TRAINING GUIDE

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Enhanced Day-Ahead Commitment (EDAC)

Marketplace Training

Guide to the Day-Ahead Commitment Process (DACP)

EDAC Issue 0.2

This guide has been prepared to assist in the IESO training of market participants and has been compiled using excerpts from the market rules and other documents posted on the web site of Ontario's Independent Electricity System Operator.

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EDAC Disclaimer

This is an internal EDAC project document. Market participants and IESO operations shall not use this document as a reference for their operations. The existing *Guide to the Day-Ahead Commitment Process (DACP)*, which is available on the IESO website via the following link: http://www.ieso.ca/imoweb/pubs/training/DACPguide.pdf, shall be used by markets and IESO operations until otherwise notified by the IESO.

Background

The purpose of this document is to revise the existing *Guide to the Day-Ahead Commitment Process (DACP)* based on changes introduced by the EDAC project, and to prepare the marketplace training guide for formal release under the IESO Baseline Management process.

This document is controlled under the EDAC project baseline management process; therefore, the document versioning (i.e., issue number) follows the EDAC document versioning standards, which are different from the IESO Baseline Management versioning standards.

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Issue	Reason for Issue	Date
0.1.0	First draft for internal project review.	October 28, 2010
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EDAC Related Documents

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EDAC Table of Changes

Reference (Paragraph and Section)	Description of Change
Entire Document	This is a new document replacing the existing *Guide to the Day-Ahead Commitment Process (DACP)* marketplace training guide.
Figure 3	Illustration modified to include Elapsed Time to Dispatch (ETD).
Section 3	Section added regarding *Registration of Facilities in the DACP* (from MM9.1).
Section 3	Information added regarding EELR and DCHD (from IESO_DES_0039).
Section 4	Information added regarding DGD (from IESO_PRO_0172, Section 2.4).
Section 9	Section added regarding *Publishing and Reporting* (from IESO_DES_0039).
Appendix	Section added: *Glossary of Acronyms*.
Figures 11-14, 17-19	Colour versions of illustrations added.
Section 4	Information added regarding Availability Declaration Envelope (ADE).
Figures 17, 18 & 19	Applied gradient to illustrations to improve legibility.
Figure 9	Added illustration of three passes of constrained algorithm (Fig 5-1 from IESO_DES_0035).
Section 3 & 10	IESO_FORM_1721 is now entitled *Implementation of Three Part Offers.*
Figure 19	Replaced illustration to reflect correct DA-LWFC calculation.
Section 9	Deleted sections on *Outage Reports* and *Transmission Rights Reports*.
Section 8	Deleted all references to *Financially Binding Status*.
Section 4	Replaced section on *Offer and Bid Changes*.
Figure 6	Modified illustration to replace *EDAC optimization* with *DACP optimization*.
Figure 8	Modified illustration of Pass 2 for improved clarity.
Entire Document	*EDAC* replaced with *DACP*, references to the process in the future tense replaced with present tense, and references comparing the process to the *current DACP* deleted.
Section 9	Information added regarding *PSU DGD Computed Values Report*.

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Guide to the Day-Ahead Commitment Process (DACP)

Marketplace Training

November 25, 2010

Guide to the Day-Ahead Commitment Process (DACP)

AN IESO MARKETPLACE TRAINING PUBLICATION

This guide has been prepared to assist in the IESO training of market participants and has been compiled using excerpts from the market rules and other documents posted on the web site of Ontario's Independent Electricity System Operator. Users of this guide are reminded that they remain responsible for complying with all of their obligations under the market rules and associated policies, standards, and procedures relating to the subject matter of this guide, even if such obligations are not specifically referred to herein. While every effort has been made to ensure the provisions of this guide are accurate and up to date, users must be aware that the specific provisions of the market rules or other particular document shall govern.

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1. Introduction

Purpose

This guide describes the design of the Day-Ahead Commitment Process (DACP). This process improves the efficiency of the electricity market through the advanced scheduling and commitment of resources required to provide electricity on a daily basis, while ensuring reliability.

This document is intended to provide a general overview of the DACP. For more detailed information regarding the DACP, please refer to section *10. Additional Information*, which includes links to supporting reference material.

Conventions

The conventions followed in this document are as follows:

- "We", "our", "us" refers to the IESO and unless otherwise specified, "you", "your" and "yours" refers to participants in the IESO-administered markets and the DACP process.
- Time is Eastern Standard Time (EST). The DACP operates on Eastern Standard Time (EST) all year round. For example, a time stamp in this document of 15:07 means 15:07 EST.
- We use the 24-hour clock and the Hour Ending (HE) convention to identify hours. For example, HE19 or Hour Ending 19:00 is the hour that starts at 18:00 and ends at 19:00.
- Footnotes are used in this document in order to define certain terms that may be unfamiliar to market participants.
- The word "must" denotes a mandatory requirement.
- Italics are used for emphasis and to indicate the titles of publications.
- All prices (e.g., $/MW-month) are in Canadian dollars.
- The term "cost" used in subsequent sections, refers to as-bid and as-offered amounts as submitted by market participants, to consume and produce energy and operating reserve in the market respectively. It does not represent the actual expenditures by a market participant to maintain or generate an electricity-related product.

Background

We originally 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 the following:

- 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.

Changes were later introduced in order to enhance the efficiency of the process for scheduling and committing resources, while continuing to ensure reliability.

These new or revised features include the following:

- Optimization of energy and operating reserve over a 24-hour dispatch day.
- Optimizes using total costs for committable generators (i.e., 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.
- A daily opportunity to revise certain parameters associated with generation units when the technical characteristics of the facility change.

2. Participation

We need the following information from market participants in order to create a dependable view of the next day's supply and demand situation (Figure 1), and to make economically sound scheduling and commitment decisions:

- Dispatchable generators must submit dispatch data day-ahead if they wish to participate in the next day's real-time market.
- Dispatchable loads must submit dispatch data day-ahead if they wish to participate in the next day's real-time market as dispatchable resources. Loads that do not submit dispatch data day-ahead can still operate in real-time as non-dispatchable.
- 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 plan to produce the next day.
- Combined cycle facilities can choose to submit offers using the combined cycle model known as the Pseudo Unit (PSU) model1.

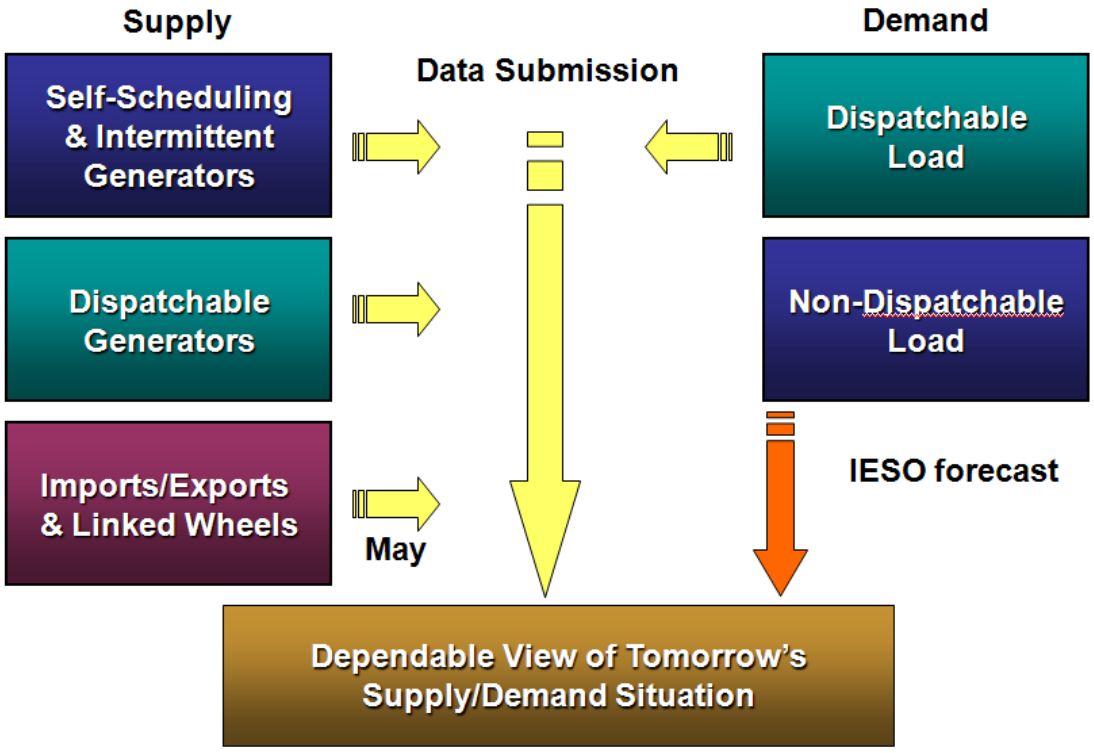

Figure 1: Data Submission

[1] For an explanation of the PSU model, refer to section *3. Registration of Facilities in the DACP* in this guide.

Using this dispatch data, our demand forecast, and other committable generator information, we run the Day-Ahead Calculation Engine[2] (DACE) to create schedules and commitments for the next day.

Committable Generators

The DACP schedules all types of resources to meet tomorrow's expected demand. Generators that are eligible to receive a Day-Ahead Production Cost Guarantee[3] (DA-PCG) are referred to as *committable generators* in this document.

A committable generator must meet all of the following criteria:

- Not a *quick-start*[4] generator.
- Has a Minimum Loading Point[5] (MLP) greater than 0 MW.
- Has a Minimum Generation Block Run-Time[6] (MGBRT) greater than one hour.
- Has an Elapsed Time to Dispatch[7] (ETD) greater than sixty minutes.
- Its *Registered Resource Fuel Type* is not uranium.

[2] For an explanation of the DACE, refer to section *6. Day-Ahead Calculation Engine (DACE)* in this guide.
[3] The DA-PCG is a settlement amount that guarantees cost recovery for eligible dispatchable *generation facilities* when dispatched to produce *energy* in the *real-time market* and where real- time revenue is insufficient to cover as-offered costs to produce schedules as committed day ahead.
[4] A quick start facility is defined by the market rules as a generation facility whose electrical energy output can be provided to the IESO-controlled grid within 5 minutes of the IESO's request, and is provided by equipment not synchronized to the IESO-controlled grid when the request to start providing energy is made (in keeping with existing IESO market manuals, the term *not quick start* facility is used in this document to refer to a generation facility that *does not* meet the definition of a *quick start* facility).
[5] For an explanation of MLP, refer to the appropriate footnote in section *3. Registration of Facilities in the DACP* in this guide.
[6] For an explanation of MGBRT, refer to the appropriate footnote in section *3. Registration of Facilities in the DACP* in this guide.
[7] For an explanation of ETD, refer to the appropriate footnote in section *3. Registration of Facilities in the DACP* in this guide.

3. Registration of Facilities in the DACP

Overview

As part of the DACP registration process, we collect specific operational information in order to determine the following:

- Your resource's day-ahead commitments and schedules while respecting the resource technical data.
- Your Eligible Energy Limited Resource[8] (EELR) status.
- Your eligibility for the Day-Ahead Production Cost Guarantee (DA-PCG).
- Your DA-PCG settlement amounts[9].

To participate in the DACP, you must ensure that you are authorized to participate in the IESO-administered markets, and that the physical facilities which you intend to participate in the DACP have been registered with us in the real-time markets. There are specific registration requirements for dispatchable generators participating in the DACP. All other facilities (i.e., load facilities, boundary entities, and non-dispatchable generators) have no new registration requirements. In addition, you must also indicate to the IESO whether you intend to submit three part offers.

DACP Registration Forms

All market participants with registered generation facilities must submit a number of DACP registration forms in order to capture relevant information. This information is then processed by the IESO within six business days of receipt.

IMO_FORM_1552 – Spare Generation On-Line and DA-PCG Form

Not quick start dispatchable generation facilities must complete this form in order to provide us with the following Registered Technical Data (RTD) for each resource:

- Minimum Loading Point[10] (MLP).
- Minimum Run-Rime[11] (MRT).

[8] For an explanation of EELR, refer to the end of section *3. Registration of Facilities in the DACP* in this guide.
[9] For an explanation of DA-PCG settlement amounts, refer to section *7. Committable Generator Scheduling and Settlement* in this guide.
[10] MLP is defined as the minimum output of energy specified by the market participant that can be produced by a generation facility under stable conditions without ignition support.
[11] MRT is defined by the market rules as the number of hours required for the generation facility to ramp from a cold start to minimum loading point plus minimum generation block run-time, specified by the market participant, in accordance with the technical requirements of the facility.

- Minimum Generation Block Run-Time[12] (MGBRT).

Registered MLP and MGBRT values are assumed to be relatively static. They represent the baseline we use to validate changes through the day-ahead daily generator data submissions. Submitted Daily Generator Data[13] (DGD) values are used to schedule *not quick start* resources, to determine DA-PCG commitment actions, and to calculate the DA-PCG. You can view the registered values of your MLP, MRT, and MGBRT through the Facility Registration system.

Registered Technical Data (RTD) is shared with the Spare Generation On-Line[14] (SGOL) program. You must, therefore, also indicate whether you want to participate in the SGOL program on the same form.

IMO_FORM_1181 – Facility/Resource Profile

All generation and load facilities must complete this form in order to provide us with the following DACP-specific registration data:

- Elapsed Time to Dispatch[15] (ETD).
- Daily Cascading Hydroelectric Dependency[16] (DCHD).
- Quick Start facilities.
- Cascading hydroelectric dependent generation resource.

IESO_FORM_1702 – Combined Cycle Plant Form

Generation facilities that are part of a combined cycle plant must complete this form in order to provide us with the following information:

[12] MGBRT is defined by the market rules as the number of hours, specified by the market participant, that a generation facility must be operating at minimum loading point in accordance with the technical requirements of the facility.
[13] For an explanation of DGD, refer to the end of section *4. Offers/Bids* in this guide.
[14] Some forms of generation, primarily fossil, can take anywhere from two to sixteen hours to start and synchronize to the grid. During this period, they incur significant start-up costs. They might then be unable to make sufficient market revenues to cover these costs. The SGOL cost guarantee removes this concern by covering certain costs should market revenues fall short. In this way, the program ensures that more generation is available on-line to respond to disturbances.
[15] ETD is the minimum amount of time, in minutes, between the time a generation unit initiates its start-up sequence and the time it becomes dispatchable by reaching its Minimum Loading Point. For fossil fired generation units this is based on a hot start.
[16] For an explanation of DCHD, refer to the end of section *3. Registration of Facilities in the DACP* in this guide.

- Physical Combustion Turbine (CT) and Steam Turbine (ST) Resource Names and Resource Ids.
- Steam Turbine Percentage Share of Pseudo Unit[17].
- Steam Turbine Duct Firing Capacity[18].
- Steam Turbine MLPs for n-on-1 CT-to-ST configuration[19].
- Declaration to use Pseudo Unit (PSU) model.

IMO_FORM_1004 – Generation Facilities

All generation facilities must complete this form in order to provide us with the following DACP-specific registration data:

- Primary Fuel Type[20].
- Secondary Fuel Types[21].

IESO_FORM_1721 – Implementation of Three Part Offers

This form is used to notify us of your intention to submit three-part offers for the DACP. This declaration is used by IESO systems to determine the version of the Market Participant Interface (MPI) and Application Programmer Interface (API) offer template file that you use to submit and retrieve dispatch data. This form contains the *Three-Part Offer Eligibility Declaration*.

[17] Steam Turbine Percentage Share of a PSU is the amount of steam turbine capacity associated with each PSU, expressed as a percentage. The values are captured only when the market participant intends to use pseudo unit modeling and must reflect the technical capability of the generation unit.

[18] Duct Firing Capacity is the capacity available from the duct firing of a physical steam turbine. For registration purposes, a single value of Duct Firing Capacity will be provided and captured for a steam turbine resource associated with a combined cycle plant that has indicated the desire to use pseudo unit modeling. The value must reflect the technical capability of the generation unit.

[19] The Minimum Loading Point of a steam turbine at a combined cycle plant may differ depending on the number of combustion turbines that obtain a schedule from DACP. For registration purposes, *n*-1 additional ST MLPs are required for all combined cycle configurations above the MLP submitted for a 1 CT on 1 ST configuration; *n* is equal to the number of combustion turbines at the combined cycle plant. Each value must reflect the technical capability of the generation unit.

[20] A list of possible fuel types can be found on IMO_FORM_1111 – *NERC Fields-Valid Codes*.

[21] It is mandatory to submit a single Generator Primary Fuel Type for each generation resource, for registration purposes. You also have the option to submit a single Generator Secondary Fuel Type. The fuel type must reflect the technical capability of the generation resource, and is prohibited if the resource is not a generation resource.

Eligible Energy Limited Resource (EELR)

An Eligible Energy Limited Resource (EELR) can resubmit dispatch data during the DACP process.

An EELR is an Energy Limited Resource (ELR) with the following characteristics:

- A cascading hydroelectric generation facility.
- Has a minimum hydraulic time lag to adjacent (upstream or downstream) hydroelectric generation facilities of less than 24 hours.
- Where the upstream hydroelectric generation facility is operated by the same registered market participant.

We determine EELR status using the Daily Cascading Hydroelectric Dependency[22] (DCHD) registration data submitted by market participants.

Once defined as an EELR, a generation unit is deemed eligible to resubmit dispatch data after the initial run of the Day-Ahead Calculation Engine[23] (DACE), provided that a Daily Energy Limit[24] (DEL) was submitted as part of the day-ahead offer.

For registration purposes, the market participant submits the following information for each dispatchable hydroelectric generation unit:

- A self-declaration that the generation unit has a DCHD.
- The Resource Name and Resource ID of the cascading hydroelectric dependent generation facility.

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 dispatch algorithm does not consider these dependencies when determining pre-dispatch and real-time schedules. This can sometimes result in an impractical outcome.

[22] A dispatchable hydroelectric generation facility has a DCHD if the facility has a Minimum Hydraulic Time Lag of less than 24 hours to or from an adjacent cascading hydroelectric generation facility that is controlled by the same registered market participant.
[23] For an explanation of the DACE, refer to section *6. Day-Ahead Calculation Engine (DACE)* in this guide.
[24] DEL represents the maximum amount of energy that can be scheduled at a specified hydroelectric generation facility for a given day.

The DACP uses a Pseudo Unit (PSU) model to address this issue. The PSU model combines each combustion turbine's capability with a proportional share of the steam turbine's capability. An illustration of this model for a three-on-one configuration is shown in Figure 2.

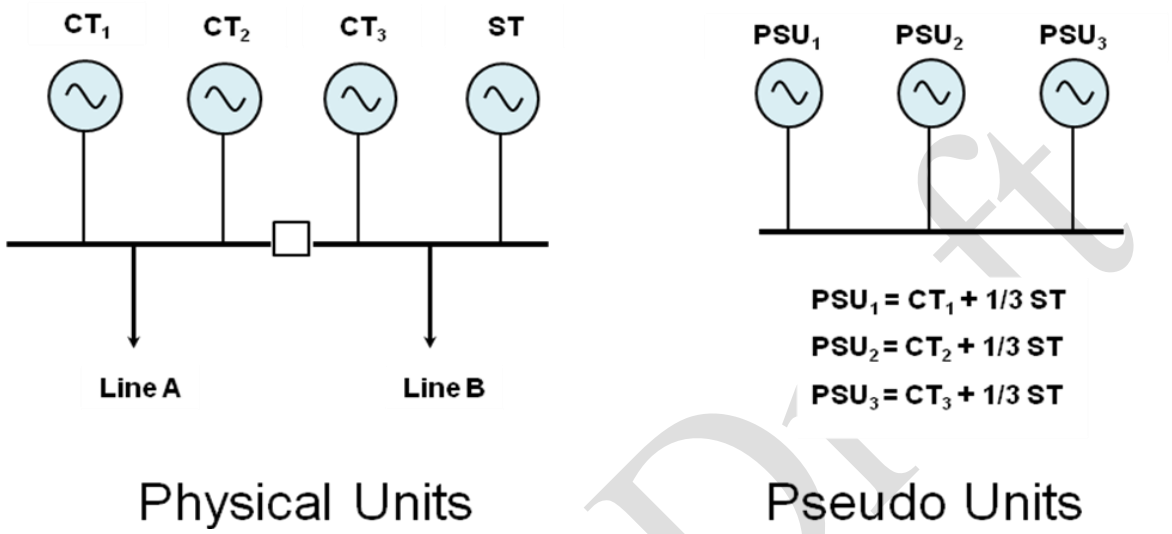

Figure 2: Pseudo Unit (PSU) Model

Participants with a combined cycle plant offer into the DACP using pseudo units (i.e., PSU1, PSU2, and PSU3), which allows realistic commitment and scheduling outcomes. The minimum loading point for each PSU is calculated by the IESO as the total of the MLPs for the associated CT plus MLP of the ST when it is in a 1-on-1 configuration. A program calculates the PSU values based on the information submitted for the CTs and ST of a combined cycle plant. The DACE also uses the following values associated with the CT and ST that can be updated daily through the market participant's DGD submission:

- Minimum Generation Block Down-Time (MGBDT).
- Maximum number of starts per day.
- Single cycle mode (CT only).
- Minimum Generation Block Run-Time (MGBRT).

The DACP publishes schedules for each of the physical resources (i.e., CT1, CT2, CT3, and ST1) associated with a pseudo unit. Participants continue to use the physical resources to offer in pre-dispatch and real-time.

Registration Procedures by Resource Type

Table 1 lists the registration data submission procedure for each resource type.

Resource Type	Submit DACP Registration Data	Submit CCP and PSU Data
Not Quick Start	X	X[25]
Pseudo Unit	X	X
Quick Start	X	
TSG; Intermittent; Self Scheduling	X	
Dispatchable Load	X	

Table 1: Applicability of Procedures

Additional Committable Generator Data

Committable generators submit additional technical and operational data that reflects their physical capabilities, as shown in Figure 3 (items marked with an asterisk indicate daily values submitted through Daily Generator Data).

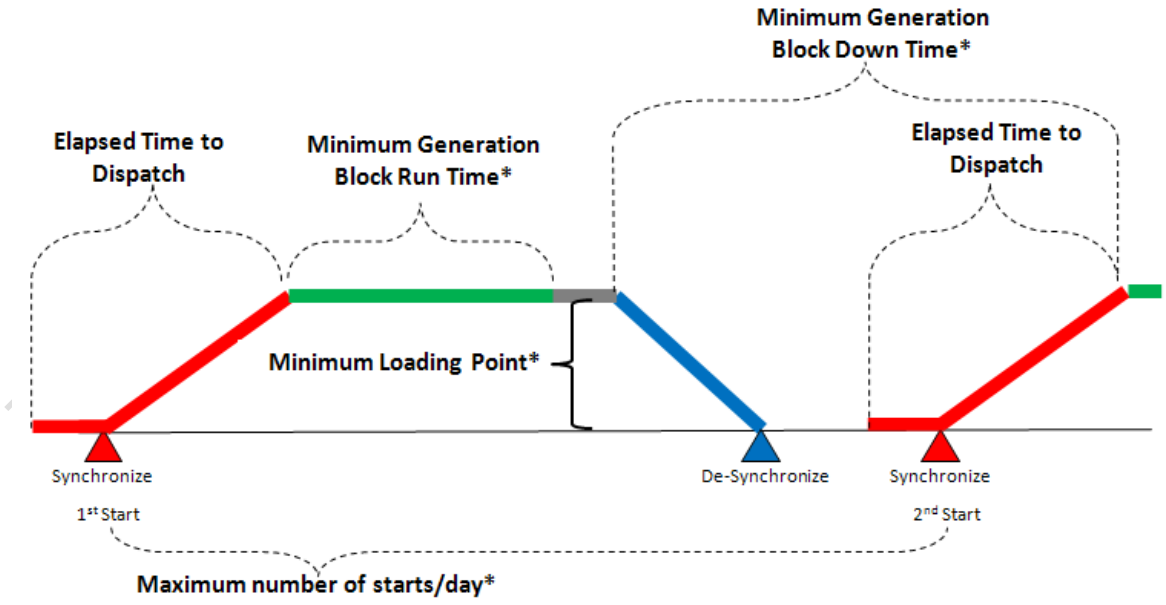

Figure 3: Dispatchable Generator Technical Data

[25] Required for combined cycle plants.

4. Offers/Bids

Offer/Bid Structure

- 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[26] 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 can revise certain generation parameters daily if the technical characteristics of the facility change.
- Other dispatchable generators, dispatchable loads, imports, and exports continue to provide single-part offers.

Three-Part Offers

The new DACE[27] compares total costs when making commitments.

Committable generators and other *not quick start* generators may provide three-part offers that reflect all of their costs (i.e., start-up, speed-no-load, and incremental energy costs – refer to Figure 4).

- Fixed costs are represented by:
  - *Start-up costs*: The cost incurred to bring an off-line generation unit through all of the unit-specific start-up procedures, including synchronization and ramp up to minimum loading point.
  - *Speed-no-load costs*: The cost to maintain a generation unit synchronized with zero net energy injected into the system for an hour. The speed-no-load cost and the incremental offer for energy up to a generation unit's minimum loading point forms its minimum generation cost.
- Committable generators use price-quantity pairs to reflect their incremental energy costs.
- Once the DACP 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.

[26] A generation facility that does not meet the definition of a quick start facility.
[27] For an explanation of the DACE, refer to section *6. Day-Ahead Calculation Engine (DACE)* in this guide.

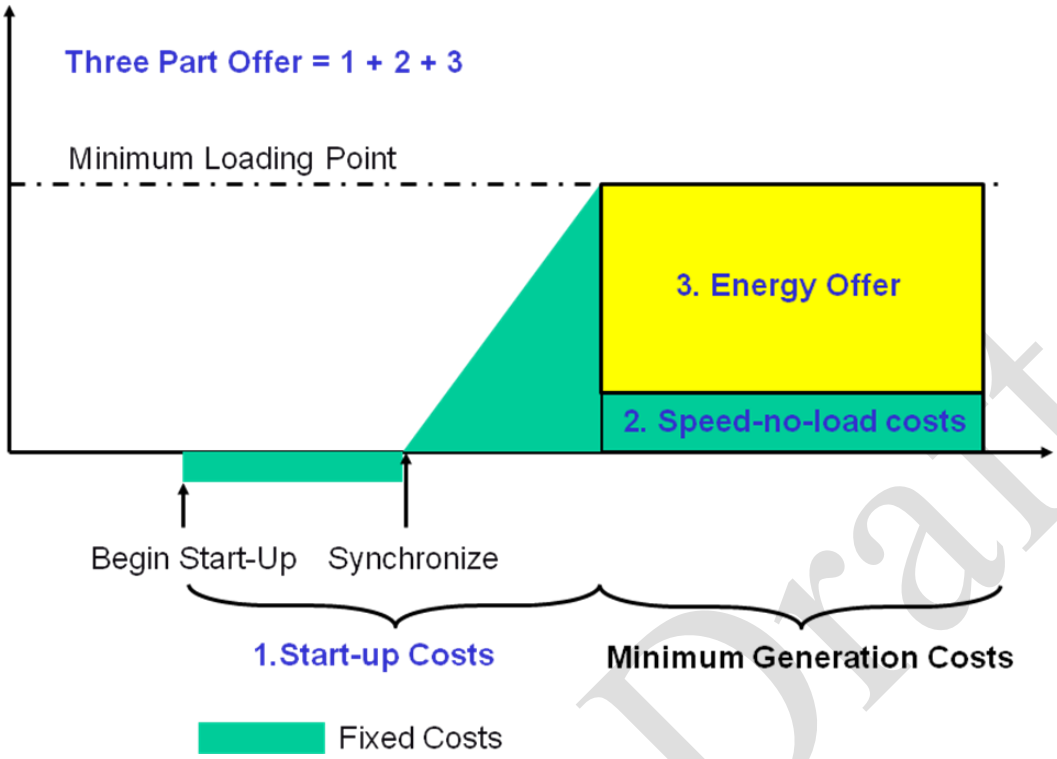

Figure 4: Three Part Offer and Cost Terms

Offer and Bid Changes

We accept dispatch data submissions during the DACP optimization process (between 10:00 and 14:00) from the following:

- Non-dispatchable generators (forecasts and schedules).
- Physical units associated with a pseudo unit (the physical CT and ST that make up a pseudo unit) to assist in pre-dispatch and real-time scheduling.
- Eligible Energy Limited Resources (EELR) that pass standard validation rules.

You must include a reason code for dispatch data submissions between 10:00 and 14:00 from all other dispatchable generators and dispatchable loads (see *Appendix A, Market Manual 9.2* for a list of valid reason codes). If you do not include a reason code, the bid/offer is automatically rejected and a validation error is issued.

Cascade hydroelectric generation units that are energy limited may be scheduled in a sub-optimal way. For this reason, we give EELRs that submit a Daily Energy Limit (DEL) prior to 10:00 an opportunity to look at the results of one complete run of the DACE, and allow EELR offers including the DEL to be adjusted. During the EELR re-submission window (normally from 11:00 to 12:00), restrictions do not apply to dispatch data changes from EELRs.

You do not need our approval for changes to offers for physical units associated with a PSU when these changes occur between 10:00 and 14:00. You must ensure that the offers for your physical units are sufficient to allow the physical unit schedules you receive from the DACP to be scheduled in Pre-dispatch.

Availability Declaration Envelope (ADE)

The Availability Declaration Envelope (ADE) rules state that participants may not increase either the quantity or hours of their offers or bids after their initial DACP submission, except under specific circumstances.

The ADE applies to dispatchable generators and dispatchable loads (the notion of the ADE does not apply to non-dispatchable generators, non-dispatchable loads, imports, or exports).

The ADE is the hourly energy and capacity offered into the DACP for dispatchable generators, or the hourly load bid as dispatchable for dispatchable loads.

Offers for operating reserve into the DACP must be accompanied by a corresponding energy offer (or a bid for dispatchable loads). While there is no ADE for Operating Reserve (OR), the ADE of the corresponding energy offer/bid impacts the amount of OR that you can offer in real time.

The ADE is established for the next dispatch day by the most recent approved dispatch data that was considered in the DACP Schedule of Record (SOR).

If you are a dispatchable generator, you may submit offers in real time within the hours, energy, and capacity of your facility's ADE. There are no restrictions on price changes within the ADE (except where a change may affect eligibility for a real-time guarantee program) and there are no restrictions on daily energy limit changes within the ADE. However, offers exceeding the hours and/or quantities of the ADE require our approval.

If you are a dispatchable load, you may submit bids in real time (and corresponding offers for OR) within the hours and dispatchable load quantities of your facility's ADE. There are no restrictions on price changes within the ADE. However, bids (and offers for OR) exceeding the hours and dispatchable load quantities of the ADE require our approval.

We approve the submission of new or revised dispatch data that increases the ADE for dispatchable generation or dispatchable load facilities for the following reasons:

- If the facility is returning early from planned or forced outages, forced de-ratings, or cancellation of planned outages.
- If we requested additional bids and offers (in which case, you do not need to call us).
- If such increases to your facility's ADE resolve emerging reliability concerns.

For the late start of a planned outage, we accept the dispatch data submitted, but we do not approve the expansion of your ADE. The submission is logged to compliance for follow up.

Daily Generator Data (DGD)

The DACE requires Daily Generator Data (DGD) values for dispatchable *not quick start* generators. The DACE initializes DGD with the default values as shown in Table 2.

Data Description	Unit of Measure	Default Value	Not Quick Start Generator	Quick Start Generator	Non-dispatchable resources
Minimum Loading Point	MW	0	x	n/a	n/a
Minimum Generation Block Run Time	Hours	0	x	n/a	n/a
Minimum Generation Block Down Time[28]	Hours	0	x	n/a	n/a
Maximum Number of Starts per Day[29]	Number	24	x	n/a	n/a
Single Cycle Flag[30]	Yes/No	No	x	n/a	n/a

Table 2: Daily Generator Data Submission by Resource Type

Not quick start generators can submit revised baseline DGD through the offer/bid submission tools on a daily basis. DGD remains the same as the most recently submitted value unless otherwise updated.

Revised DGD must be submitted before 10:00 day-ahead. No approval is required if revised DGD values are within registered MLP and MGBRT limits. IESO approval is required if DGD exceeds MLP and MGBRT limits.

[28] Minimum Generation Block Down-Time (MGBDT) is the minimum number of hours (specified by the market participant) required between the time a generation facility is last at its minimum loading point before de-synchronization, and the time the generation facility reaches its minimum loading point again after synchronization.

[29] The number of times a generation unit can be started within a dispatch day - formerly part of Expedited Operational Data (EOD).

[30] Only applies to CTs associated with pseudo units.

5. Process Timeline

The DACP uses a computational engine that optimizes (i.e., derives the lowest cost supply solution) over the whole day (refer to Figure 5). This increases the calculation time, which has two impacts:

1. Any participant that wants to participate in the day-ahead commitment process must submit dispatch data by 10:00 day-ahead to allow sufficient time for the calculations and publishing of final results by 15:00.
2. Multiple runs of the computational engine occur between 10:00 and 15:00. The results of each run are published via the Market Data and Market Data DACP Reports web pages on the IESO web site (refer to section *10. Additional Information* for direct links to these resources).

Eligible Energy-Limited Resources have one opportunity to revise their offers following the first DACP run. This allows them to address any sub-optimal scheduling of their resources.

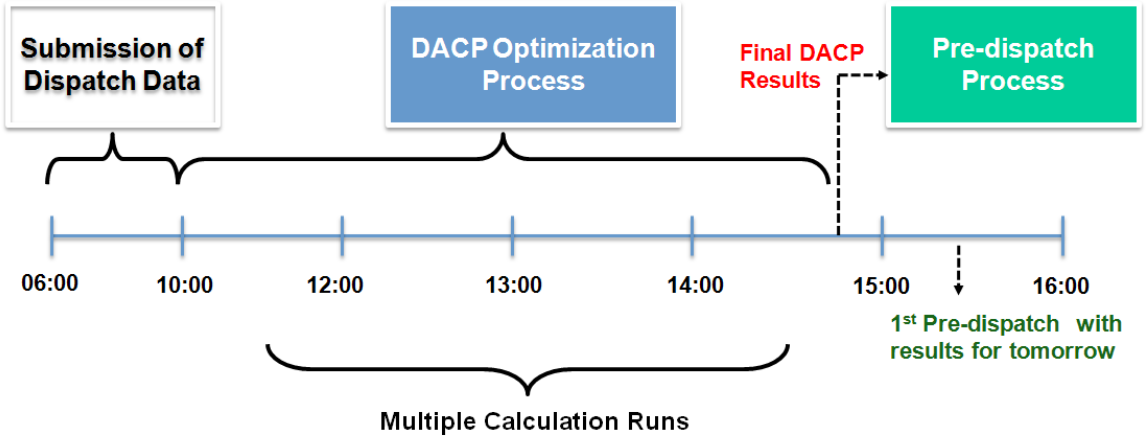

Figure 5: Process Timeline

Pre-dispatch is run hourly. Pre-dispatch results for the next day are not published during the DACP process (from 10:00 -15:00). Results from the 15:07 pre-dispatch run incorporate the commitment outcomes from the DACP and provide the first pre-dispatch schedule showing the hours for the next day (refer to Figure 6).

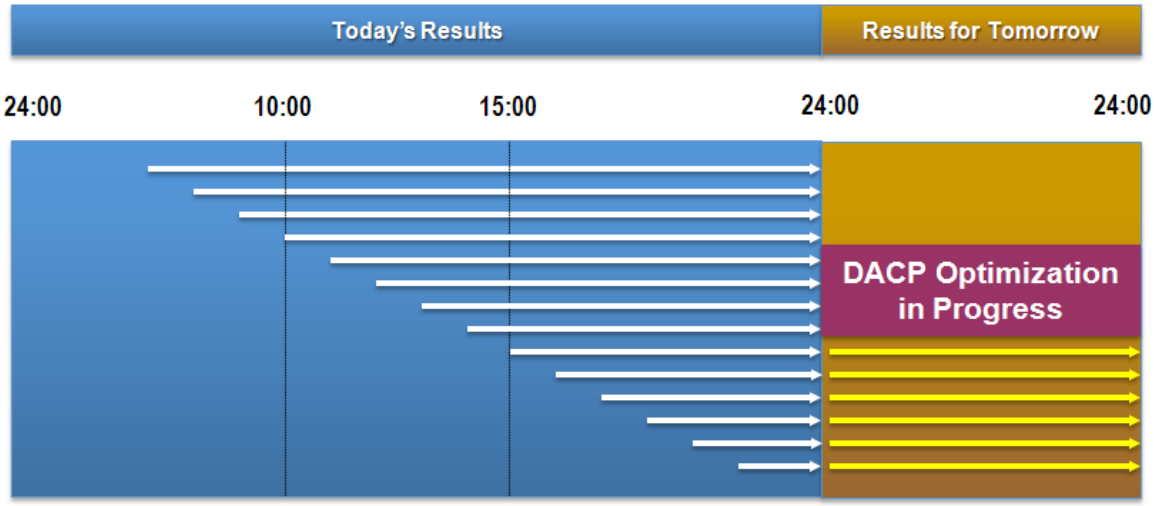

Figure 6: Pre-Dispatch Timeline

To summarize the timeline:

- MPs wishing to participate in the DACP must submit dispatch data by 10:00.
- DACP results are published after each run.
- The DACE is a separate calculation engine from pre-dispatch – pre-dispatch continues to run hourly.
- Once the DACP has finished and results have been passed to the 15:07 pre-dispatch, pre-dispatch results are published showing the hours of tomorrow.

6. Day-Ahead Calculation Engine (DACE)

The Day-Ahead Calculation Engine (DACE) co-optimizes energy and operating reserve over the 24 hours of the next day. It uses dispatch data, IESO inputs, and additional data from committable generators and other *not quick start* generators to determine commitments and schedules.

Each run of the DACE consists of three passes, as shown in Figure 7.

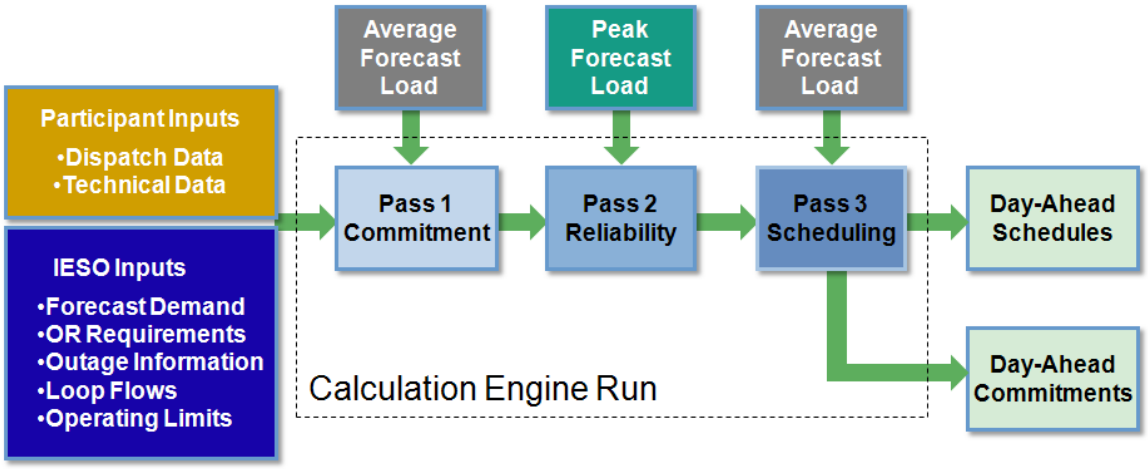

Figure 7: Day-Ahead Calculation Engine (DACE)

Pass 1 - Commitment

In Pass 1, resource schedules are chosen that serve average hourly demand over the next day at the lowest possible total cost. Average demand is used in this pass so that resources are not over-committed.

- 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.[31]
- We schedule committable generators based on the following:
  - Their total costs as submitted through their three-part offers.
  - Their operational restrictions, such as MGBRT, provided through their additional data submissions.

[31] 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.

Pass 1 Results

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

These results are used as inputs to Pass 2.

Pass 2 - Reliability

Pass 1 ensures that we have sufficient resources scheduled to meet average demand. The objective of the second pass is to ensure that we have sufficient capacity and energy to meet our hourly peak demand for the next day, again at the lowest possible cost. Normally, peak occurs over a single 5-minute interval, which is taken into account when Pass 2 determines which resources to commit in order to meet this need.

Pass 2 uses the schedules and commitments from Pass 1 and chooses the lowest cost solution from the following options in order to cover peak:

- Ramp up a quick-start or already committed *not 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 reduce 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[32].

In most hours, peak occurs for only 1 interval. The peak can be served by either ramping up dispatchable generation resources for the interval, or scheduling an hourly import while backing down generation for other intervals. Similarly, a dispatchable load can be ramped down for an interval or an export can be reduced for an hour.

[32] Imports committed in Pass 1 are scheduled to no less than their Pass 1 amounts; the import amounts scheduled in Pass 1 are already eligible for Day-Ahead guarantees. If a Pass 2 import schedule is greater than its Pass 1 schedule, the entire Pass 2 import schedule is eligible for the Day-Ahead guarantee. Additionally, if required, new imports or additional PCG-eligible generation that did not receive a commitment from Pass 1 may be committed in Pass 2.

However, the calculation engine commits and schedules for an hourly basis. To properly assess, on an equivalent basis, whether to ramp a dispatchable resource for an interval or schedule an hourly intertie transaction, Pass 2 performs a least-cost security constrained commitment to satisfy peak for 1 interval by assessing offers/bids from dispatchable resources in the following manner:

- The incremental offers from non-quick starts committed in Pass 1 and all offers from quick starts that are greater than their shadow prices[33] in Pass 1 will be evaluated as shown in Figure 8.
- This averages out the cost per interval.
- Bids for dispatchable loads will be treated in a similar manner.

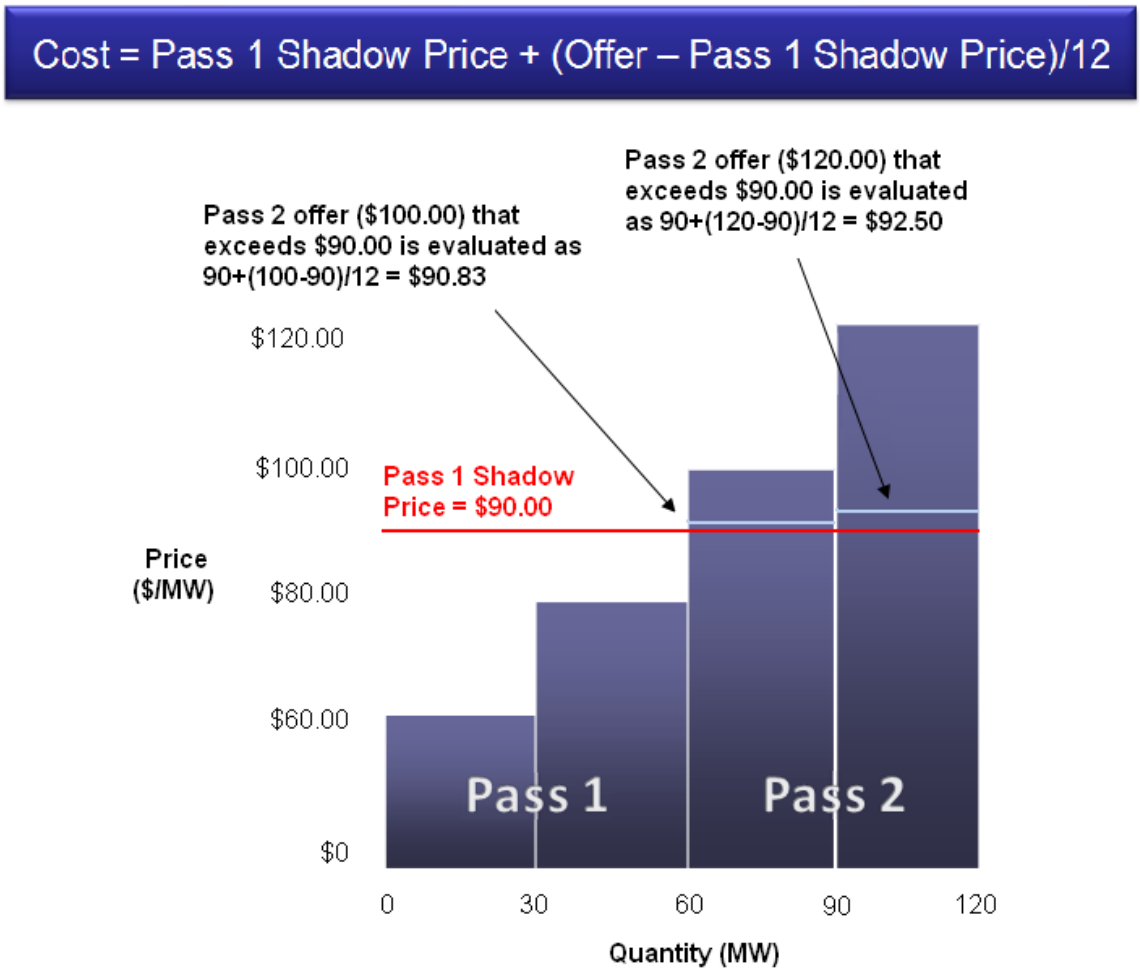

Figure 8: Pass 2 – Reliability - Energy Offer Evaluation Example

[33] Shadow prices are the price of energy at every injection and withdrawal point, and are calculated by the constrained mode (which considers the effects of ramp rates, losses and transmission limits). Shadow prices are not used for settlement.

A generator is scheduled to 60 MW in Pass 1:

- Its Pass 1 shadow price is $90/MW.
- Pass 2 offers that exceed $90/MW are assessed as the Pass 1 shadow price plus one twelfth of the difference between the offer and shadow price.

Of that generator's remaining capacity:

- Up to 30 more MW is available at $90.83/MW.
- 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 involves scheduling an additional committable generator or import, or reducing an export, this schedule has the same resources as Pass 1 – they are simply 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 scheduled in Passes 1 and 2 that submitted a minimum loading point are scheduled to at least that level.
- 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 *not quick start* generators ramping to their minimum loading points (in the hour before the first commitment hour) is considered when determining the schedules for all resources.

Note that we 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.

Results are passed to pre-dispatch for use in the 15:07 run. Committable generators are constrained to at least their minimum loading point for all hours of their DACP schedule.

In summary, the DACE includes the following features:

- The DACE is a calculation engine that minimizes total commitment costs and optimizes over 24 hours.
- Exports, linked wheels, and three-part offers from committable generators are considered.
- Committable generators are constrained to at least their MLP for all hours of their DACP schedule in all subsequent pre-dispatch and real-time runs.

The result of the DACP optimization is a set of commitments for PCG-eligible generating resources and schedules for imports necessary to meet reliability requirements, along with constrained schedules for all resources to meet forecasted average demand.

An overview of the three passes is depicted below.

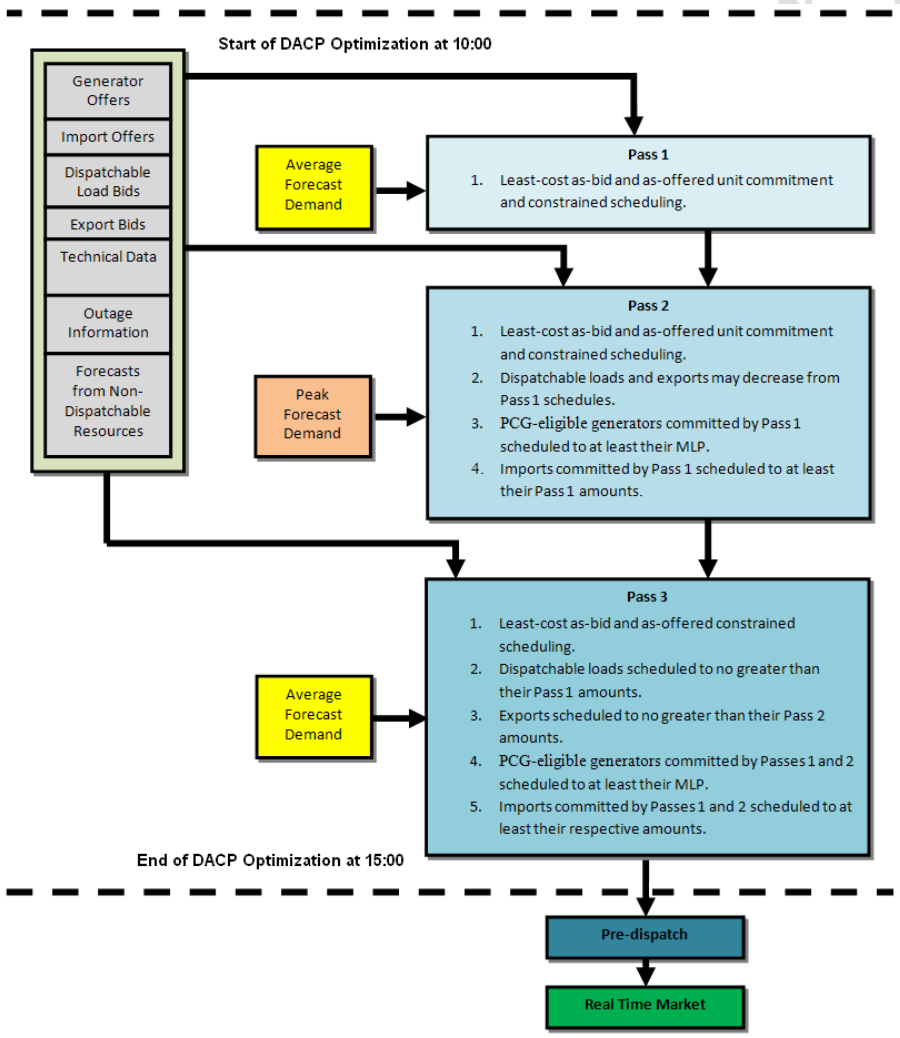

Figure 9: Three Passes of Constrained Algorithm

7. Committable Generator Scheduling and Settlement

Committable Generator Considerations

- The DACP commits a generator even if its Minimum Generation Block Run-Time (MGBRT) extends past midnight (refer to Figure 10). When the DACP runs the next day, it recognizes the need to complete MGBRT as long as the participant has submitted offers for those hours.

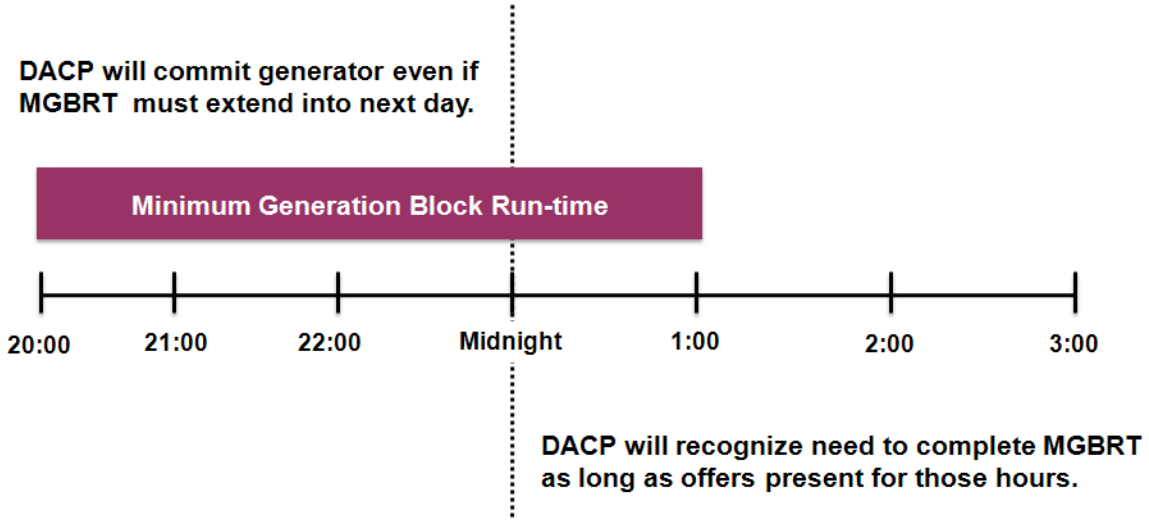

Figure 10: MGBRT Considerations

- Committable generators may submit escalating start-up offers at the end of the DACP day to receive start-up, speed-no-load, and incremental energy to the MLP within that day. This ensures that the causality of a start is attributed to the day in which the start occurs. The escalating start-up costs submitted by the market participant may include anticipated Day 1 revenues.
- The DACP 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 strategy*[34] must ensure that minimum generation block down-time is respected over midnight.

Day-Ahead Production Cost Guarantee (DA-PCG)

The Day-Ahead Production Cost Guarantee (DA-PCG) allows cost recovery for committable generators if real-time revenue does not cover the generator's as-offered costs for the hours included in the DACP schedule. *The DA-PCG cannot be rejected*. It is based on the total day-ahead schedule. All cost information is submitted before the DACP runs at 10:00.

[34] e.g., The participant does not offer for the period required to satisfy their MGBDT.

The DA-PCG is calculated as shown in Figure 11.

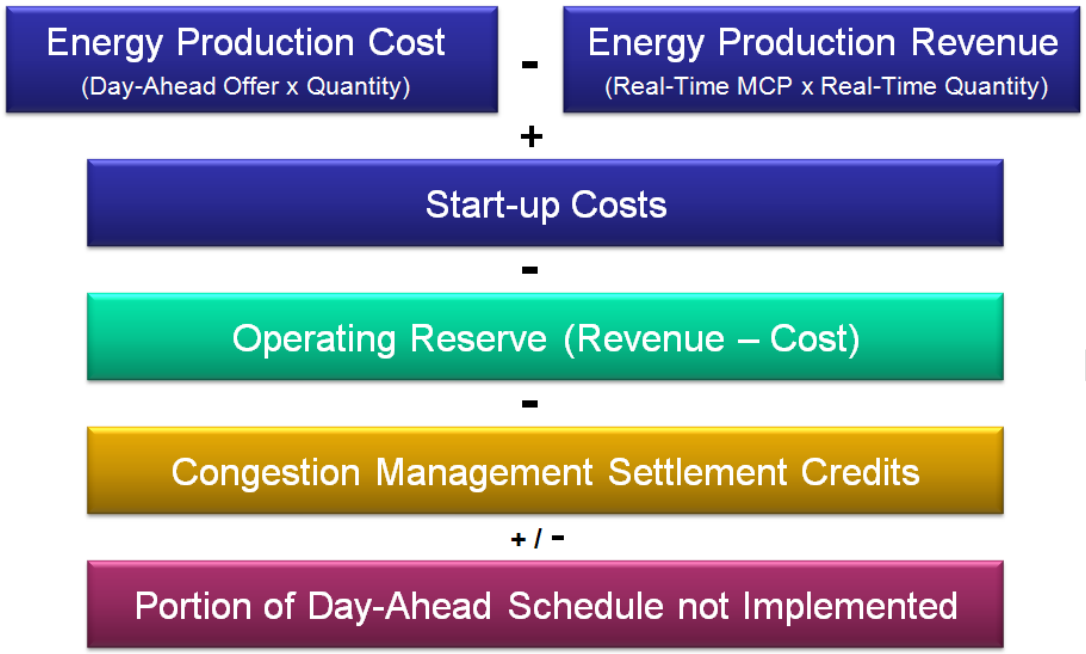

Figure 11: DA-PCG Calculation

Assume that a generator receives the following schedule from the DACP (see Figure 12):

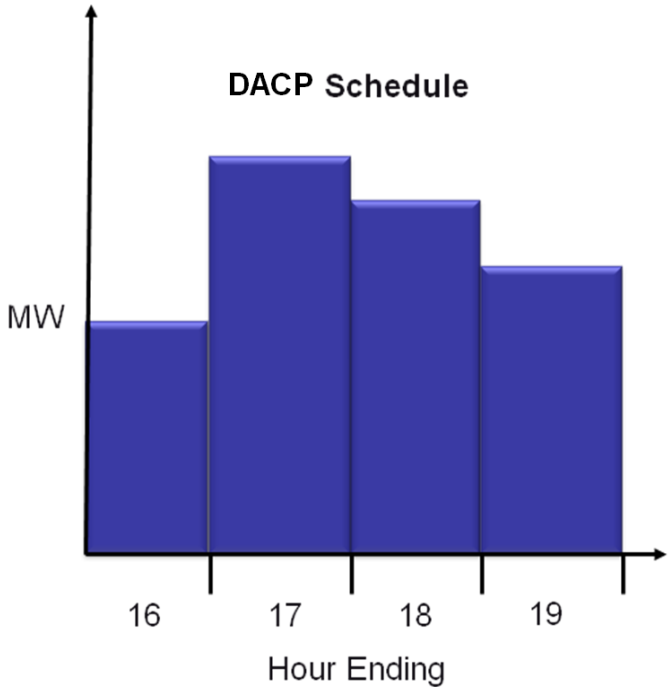

Figure 12: Sample DACP Schedule

The generator's real-time outcomes compared to its DACP schedule are shown in Figure 13. In this example, the generator does the following:

- It produces energy to meet its dispatch instructions.
- It is scheduled for operating reserve.
- It is partially constrained for hours 17 and 18.
- It does not implement a portion of its day-ahead schedule for hour 17.

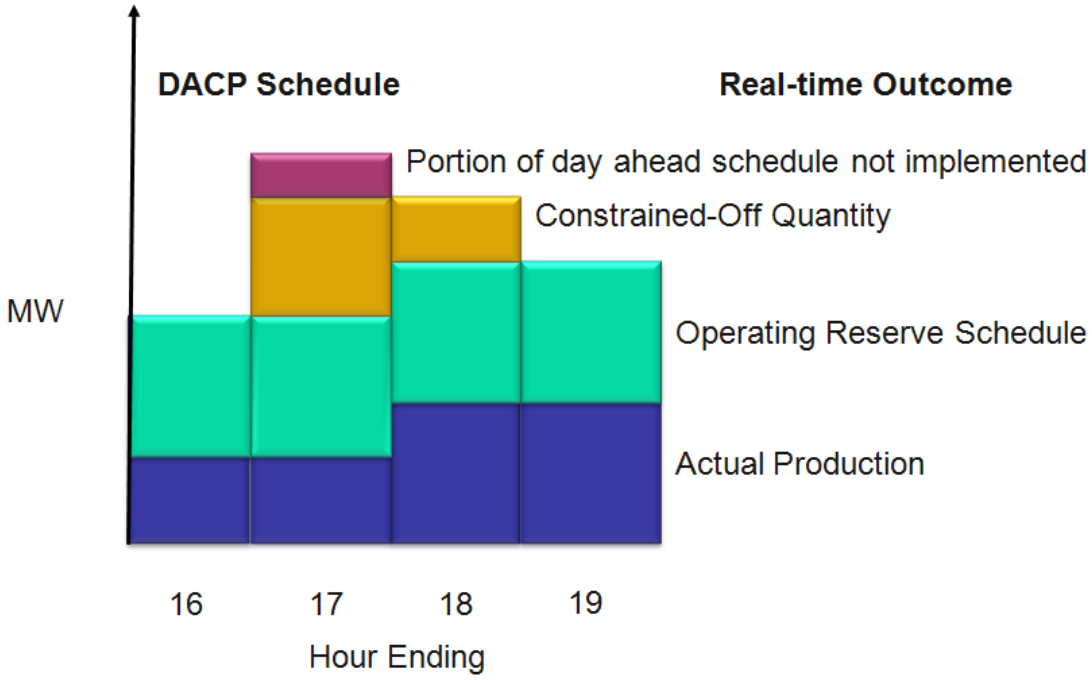

Figure 13: Real-Time Outcomes

The production guarantee for a generator is based on the generator's costs to meet its DACP schedule and the associated revenues from that schedule (see Table 3).

Costs (+)	Revenues (-)
Start-up Costs	
Energy Production Costs (Day-Ahead Energy Offer x Quantity)	Energy Production Revenues (Real-Time Energy Market Clearing Price (MCP) x Quantity Injected)
Operating Reserve Costs (Day-Ahead OR Offer x Quantity)	Operating Reserve Revenues (Real-Time OR MCP x Quantity Scheduled)
	Congestion Management Settlement Credits
Portion of Day-Ahead Schedule not Implemented in Real-Time	

Table 3: Generator Costs and Revenues

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 in order to determine whether they attempted to get scheduled to meet their day-ahead commitment.

For the portion of the day-ahead schedule not implemented in real-time, 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.

The DA-PCG includes the following features:

- Committable generators cannot reject the cost guarantee.
- It is based on the entire DACP schedule, not just minimum loading point for minimum generation block run-time.
- It includes the unimplemented portion of the day-ahead schedule.

Withdrawal of DACP Commitment

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 the following occur:

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

The formula used to determine the charge is based on how much advance notice of the withdrawal the participant provides.

If notification is given more than four hours ahead of real-time, the market has time to respond to the withdrawal; therefore, we base the charge on the lower of the hour-ahead pre-dispatch or real-time MCP.

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

8. Imports, Exports, and Linked Wheels

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

Imports may offer in real-time regardless of whether or not they offer into the DACP. Imports scheduled in the DACP 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 similar to the DA-PCG except that it does not include start-up costs or operating reserve components.

The DA-IOG is calculated as shown in Figure 14.

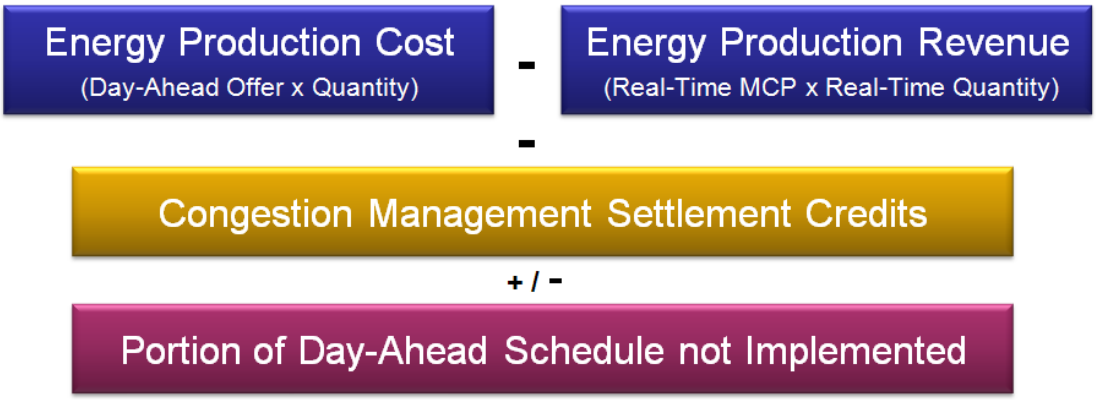

Figure 14: DA-IOG Calculation

Day-ahead scheduled imports and exports from the same participant are considered to be implied day-ahead linked wheels for settlement purposes. Import transactions that are part of an implied linked wheel do not receive IOG payments.

To determine if an import receives a DA-IOG, the calculated DA-IOG for each day-ahead import is stacked from lowest to highest IOG rate ($/MW). The quantity of day-ahead scheduled exports for the participant is then overlaid. If the total export MW is greater than 50% of a day-ahead import transaction, the import is not eligible for a day-ahead IOG as it is considered to be part of a linked wheel. The transaction may, however, qualify for a real-time IOG (Figure 15).

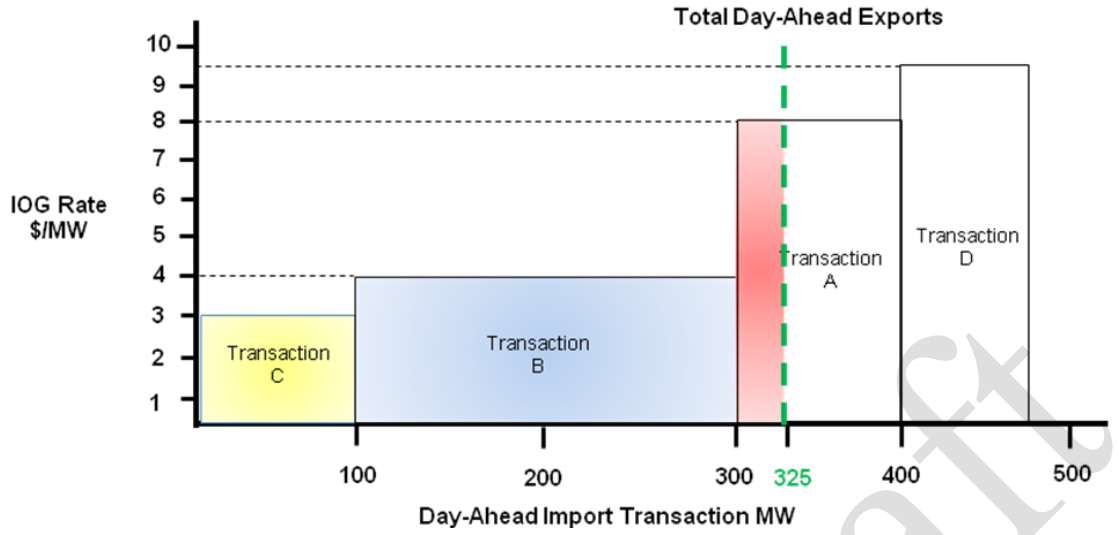

Figure 15: IOG Rate vs. Day-Ahead Import Transaction

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. Assume that all of the transactions shown in Figure 15 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 (i.e., transactions B and C) are stacked using their real-time IOG rate. The transactions that were not offset (i.e., 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 (Figure 16).

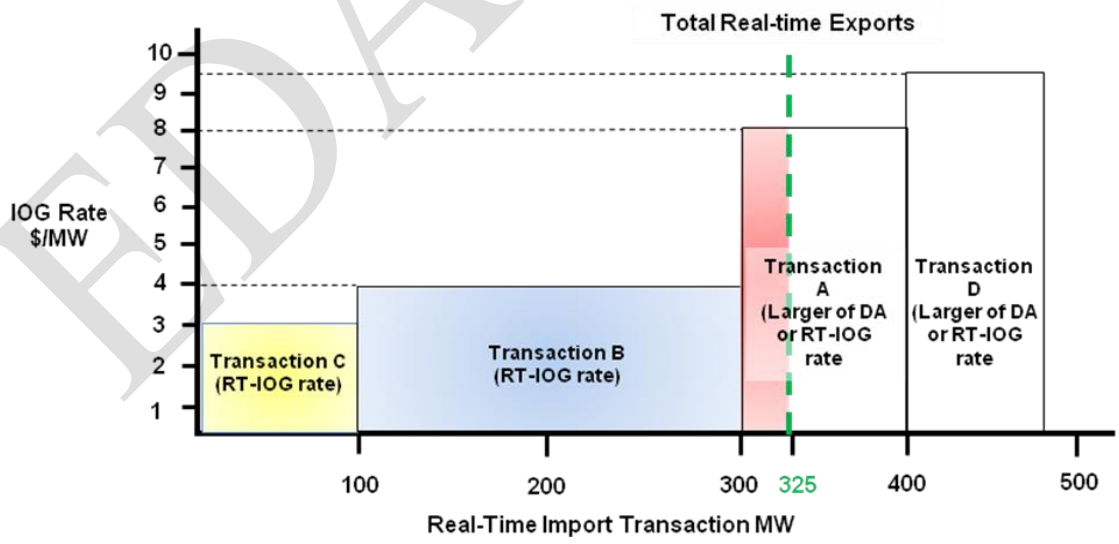

Figure 16: IOG Rate vs. Real-Time Import Transaction

The DA-IOG includes the following features:

- We use an IOG rate rather than total IOG dollars per transaction during calculation of the offset process.
- We determine if an import transaction scheduled day-ahead was part of a day-ahead implied wheel to determine whether it is eligible for a 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 are exempt from the charge (for more detailed information, refer to IESO_MAN_0080 - *Market Manual Part 9.5: Settlement for the Day-Ahead Commitment Process*).

The new import failure charge uses the hour-ahead pre-dispatch price in the price differential calculation (refer to Figure 17). The charge reflects the quantity that failed to flow multiplied by its impact on the market. The degree of impact is based on the lesser of the price difference between the day-ahead offer and:

- The hour-ahead pre-dispatch offer.
- The hour-ahead pre-dispatch price.

Figure 17: DA-IFC Calculation

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

Day-Ahead Export Failure Charge (DA-EFC)

The DACP 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 implement an export failure charge with the DACP (refer to Figure 18).

Failures outside the participant's control are exempt from the charge. Exports are charged the higher of the two failure charges in cases where both day-ahead and real-time failure charges apply.

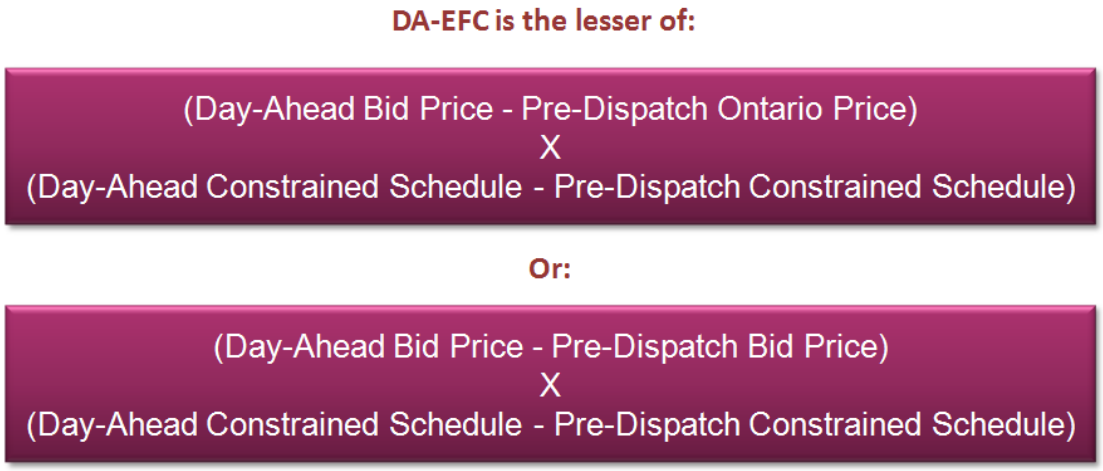

Figure 18: DA-EFC Calculation

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 (refer to Figure 19). 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 both of the following conditions occur:

- The pre-dispatch constrained schedule is less than the day-ahead constrained schedule.
- 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.

DA-LWFC is calculated as follows:

(Day-Ahead Price Spread - Pre-Dispatch Price Spread)
X
(Day-Ahead Constrained Schedule - Pre-Dispatch Constrained Schedule)

Figure 19: DA-LWFC Calculation

9. Publishing and Reporting

Overview

Reporting refers to the creation of documents related to the operation of the IESO-administered markets. Publishing refers to the preparation of public documents made available on the IESO web site. DACP-related reports are explained below.

System Status Reports (SSR)

The System Status Report (SSR) published at 9:00 (before the dispatch data submission window closes at 10:00 EST) helps market participants make market and operational decisions.

Pre-Dispatch Reports

Pre-dispatch runs beginning between 15:07 and 23:07 publish data for the remaining hours of the current day and all hours of the next day.

Public Reports

These reports can be used by participants as a resource for making their day-ahead business decisions.

- **Day-Ahead Adequacy** - This report provides a summary of any projected shortfall or surplus of energy for the next day.
- **Day-Ahead Shadow Prices** - This report contains *shadow prices* for energy and operating reserve at selected nodes internal to Ontario and at the interties as calculated by the DACE.
- **Day-Ahead Area Operating Reserve Shortfalls** - This report contains any *operating reserve* shortfalls in each hour, by dispatch area, for the day ahead as calculated by the DACE.
- **Day-Ahead Area Reserve Constraints** - This report contains hourly maximum and minimum constraints for the *area reserve* regions used as inputs for the DACE. The report indicates regions where reserve supply may be an issue.
- **Day-Ahead Constrained Totals** - This report contains hourly MW totals (i.e., total energy, total losses, total load, total dispatchable load and total operating reserve).
- **Day-Ahead Intertie Scheduling Limits** - This report contains hourly *intertie scheduling limits*.
- **Day-Ahead Security Constraints** - This report contains binding *security constraints* as determined by the DACE. The report may help a participant understand why a particular resource received the schedule that it did.

Market Participant Confidential Reports

- **Day-Ahead Check Source / ADE** - This is one of two reports that comprise the Schedule of Record (SOR). The report provides the market participant with a confirmation of the dispatch data submission used for a resource, included in the DACP SOR. This dispatch data forms the resource's ADE.
- **Day-Ahead Scheduled Energy** - This is one of two reports that comprise the SOR. The report provides energy and operating reserve schedules for each of a participant's resources for each hour of the next day.
- **Day-Ahead Commitments** - This report provides a list of a market participant's resources that have been committed for the DA-PCG. The report is a confirmation that PCG-eligible resources receiving a schedule in the SOR have been constrained to at least their MLP for their MGBRT in our systems for the next day.
- **Valid Bid Report** – This report is an existing query, available to market participants through the Market Participant Interface (MPI), for viewing the most recent valid submitted dispatch data. The query is revised to allow market participants to see submitted three-part offers.
- **Daily Generator Data Reports** – *Not quick start* dispatchable generators receive a report that provides the DGD used in the DACP. The report provides a confirmation of the DGD that was used by the DACE when determining the next day's schedules. This report is available after 10:00 EST of the DACP day.
- **PSU DGD Computed Values Report -** This report provides the values used by the DACE for pseudo units, as of 10:00. These values are computed from the market participant DGD submission for physical units.

Day Ahead Schedule of Record (SOR)

The SOR is published after the successful completion of the DACP. The SOR is made up of two sets of private reports—the Day-Ahead Scheduled Energy Reports and the Day-Ahead Check/Source ADE Reports. If either of these reports fails to publish, the DACP is declared a failure for that day. On a successful day, the SOR is always published by 15:00 and is always based on the last set of published results.

10. Additional Information

For additional information, please refer to the resources listed below.

- For more detailed information relating to the DACP registration process, refer to IESO_MAN_0076 - *Market Manual Part 9.1: Submitting Registration Data for the Day-Ahead Commitment Process.*
- The forms relating to the DACP registration process can be found on the IESO web site via the following links:
  - IMO_FORM_1552 – Spare Generation On-Line and DA-PCG Form
  - IMO_FORM_1181 – Facility Profile
  - IESO_FORM_1702 – Combined Cycle Plant Form
  - IMO-FORM-1004 - Generation Facilities
  - IESO-FORM-1721 - Implementation of Three Part Offers
- Public reports can be found via the Market Data and Market Data DACP Reports web pages.
- The *Introduction to Ontario's Physical Markets* workbook is available on our Marketplace Training web pages.
- For other DACP-related information, please refer to the DACP web pages.
- The *Market Participant Interface Training Manual* can be found via the MPI Training web page.

Glossary of Acronyms

ADE – Availability Declaration Envelope

API – Application Programmer Interface

CCP – Combined Cycle Plant

CT – Combustion Turbine

DACE – Day-Ahead Calculation Engine

DACP - Day-Ahead Commitment Process

DA-EFC – Day-Ahead Export Failure Charge

DA-IFC – Day-Ahead Import Failure Charge

DA-IOG – Day-Ahead Intertie Offer Guarantee

DA-LWFC – Day-Ahead Linked Wheel Failure Charge

DA-PCG – Day-Ahead Production Cost Guarantee

DCHD – Daily Cascading Hydroelectric Dependency

DEL – Daily Energy Limit

DGD – Daily Generator Data

EELR – Eligible Energy Limited Resource

ELR – Energy Limited Resource

EOD – Expedited Operational Data

ETD – Elapsed Time to Dispatch

MCP – Market Clearing Price

MGBDT - Minimum Generation Block Down-Time

MGBRT – Minimum Generation Block Run-Time

MLP – Minimum Loading Point

MPI – Market Participant Interface

MRT – Minimum Run Time

PSU – Pseudo Unit

RTD – Registered Technical Data

RT-GCG – Real-Time Generation Cost Guarantee

SGOL – Spare Generation On-Line

SOR – Schedule of Record

SSR – System Status Report

ST – Steam Turbine