Guide to the Enhanced Day-Ahead Commitment Process (EDAC)

Marketplace Training

August 2009

Guide to the Enhanced Day-Ahead Commitment Process (EDAC)

AN IESO MARKETPLACE TRAINING PUBLICATION

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1. Introduction

Background

This document describes the high-level design of the Enhanced Day-Ahead Commitment (EDAC) process. This new process, which is in the detailed design phase, will improve the efficiency of current Day-Ahead Commitment Process (DACP) for scheduling and committing resources while ensuring reliability.

You should have a good understanding of the current Day-Ahead Commitment Process before using this guide. For detailed information on the DACP, please see the *Guide to the Day Ahead Commitment Process* on the Marketplace Training web page.

The Day-Ahead Commitment Process

We introduced the DACP in June 2006 to address reliability concerns. The DACP allows the commitment of certain dispatchable generators and the economic scheduling of imports in the day-ahead time frame, in return for a financial guarantee.

The DACP provides:

- A dependable view of the next day's available supply (capacity and energy) and anticipated demand
- An opportunity for participants to use their energy-limited resources to most effectively meet reliability needs
- An incentive to imports that have been scheduled day-ahead to flow in real-time
- An incentive to ensure sufficient internal generation resources are on-line in real-time
- A way to mitigate the financial risk of commitment for importers and generators
- A mechanism for us* to commit generators, with the participant's agreement, when market-driven attempts don't meet reliability needs

What's Different with EDAC?

New or revised features include:

- Optimization of energy and operating reserve over a 24-hour dispatch day
- Optimizes using 'total' costs for committable generators (start-up, speed-no-load, and incremental energy costs via three-part offers)
- Revised cost guarantee principles
- Revised/new failure charges
- Includes exports and linked wheel transactions
- A model for combined cycle facilities that provides better scheduling of these facilities

** In this document, 'we', 'us' and 'our' refer to the IESO. 'You' refers to the market participant.*

- A daily opportunity to revise certain parameters associated with generation units when the technical characteristics of the facility change

The **What's Different** headings in the following sections highlight these features and other differences from the current DACP.

2. Participation

We need information from market participants to create a dependable view of the next day's supply and demand situation and to make economically sound scheduling and commitment decisions:

- Dispatchable participants in Ontario must submit dispatch data day-ahead if they wish to participate in the next day's real-time market
- Imports, exports and linked wheels may choose to submit dispatch data day-ahead, but are not obligated to do so
- Self-scheduling and intermittent generators must submit a schedule or forecast that represents their best estimate of what they think they will produce the next day

Using this dispatch data, our demand forecast, and other committable generator information, we run the optimization to create schedules and commitments for the next day.

What's Different

- Exports and linked wheels may submit dispatch data for us to include in the EDAC process
- Combined cycle facilities can choose to submit offers using the combined cycle model (known as the pseudo unit model, or PSU)

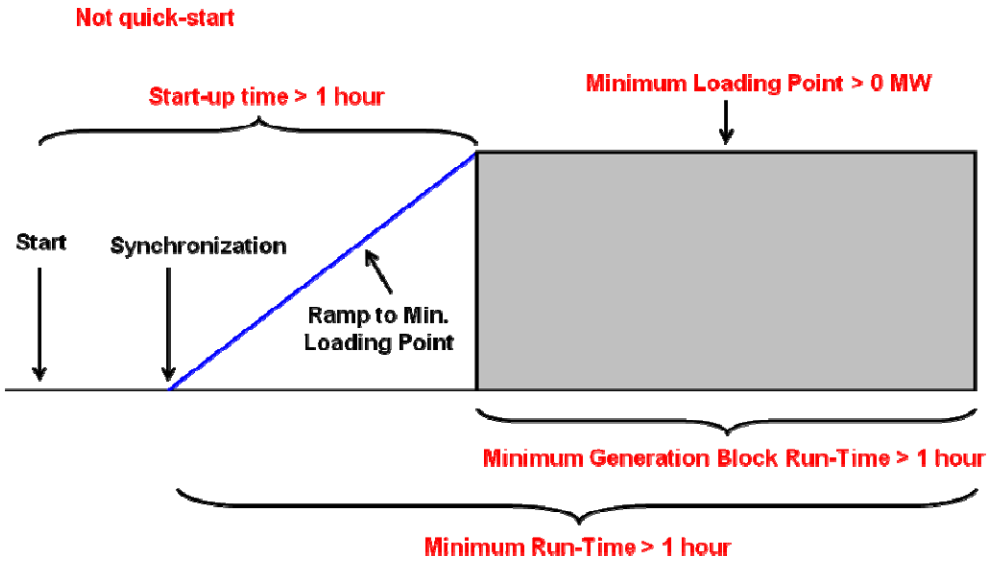
Committable Generators

Although the EDAC process commits all types of resources to meet tomorrow's expected demand, in this document the term 'committable generators' refers to generators that are eligible to receive a cost guarantee.

A committable generator[1] must meet all of the following criteria:

- Not a quick-start generator
- Has a minimum run-time greater than one hour
- Has a minimum generation block run-time greater than one hour
- Has a start-up sequence greater than one hour (start-up sequence is the time from when they begin start-up until they reach their minimum loading point)

[1] While nuclear generation units may meet these criteria, we do not consider them committable generators for EDAC



What's Different

- Committable generators must meet the minimum start-up time criteria
- Committable generators are automatically eligible for the DA-PCG and cannot reject the DA-PCG

3. Data Requirements

Offer/Bid Structure

- Committable generators and other not quick start generators may use three-part offers
- Other dispatchable generators, dispatchable loads, imports and exports continue to provide single-part offers

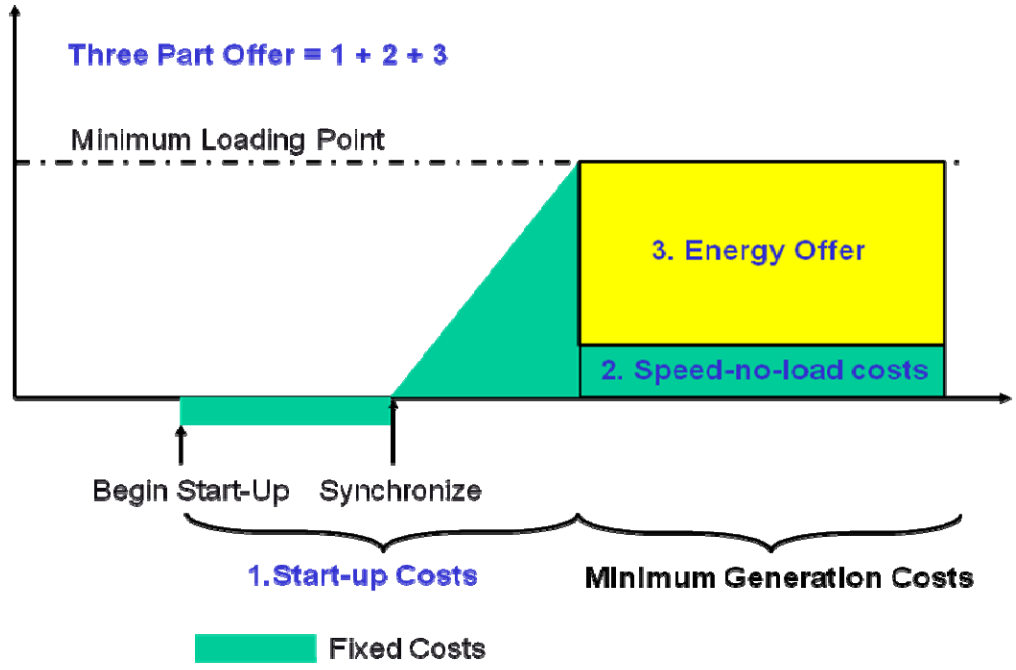
Three-part offers

The new optimization compares total costs when making commitments.

Committable generators and other not quick start generators may provide three-part offers that reflect all their costs, i.e., start-up, speed-no-load, and incremental energy costs.

- Start-up costs and speed-no-load costs represent their fixed costs.
- Committable generators determine their incremental energy costs the same way as before, and these costs are reflected in price-quantity pairs. Incremental energy costs and price-quantity pairs do not include start-up costs and speed-no-load costs.

Once EDAC commitment is complete, only the incremental energy offer (i.e., the price-quantity pairs) is transferred to the pre-dispatch and real-time dispatch algorithms. Start-up costs and speed-no-load costs are used when the new optimization considers total costs.



What's Different

- Committable generators may submit three-part offers, which allow a total cost comparison and enable efficient scheduling and commitment decisions
- Other not quick start generators may submit three-part offers, which allow a total cost comparison and enable efficient scheduling decisions (these resources are not eligible for a DA-PCG)
- Dispatchable not quick start generators have a daily opportunity to revise certain parameters associated with generation units when the technical characteristics of the facility change

Offer and Bid Changes

Offer and bid changes are not allowed during the EDAC process, except for energy-limited resources who may resubmit dispatch data once. Others are restricted by the same criteria used in the DACP.

Also, the concept of the Availability Declaration Envelope (ADE) continues, i.e., participants may not increase either the quantity or hours of their offers or bids after their initial EDAC submission, except under specific circumstances.

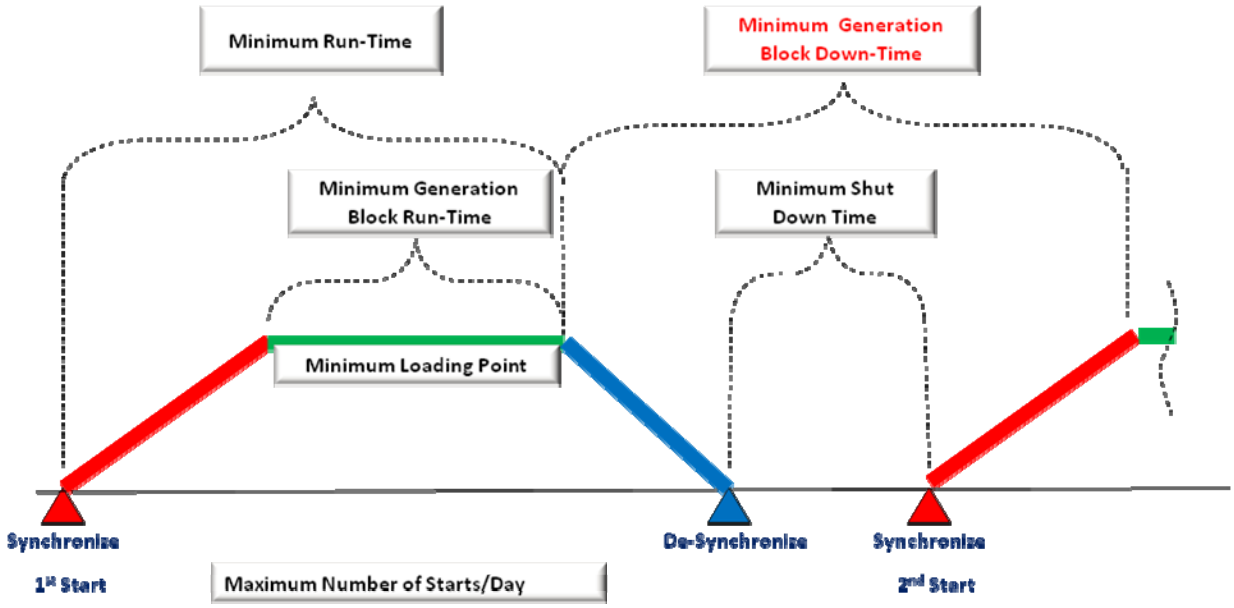
What's Different

- Only eligible energy-limited resources have an opportunity to revise dispatch data during the process – these resources will have only one opportunity to do this [2]

Additional Committable Generator Data

Committable generators submit additional technical and operational data that reflects their physical capabilities, as shown below.

[2] Unlike DACP where all energy limited resources can resubmit dispatch data, only eligible energy-limited resources (resources that are cascade hydroelectric facilities, operated by the same registered market participant, and with a hydraulic time lag to adjacent upstream and downstream plants of less than 24 hours) will be allowed to resubmit dispatch data during the scheduling process.



What's Different

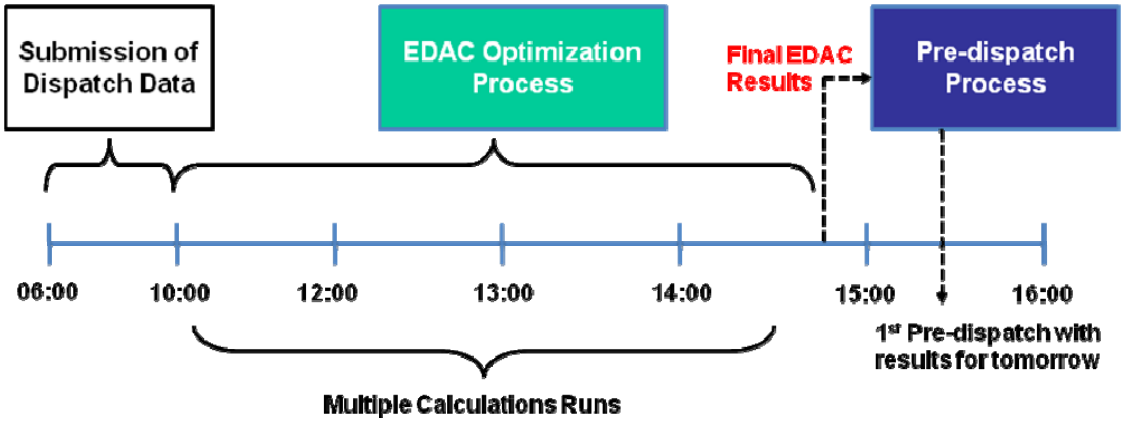
- Committable generators and other not quick start generators may submit:
  - Minimum generation block down-time
  - Maximum number of starts per day
  - Single cycle mode

4. Process Timeline

The current DACP uses the pre-dispatch process, which runs hourly, to determine commitments. EDAC uses a new computational engine that optimizes over the whole day. This increases the calculation time, which has two impacts:

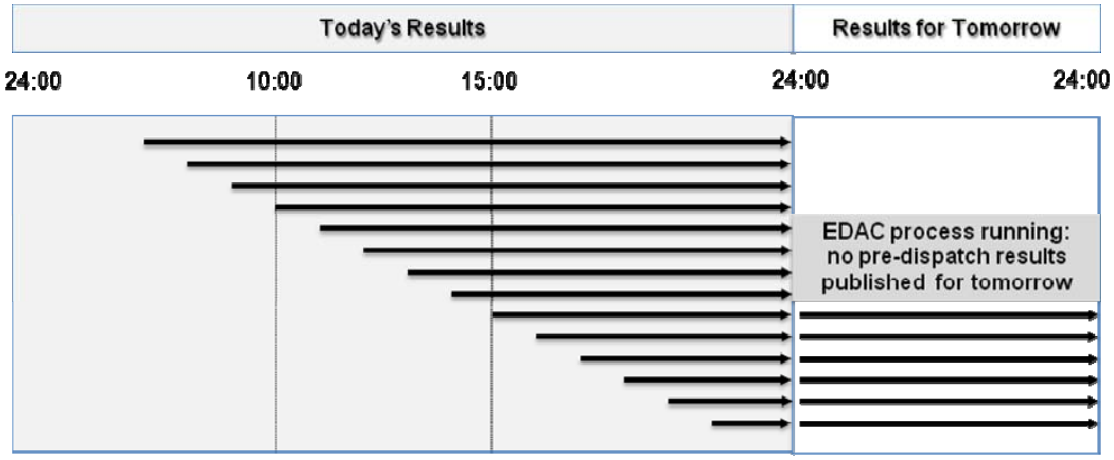
1. Any participant that wishes to operate in real-time must submit dispatch data by 10:00 to allow sufficient time for the calculations and publishing of final results by 15:00.
2. While we do not yet know how long each run will take, there will be enough time between 10:00 and 15:00 for multiple runs, with results published after each run, but this will not occur hourly as it does for DACP.

Eligible energy-limited resources have one opportunity to revise their offers as a result of the first EDAC run so that they can address any sub-optimal scheduling of their resources for cascade river systems as previously noted.



Pre-dispatch will continue to run hourly, but during the EDAC process (from 10:00 - 15:00), pre-dispatch results will not be published for the next day.

Results from the 15:00 pre-dispatch run will incorporate the commitment outcomes from EDAC and provide the first pre-dispatch that shows the next day's schedules.

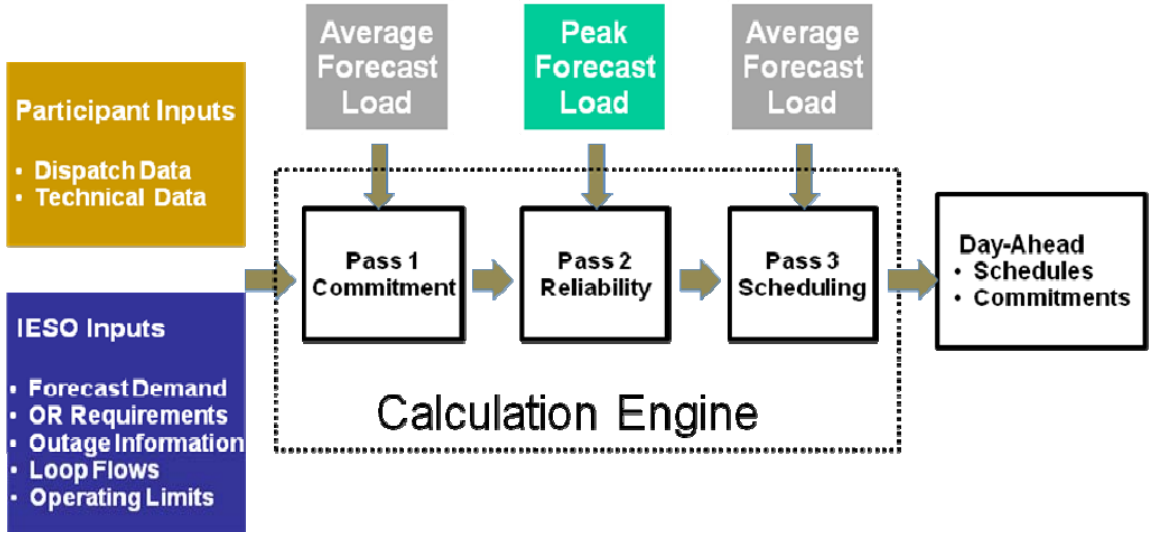


What's Different

- Dispatch data must be submitted by 10:00
- We publish EDAC results after each run, but not hourly
- EDAC uses a separate calculation engine from pre-dispatch – pre-dispatch continues to run hourly
- We do not publish pre-dispatch results showing tomorrow until after EDAC has finished and results have been passed to the 15:00 pre-dispatch

5. Calculation Engine

The EDAC calculation engine co-optimizes energy and operating reserve over the 24 hours of the next day. It uses dispatch data, additional data from committable generators and other not quick start generators, and IESO inputs to determine commitments and schedules. Each run consists of three passes, as shown below.



Pass 1: Commitment

- The optimization objective is to minimize the total costs to serve average hourly demand over the next day. We use average demand so that we do not over-commit resources.
- We assume that non-committable generators have no commitment costs – we consider only their energy and operating reserve offers. Similarly, we schedule imports, exports, and linked wheels based on the economics of their offers and bids. [3]
- We schedule committable generators based on their total costs, submitted through their three-part offers, and their operational restrictions such as minimum run-time, provided through their additional data submissions.

Pass 1 results:

- Schedules and forecasts of self-scheduling and intermittent generators, as submitted by them
- Schedules for dispatchable loads, imports, exports, and linked wheels, based on their offers and bids

[3] Other non committable not quick start generators, although not eligible for a DA-PCG, may submit operational restrictions and fixed costs to be used in the calculation engine.

- Schedules for committable generators and other not quick start generators, based on their total cost to supply – these schedules respect all submitted technical and operational limitations such as minimum run-time and minimum loading point
- Schedules for other dispatchable generation, based on their offers

These results are used as inputs to Pass 2.

Pass 2: Reliability

The objective of the second pass is to minimize the cost of ensuring that we have sufficient capacity and energy to meet our hourly peak demand for the next day. Normally, this peak occurs over a single 5-minute interval, which is taken into account when Pass 2 determines which resources to commit to meet this need.

Pass 2 uses the schedules and commitments from Pass 1 and chooses the lowest cost solution from the following options:

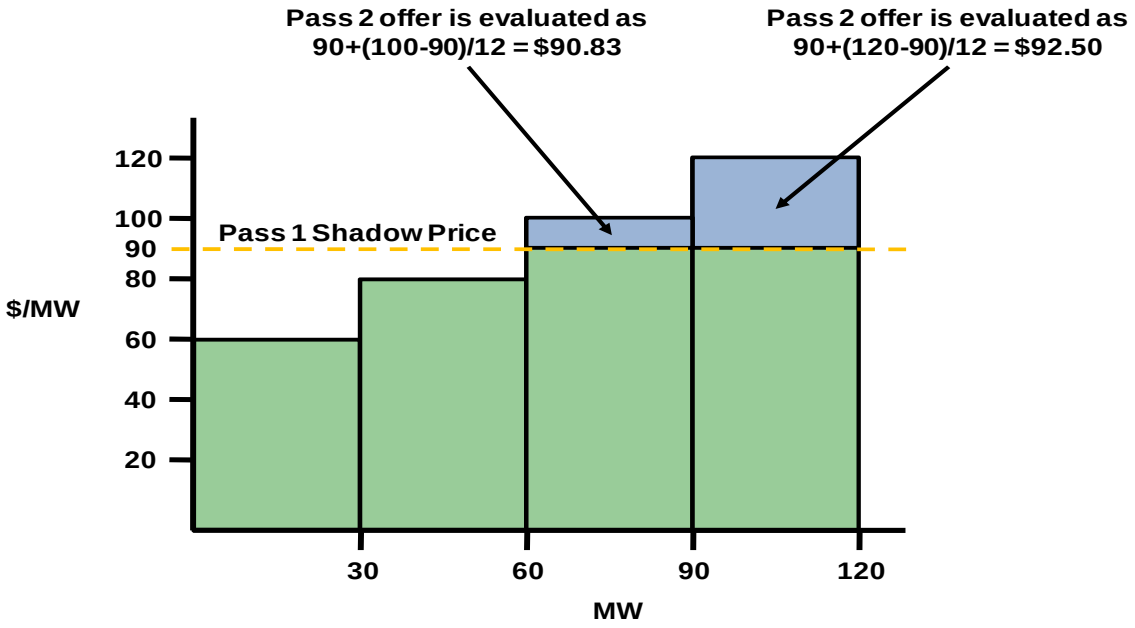
- Ramp up a quick-start or already committed non quick-start generator
- Ramp down a dispatchable load
- Schedule an import for the hour (and reduce generation in the other non-peak intervals)
- Reduce an export for the hour (and increase generation in the other non-peak intervals)
- Schedule an additional committable generator as necessary.

Note that we do not reduce imports from their Pass 1 quantity.

To determine the relative cost of using the first two options, the calculation engine uses shadow prices to find the most economic solution to meet a single interval's demand.

$$\text{Cost} = \text{Pass 1 shadow price} + \frac{(\text{Offer} - \text{Pass 1 shadow price})}{12}$$

Example:



A generator is scheduled to 60 MW in Pass 1:

- Its shadow price is $90
- Of the remaining capacity, up to 30 more MW is available at $90.83/MW and from 30-60 more MW is available at $92.50/MW

Pass 2 results

Pass 2 results reflect the additional energy required to meet the hourly peak demands. Unless this has required scheduling an additional committable generator or import, or reducing an export, this schedule will have the same resources as Pass 1 – they will just be dispatched differently to meet the peak.

Pass 2 results are used as inputs to Pass 3.

Pass 3: Scheduling

Pass 3 has the same objective as Pass 1 (to meet average hourly demand), but it must consider the results of Pass 2. If Pass 2 was satisfied by ramping up already committed generators from Pass 1, then Pass 3 results are identical to Pass 1 results.

Pass 3 respects the following rules to minimize commitment costs:

- Committable generators and other not quick start generators that submit a minimum loading point from Passes 1 and 2 are scheduled to at least their minimum loading point
- Imports are scheduled to at least their Pass 2 schedules
- Exports are scheduled to no greater than their Pass 2 schedules
- The energy associated with non-quick-starts ramping to their minimum loading points is considered when determining the schedules for all resources

Note that we will ensure that the energy scheduled for the export and import legs of a linked wheel is equal.

Pass 3 results

Pass 3 results are the final day-ahead commitment schedules used to determine the production cost guarantees and any withdrawal charges for committable generators or failure charges for imports, exports, and linked wheels.

Results are passed to pre-dispatch for use in the 15:00 run. Committable generators are constrained to at least their minimum loading point for all hours of their EDAC schedule.

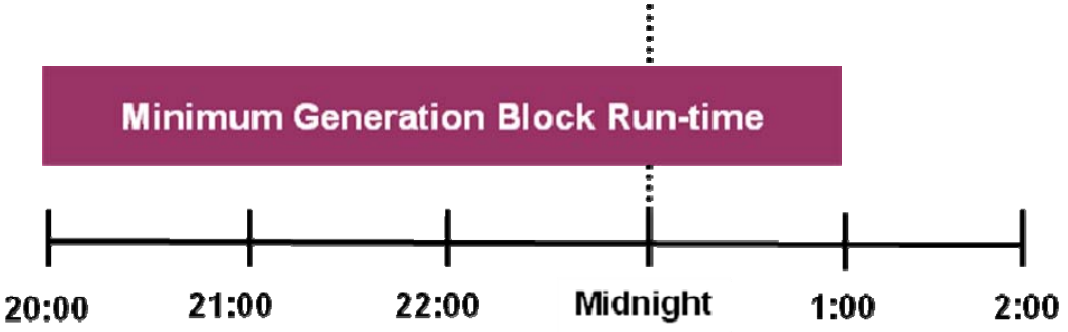
What's Different

- New calculation engine that minimizes total commitment costs and optimizes over 24 hours
- Considers exports, linked wheels, and three-part offers from committable generators
- Committable generators are constrained to at least their minimum loading point for all hours of their EDAC schedule in all subsequent pre-dispatch and real-time runs following completion of EDAC

6. Committable Generator Scheduling and Settlement

Committable Generator Considerations

- EDAC respects all minimum generation block down-times within a day, but does not recognize when a generator needs to remain shut down past midnight to satisfy this requirement. The participant's offer must ensure that minimum generation block down-time is respected over midnight.
- EDAC will commit a generator even if its minimum generation block run-time (MGBRT) extends past midnight. When EDAC runs the next day, it will recognize the need to complete MGBRT as long as the participant has submitted offers for those hours.



- Committable generators may submit escalating start-up costs for hours at the end of the EDAC day to recover their start-up and minimum generation costs within that day.

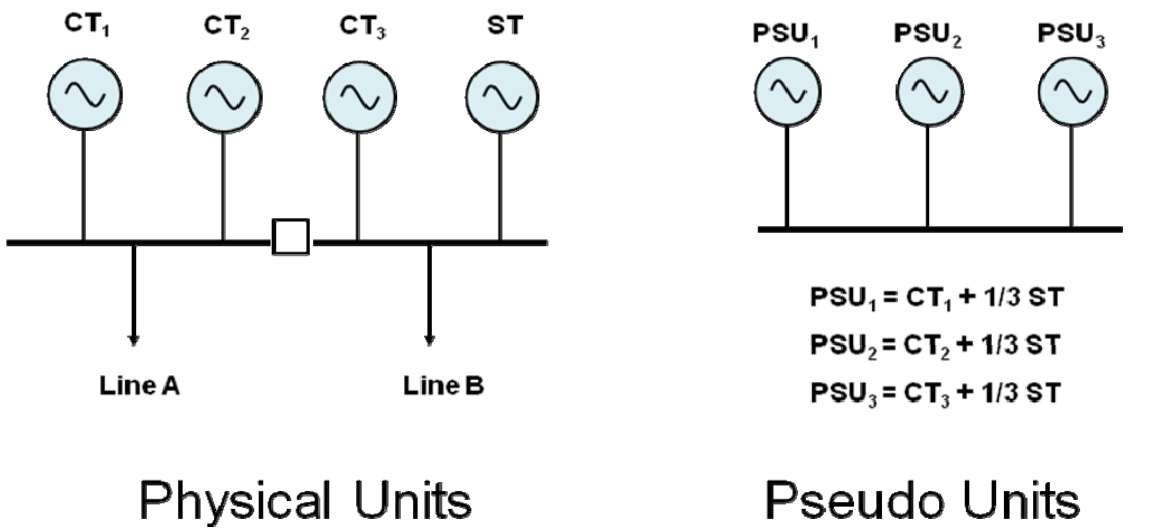
What's Different

- All of these considerations are new

Pseudo Unit (PSU) Model

Combined cycle generators consist of one or more combustion turbines (CT) and a steam turbine (ST). The capability of the steam generator is dependent on the output of the combustion turbines. The existing dispatch algorithm does not consider these dependencies when it determines schedules, which sometimes results in unfeasible outcomes.

EDAC uses a pseudo unit model (PSU) to address this issue. The pseudo unit model combines each combustion turbine's capability with a proportional share of the steam turbine's capability. An example for a three-on-one configuration is shown below.



Participants with combined cycle generation offer into the EDAC process using pseudo units (PSU1, PSU2), which allows realistic commitment and scheduling outcomes. The minimum generation block run-time, minimum run-time, and minimum loading point of the CT are used for each PSU. The calculation engine also uses the following values associated with the CT and ST that can be updated daily:

- Minimum generation block down-time
- Maximum number of starts per day
- Single cycle mode

EDAC publishes schedules for each of the physical resources (CT1, CT2, ST1) associated with a pseudo unit. Participants continue to use the physical resources to offer in pre-dispatch and real-time.

What's Different

- The PSU model is new

Production Cost Guarantee

The Day-Ahead Production Cost Guarantee (DA-PCG) allows guaranteed cost recovery for committable generators when the real-time revenue does not cover the generator's as-offered costs for the EDAC schedule. The DA-PCG cannot be rejected, and is based on the total day-ahead schedule rather than just minimum loading point as used in the current DACP. All cost information is submitted before EDAC runs at 10:00.

The DA-PCG =

Energy production cost (day-head offer x quantity) - Energy production revenue (real-time MCP x real-time quantity)

+

Start-up costs

-

Operating reserve (revenue – cost)

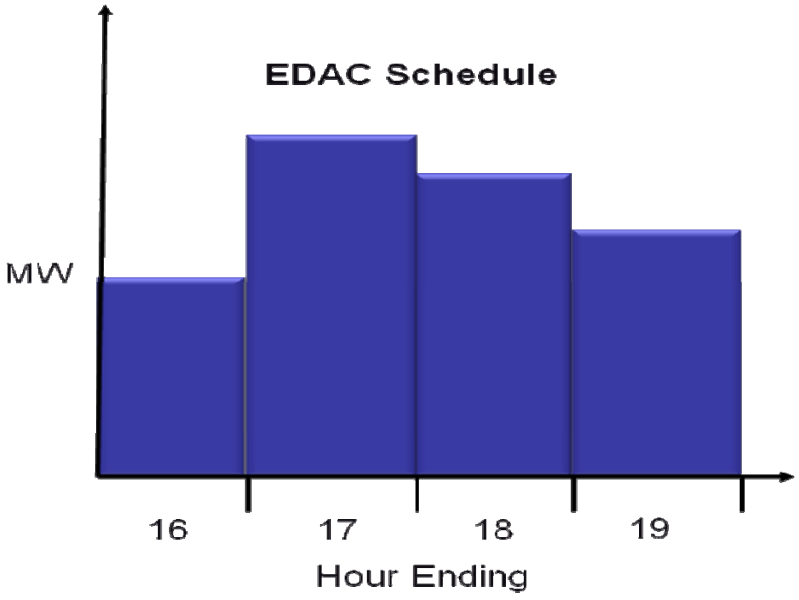
-

Congestion Management Settlement Credits

-/+

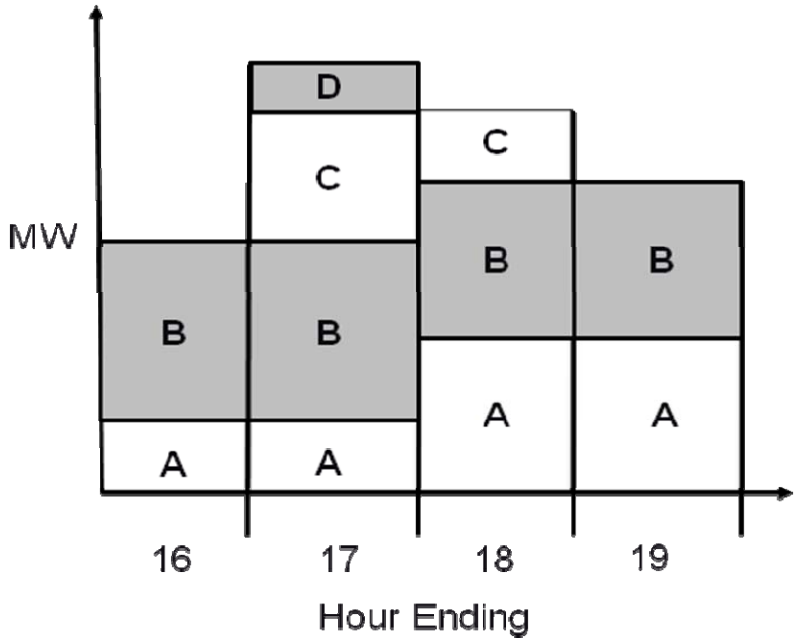
Portion of day ahead schedule not implemented

Assume a generator receives the following schedule from EDAC:



The generator's real-time outcomes compared to its EDAC schedule are as shown below. In it, the generator:

- Produces energy to meet its dispatch instructions (A)
- Is scheduled for operating reserve (B)
- Is partially constrained-off for hours 17 and 18 (C)
- Does not implement a portion of its day-ahead schedule for hour 17 (D), i.e., none of these three conditions (A, B or C) occurs



The production guarantee for a generator is based on the generator's costs to meet its EDAC schedule and the associated revenues from that schedule.

Costs (+)	Revenues (-)
Start-up costs	
Energy production costs (A) (day-ahead energy offer x quantity)	Energy production revenues (A) (real-time energy market clearing price (MCP) x quantity injected)
Operating reserve costs (B) (day-ahead OR offer x quantity)	Operating reserve revenues (B) (real-time OR MCP x quantity scheduled)
	Congestion Management Settlement Credits (C)
Portion of day-ahead schedule not implemented in real-time (D)	

The portion of the day-ahead schedule not implemented in real-time can either add to or subtract from the DA-PCG. We compare the participant's real-time offer against their day-ahead offer to determine whether they attempted to get scheduled to meet their day-ahead commitment. If their real-time offer price is:

- Equal to their day-ahead offer, then this component is zero
- Greater than their day-ahead offer, then this component subtracts from the DA-PCG
- Less than their day-ahead offer, then this component adds to the DA-PCG

What's Different

- Committable generators cannot reject cost guarantee
- Guarantee is based on entire EDAC schedule, not just minimum loading point for minimum generation block run-time
- Includes unimplemented day-ahead schedule

Withdrawal

Committed generators that withdraw their commitment in real-time may incur a charge. This ensures that treatment of generators is consistent with treatment of imports and exports, which are charged for failing to meet their day-ahead commitments.

The charge applies if:

- A generator withdraws before completing its day-ahead commitment, and
- The reason for withdrawal is within the generator's control, and
- A price test is failed.

The formula we use to determine the charge is based on how much warning the participant gives us.

If the notification is within four hours of real-time, the market has enough time to respond to the withdrawal, and we base the charge on the lower of the hour-ahead pre-dispatch or real-time MCP.

If the notification is less than four hours ahead of real-time, we use the real-time MCP for the entire calculation.

7. Imports, Exports, and Wheels

Import Day-Ahead Intertie Offer Guarantee (DA-IOG)

Imports may offer in real-time regardless of whether or not they offer into EDAC. Imports scheduled in EDAC are eligible to receive a day-ahead intertie offer guarantee (DA-IOG). This ensures that the participant recovers the costs of supplying energy in real-time that was committed day-ahead. The new DA-IOG is the same as the DA-PCG except that the DA-IOG does not include start-up costs and operating reserve components.

DA-IOG =

Energy production cost (day-head offer x real-time quantity) - Energy production revenue (real-time MCP x real-time quantity)

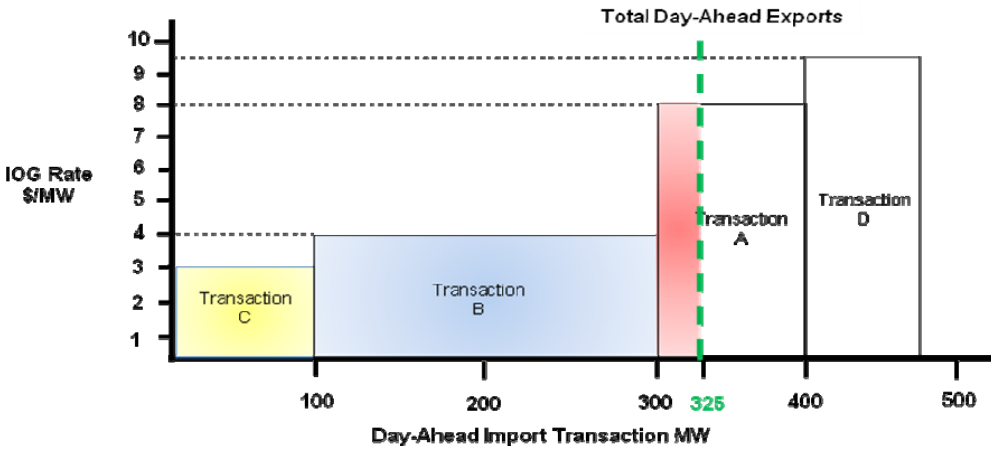
-

Congestion Management Settlement Credits

-/+

Portion of day ahead schedule not implemented

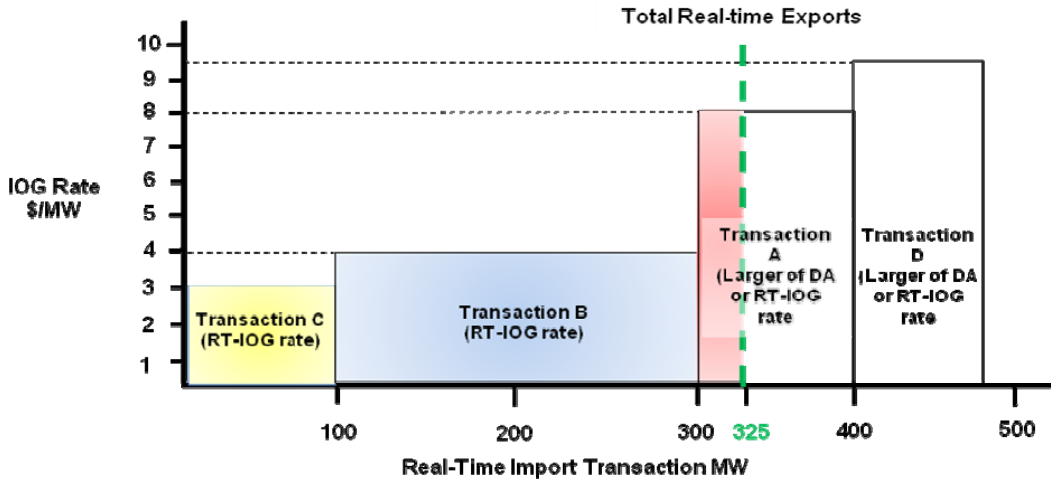
During settlement, day-ahead scheduled imports and exports from the same participant are considered implied day-ahead wheels. The calculated DA-IOG for each day-ahead import is stacked from lowest to highest IOG rate ($/MW). The corresponding quantity of day-ahead scheduled exports are overlaid. If the total export MW is greater than 50% of a day-ahead import transaction, the import is considered part of a linked wheel, and is not eligible for a day-ahead IOG, but may get a real-time IOG.



In real-time, simultaneous imports and exports from the same participant are considered implied wheels, regardless of whether or not the import was scheduled day-ahead. We claw back (offset) intertie offer guarantees for exports that flow during the same hour.

Assume all the transactions shown flow in real-time. The real-time IOG offset process stacks all import transactions from lowest to highest IOG rate ($/MW). The transactions that were offset based on simultaneous day-ahead exports (transactions B and C) are stacked using their real-time IOG rate. The transactions that were not offset (transactions A and D) based on an implied day-ahead wheel are stacked using the higher of their day-ahead or real-time IOG rates.

The corresponding quantity of exports from that participant is overlaid and the lowest value IOGs are clawed back, up to a maximum of the total export quantity.



What's Different

- There is no exemption for 'financially binding status' of day-ahead imports as used in the current DACP
- We use an IOG rate rather than total IOG dollars/transaction during calculation of the offset process
- Includes a day-ahead implied wheel to determine whether import is eligible for DA-IOG

Day-Ahead Import Failure Charge (DA-IFC)

Imports scheduled day-ahead that fail to flow in real-time are subject to an automatic failure charge based on the quantity that didn't flow, multiplied by a price differential.

Failures outside the participant's control remain exempt from the charge, following the same rationale as current practice.

The new import failure charge uses the hour-ahead pre-dispatch price rather than the real-time MCP in the price differential calculation. The charge reflects the quantity that failed to flow multiplied by its impact on the market. Impact is based on the lesser of the price difference between the day-ahead offer and:

- The hour-ahead pre-dispatch offer, and
- The hour-ahead pre-dispatch price

(Pre-dispatch Ontario Price – Day-Ahead Offer Price)
X
(Day-Ahead Constrained Schedule – Pre-dispatch Constrained Schedule)

DA-IFC is the lesser of:

(Pre-dispatch Offer Price – Day-Ahead Offer Price)
X
(Day-Ahead Constrained Schedule – Pre-dispatch Constrained Schedule)

We charge imports the higher of the two failure charges in cases where both a day-ahead and real-time failure charge apply.

What's Different

- The revised DA-IFC uses the Ontario pre-dispatch price rather than the MCP

Day-Ahead Export Failure Charge (DA-EFC)

EDAC allows day-ahead export scheduling. Exports that fail to flow in real-time can affect reliability and the markets in the same way as failed imports. As a result, we will implement a new export failure charge with EDAC.

Failures outside the participant's control are exempt from the charge, following the same rationale as the current practice for imports. Exports are charged the higher of the two failure charges in cases where both a day-ahead and real-time failure charge apply.

(Day-Ahead Bid Price - Pre-dispatch Ontario Price)
X
(Day-Ahead Constrained Schedule – Pre-dispatch Constrained Schedule)

DA-EFC is the lesser of:

(Day-Ahead Bid Price - Pre-dispatch Bid Price)
X
(Day-Ahead Constrained Schedule – Pre-dispatch Constrained Schedule)

What's Different

- New failure charge to reflect that exports are included in day-ahead commitment and the impact if they fail to flow in real-time

Day-Ahead Linked Wheel Failure Charge (DA-LWFC)

Linked wheels scheduled day-ahead that fail to flow in real-time are subject to a failure charge based on the indirect impact on the Ontario energy price. A linked wheel scheduled day-ahead can displace other intertie transactions, e.g., the wheel could create congestion that limits the scheduling of other imports or exports. The failure charge is based on the price spread between the two affected intertie zones, which indicates congestion.

A linked wheel attracts a failure charge if:

- The pre-dispatch constrained schedule is less than the day-ahead constrained schedule, and
- The day-ahead price spread is higher than the pre-dispatch price spread, where price spread equals import leg (source) intertie zone price – export leg (sink) intertie zone price

Failures outside the participant's control are exempt from the charge, following the same rationale as the current practice for imports.

DA-LWFC =

(Day-Ahead Price Spread - Pre-dispatch Price Spread)
X
(Day-Ahead Constrained Schedule – Pre-dispatch Constrained Schedule)

What's Different

- New failure charge reflecting that linked wheels are included in day-ahead commitment, and the impact if they fail to flow in real-time

8. Publishing and Reporting

We will continue to publish a System Status Report (SSR) before the dispatch data submission window closes – this will help market participants make market and operational decisions. Because this window is one hour earlier, we will no longer publish the 10:30 SSR.

During the detailed design phase, we will determine the process for identifying commitment results from EDAC, and the timing of EDAC reports.

What's Different

- We will no longer publish the 10:30 SSR

9. Additional Information

For additional information, please see:

- DACP web pages
- EDAC web pages
- *Guide to the Day-Ahead Commitment Process* and the *Introduction to Ontario's Physical Markets* workbook, available on our Marketplace Training web pages