 5-minute interval.
- *Interchange schedule* changes may be required as a result of changing system conditions and will be implemented by the *IESO* according to operating agreements. Any mid-hour schedule changes will need to be confirmed with adjacent balancing authorities.

### Process P23 – Post Real-Time Dispatch

#### Description

This process reviews the results of the real-time calculation engine after the execution of the *real-time dispatch process* in order to provide *settlement* ready data. This is required to deal with off-market transactions, validation and correction of questionable data and *administrative pricing*.

#### Input and Output Data Flows

**Table 6-23: Process P23 Input and Output Data Flows**

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Failure Details | Process P20 | Process P23 | Event Based |

**Description:**

- See description in Process P20 above.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Validated RT Results | Process P22 | Process P23 | Every 5 Minutes |

**Description:**

- See description in Process P19 above.

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Revised Market Results | Process P23 | Market Settlement | Event Based |

**Description:**

- The post *real-time dispatch process* reviews the real-time results to ensure that the *dispatch data* is correct and applicable *settlement* flags have been set to facilitate accurate *settlement*.
- This could result in a revision of market results. Revised data is transmitted to *settlement*.

### Process P24 – Manage RT *Intertie* Schedules

#### Description

Following the validation of *intertie* transaction schedules with neighbouring jurisdictions to limit each transaction to the quantity scheduled in both markets, the RT calculation engine uses these cleared transactions as fixed *boundary entity* schedules for every interval of the next *dispatch hour*.

#### Input and Output Data Flows

**Table 6-24: Process P24 Input and Output Data Flows**

| Flow | Source | Target | Frequency |
|---|---|---|---|
| Dispatch Instructions (including schedule changes) | Process P22 | Process P24 | Every 5 Minutes |
| **Description:**<br>• See description in Process P22 above. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| Updated Intertie Schedules & Curtailments | Neighbouring Jurisdictions | Process P24 | As Required |
| **Description:**<br>• These are notifications from neighboring jurisdictions advising *IESO* of curtailments or changes to their *intertie* schedules. These will be reviewed by the *IESO* and any required adjustments will be made to our schedules to limit each transaction to the quantity scheduled in both markets. | | | |
| **Flow** | **Source** | **Target** | **Frequency** |
| Updated Intertie Schedules & Curtailments | Process P24 | Process P23<br>Real Time (Next Run)<br>Market Settlement<br>Neighbouring Jurisdictions | As Required |
| **Description:**<br>• These are notifications from the *IESO* that will be used for the next RT calculation engine run. This is to ensure that the most accurate inputs are used during each RT calculation engine run.<br>• The *IESO* may also need to make changes to *intertie* schedules. These will need to be communicated to neighbouring jurisdictions to enable them to update their schedules accordingly. | | | |

## 6.2. Internal Process Impacts

The internal processes currently used for grid and market operations will continue to have relevance in the future DAM and *real-time market*.

Internal *IESO* processes related to Grid and Market Operation Integration include:

- Direct Day-Ahead Market Operations;
- Direct Short Term Operation;
- ExPost Operations;
- Mitigate Uneconomic Production (new process);
- Prepare Restoration Plan for Power System;
- Deploy Interconnection Agreement;
- Assess Operations; and
- Prepare Settlement Ready Operational Data.

Some of the internal processes interact with various *IESO* processes around the periphery of Grid and Market Operation Integration. For the most part, any changes to the Grid and Market Operation Integration process under the Market Renewal Program do not impact the internal procedures that address these periphery areas. However, in some areas this may be contingent upon the tools impact of the future DAM and *real-time market*.

Changes or additions to internal *IESO* processes are for internal *IESO* use as documented in Appendix C, and are not included in the public version of this document. Appendix C details the impacts to internal processes in terms of existing processes that support the new market requirements, existing activities that need to be updated, and process and information models that may need to be updated to support the future market.

**– End of Section –**

# Appendix A: Market Participant Interfaces

Table A- provides a description of the changes to *IESO* technical interfaces with *market participants* that may be required to support the Grid and Market Operations Integration process design of the future DAM and *real-time market*.

**Table A-1: Changes to IESO Technical Interfaces**

<table>
<tr><th>MP Interface Name</th><th>Interface Type</th><th>Description of Impact</th></tr>
<tr><td>Energy Market Interface (EMI)</td><td>Web-Client</td><td rowspan="2">New hourly and daily dispatch data parameters, removal of daily generator data (DGD) designations, new and modified validation rules for hourly and daily dispatch data. Potential to include VG forecast quantity submissions in DAM.</td></tr>
<tr><td>Market Information Management Web Service</td><td>Application Programming Interface</td></tr>
<tr><td>Online Outage Management System (CROW OCSS)</td><td>Web-Client</td><td>No changes required</td></tr>
<tr><td>Portal - Transmission Rights Application</td><td>Web-Client</td><td>No changes required</td></tr>
<tr><td>Dispatch Service</td><td>Web-Client/Application Programming Interface</td><td>Dispatch Service may be updated to allow receipt of commitments and transmittal of de-commitments.</td></tr>
<tr><td>Real-time Network</td><td>Network</td><td>No changes required. This interface manages collection of power system data and issuance of AGC control commands</td></tr>
<tr><td>Voice Communication</td><td>Network</td><td>No changes required</td></tr>
</table>

**– End of Section –**

# Appendix B: Internal Procedural Requirements *[Internal only]*

This section is confidential to the *IESO*.

# Appendix C: IESO Internal Business Process and Information Requirements *[Internal only]*

This section is confidential to the *IESO*.

**– End of Appendix –**

# References

| Document Name | Document ID |
|---|---|
| MRP High-Level Design Single Schedule Market | DES-13 |
| MRP High-Level Design Day-Ahead Market | DES-14 |
| MRP High-Level Design Enhanced Real-Time Unit Commitment | DES-15 |
| MRP Detailed Design: Overview | DES-16 |
| MRP Detailed Design: Authorization and Participation | DES-17 |
| MRP Detailed Design: Prudential *Security* | DES-18 |
| MRP Detailed Design: *Facility* Registration | DES-19 |
| MRP Detailed Design: Revenue Meter Registration | DES-20 |
| MRP Detailed Design: Offers, Bids and Data Inputs | DES-21 |
| MRP Detailed Design: Grid and Market Operations Integration | DES-22 |
| MRP Detailed Design: Day-Ahead Market Calculation Engine | DES-23 |
| MRP Detailed Design: Pre-Dispatch Calculation Engine | DES-24 |
| MRP Detailed Design: Real-Time Calculation Engine | DES-25 |
| MRP Detailed Design: Market Power Mitigation | DES-26 |
| MRP Detailed Design: Publishing and Reporting Market Information | DES-27 |
| MRP Detailed Design: Market Settlements | DES-28 |
| MRP Detailed Design: Market Billing and Funds Administration | DES-29 |
| Market Manual 1: Connecting to Ontario's Power System, Part 1.5: Market Registration Procedures | PRO-408 |
| Market Manual 4: Market Operations, Part 4.2: Submission of Dispatch data in Real-Time Energy & Operating reserve markets | MDP_PRO_0027 |
| Market Manual 4: Market Operations, Part 4.3: Real-Time Scheduling of the Physical markets | IMP_PRO_0034 |
| Market Manual 4: Market Operations, Part 4.4: Transmission Rights Auctions | MDP_PRO_0029 |
| Market Manual 4: Market Operations, Part 4.5: Market Suspension and Resumption | MDP_PRO_0030 |
| Market Manual 4: Market Operations, Part 4.6 - RT Generation Cost Guarantee Program | PRO_324 |

| Document Name | Document ID |
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| Market Manual 7: System Operations, Part 7.1: System Operating Procedures | MDP_PRO_0040 |
| Market Manual 7: System Operations, Part 7.2 - Near-Term Assessments and Reports | IMP_PRO_0033 |
| Market Manual 7: System Operations, Part 7.3 - Outage Management | IMP_PRO_0035 |
| Market Manual 9: Day-Ahead Commitment, Part 9.0 - DACP Overview | IESO_MAN_0041 |
| Market Manual 9: Day-Ahead Commitment, Part 9.2 - Submitting Operational and Market Data for the DACP | IESO_MAN_0077 |
| Market Manual 9: Day-Ahead Commitment, Part 9.3 - Operation of the DACP | IESO_MAN_0078 |
| Market Manual 9: Day-Ahead Commitment, Part - 9.4 Real-Time Integration of the DACP | IESO_MAN_0079 |
| Market Manual 9: Day-Ahead Commitment, Part - 9.5 *Settlement* for the DACP | IESO_MAN_0080 |
| *Market Rules* for the Ontario Electricity Market (*Market rules*) | MDP_RUL_0002 |
| Guide to the Day-Ahead Commitment Process | n/a |

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