

Introduction

Replacement offers allow participants to revise the offer for one of their generators in response to the forced outage of another of their generators. In this way, the participant can 'replace' the energy that would have been produced by the generator on outage (either a forced outage or a forced de-rate). This edition of **Quick Takes** describes how and when you can use replacement offers.

Background

You need IESO operator approval to change energy or operating reserve offers within two hours of the start of the dispatch hour. This restriction on changing your offer gives us time to evaluate the available supply for the dispatch hour in relation to projected demand.

In general, we approve offer changes during this 'mandatory window' only when a unit's ability to generate has changed.

In some situations, enforcing the mandatory window can lead to reduced operational efficiencies and lost revenue for generators. For example, you might have been able to replace the production from a generator that has suffered a forced outage by quickly increasing the output of another generator at the same site.

To help resolve this issue, we now allow replacement offers. By using a replacement offer, you can:

- Have your revised offer approved for the next available dispatch hour for a unit that is replacing another that is on a forced outage
- Increase the production of the replacement unit before your revised offer is processed, if we approve the increase

You can use replacement offers for hydroelectric generating stations, and combined cycle natural gas plants (i.e., those with both combustion and steam turbines) and co-generation facilities.

Why are hydroelectric generating stations able to use replacement offers?

Some hydroelectric generating stations have more than one turbine unit at the same site. Separate offers are required for every delivery point to the grid at these multi-unit stations. When one of these units suffers a forced outage, it can no longer use water to make electricity. If its forebay is full, or if it does not have a forebay, it has to let water bypass the plant (called 'spilling'). When a plant spills, it loses the opportunity to use that water to generate electricity.

For these multi-unit stations, an alternative to spilling is to increase the production of another unit that draws water from the same source. Before we allowed replacement offers, there was no way a unit could quickly increase its production outside of the compliance deadband and stay within the market rules. Instead, the operator had to enter revised offers. The unit could not be dispatched up by our systems based on these revised offers until at least two hours later. Replacement offers allow for a much quicker response.

Why are combined cycle facilities able to use replacement offers?

A similar situation existed for combined cycle generation facilities. Combined cycle generation facilities produce electricity using a combination of combustion turbines and steam turbines. The steam turbines are driven by steam created from waste heat supplied by the combustion turbines. The turbine offers have to be submitted as separate offers if the units have separate grid delivery points.

Before the replacement offer program was available, you could not immediately increase the output of a combustion unit to replace the production lost when another of your combustion units suffered an outage. This meant that not only was the production from the combustion turbine on outage lost, but so was production from the steam turbine because it received less waste heat.

Replacement Offers

Replacement offers allow you to enter revised dispatch data for a generator if you have had a forced outage to a gas turbine at a combined cycle generation or cogeneration facility, or to a turbine at a hydroelectric facility. The replacement megawatts (MWs) and the revised dispatch data must be for a unit at the same facility.

We allow revised dispatch data for the replacement unit into the market systems as soon as possible – it is not subject to the two-hour wait. As well, you can increase the output of the replacement unit even before we process the revised offer, as long as doing so does not compromise grid reliability.

Replacement offer procedure

Assume your hydroelectric or gas turbine generator receives a dispatch instruction to generate. Subsequently, the generator suffers a forced outage or forced de-rate that makes it unable to respond to the dispatch. You decide to use a replacement offer, following this procedure:

- Call the IESO control room to advise that you intend to enter revised dispatch data for a unit to replace the energy from the unit that has suffered the forced outage or de-rate:
 - Tell us how long the replacement offer will apply
 - If the revised offer is for a hydroelectric generator, the replacement generator has to be from the same facility and use water that would otherwise have been used by the unit that had the forced outage
 - If the revised offer is for a combined cycle generation facility, the offer has to be for a gas turbine that can provide waste heat to the same steam turbine as the gas turbine it is replacing
- Submit revised dispatch data within one hour of the forced outage. If you submit the data later than this, the 2-hour offer revision window (the mandatory window) will apply.

What happens at the IESO?

- We will use the revised dispatch data for the next hour if it is submitted more than 10 minutes before the start of the dispatch hour. If it is submitted less than 10 minutes before the start of the dispatch hour, our software cannot process it until the following hour. For example, if you submit a revised offer at 10:40, it will apply for the hour starting at 11:00. If you submit a revised offer at 10:55, it won't apply until the hour starting at 12:00.
- There will be a period of time between when you enter the revised dispatch data and when our dispatch algorithm software will process it. Our systems cannot increase the output of the replacement unit through normal dispatch until the revised offer is processed. Instead, our operators will manually constrain the replacement unit so it can receive appropriate dispatch instructions, unless doing so would adversely affect grid reliability.
- The replacement energy is limited to the amount of energy that was originally scheduled for the facility experiencing the forced outage or de-rate. For example, assume that Gen A was producing 20 MW and Gen B 30 MW at the time when Gen A went on outage. Gen B will be constrained on to 50 MW during the period before the revised offers can be processed.

What if the forced outage is not expected to last for a full hour?

You do not have to submit revised dispatch data if you expect the forced outage or de-rate to end before data changes can be processed. Instead, call to let us know that you want to increase the output of a related generator. We will allow you to go ahead as long as doing so won't harm grid reliability.

For example, assume you have a forced outage at 4:50 that is expected to end by 5:30. It is too late to submit revised dispatch data for the hour between 5:00 and 6:00. Therefore, call to let us know that you want to increase the output for a related unit during the period of the outage. We will evaluate your request as soon as possible and let you know if we can allow it.

Impact on congestion management settlement credits (CMSC)

As explained above, our operators must manually constrain the replacement unit so it can receive appropriate dispatch instructions until the revised offer is processed. As a result of this treatment, the replacement unit will likely receive congestion management settlement credits (CMSC) during this period of manual constraint. There are two reasons for this:

- You are going to use a unit that has production capacity available as the replacement unit. This means that the replacement unit was not already fully dispatched. Therefore, it was likely not economic up to its entire offered quantity.
- The manual constraint applies only to the ‘dispatch schedule’, not the ‘market schedule’.

It is likely that there will be a difference between the market schedule and dispatch schedule for the replacement unit because of these factors, resulting in CMSC payments. (For a detailed explanation of CMSC, including the difference between market schedules and dispatch schedules, please refer to the *Introduction to Ontario’s Physical Markets* workbook, available on the [Marketplace Training](#) web pages.)

To avoid overpayment, CMSC for intervals during which a unit is constrained on to act as a replacement unit is limited to the total CMSC paid to the replacement unit and the unit being replaced in the last 5-minute interval before the outage.

Example

Gen A and Gen B are at the same facility, which is owned by Transbord. In Interval 1:

Interval 1	Offer	Market Schedule (MQSI)	Dispatch Schedule (DQSI)
Gen A	100 MW at \$20	100	75
Gen B	100 MW at \$75	0	0

- The market clearing price (MCP) for Interval 1 was \$25.
- Gen A then suffers a forced outage.
- Transbord calls to inform us that they will be submitting updated offers for Gen B so it can replace Gen A. We apply a constraint so that Gen B is dispatched to 75 MW in the next interval.

In Interval 2:

Interval 2	Offer	Market Schedule (MQSI)	Dispatch Schedule (DQSI)
Gen A	100 MW at \$20	0	0
Gen B	100 MW at \$75	0	75

The market clearing price for Interval 2 is \$22

CMSC for Gen B in Interval 2 would be:¹

$$\begin{aligned}
 & (\text{MCP} - \text{Offer}) \times \text{MQSI} - (\text{MCP} - \text{Offer}) \times \text{DQSI} \\
 & = (\$22 - \$75) \times 0 - ((\$22 - \$75) \times 6.25^2) \\
 & = (-\$53 \times 0) - (-\$53 \times 6.25) \\
 & = \mathbf{\$331.25 \text{ for the interval}}
 \end{aligned}$$

However, Gen B was acting as a replacement for Gen A. Therefore, allowing Gen B to receive CMSC based solely on its own offer price would lead to more CMSC being paid than if Gen A had still been capable of providing the energy.

In order to avoid overpayment, CMSC for intervals during which a unit is acting as a replacement unit is limited to the total CMSC paid to the unit that it is replacing during the last interval before the forced outage.

In our example, Gen A would have received the following CMSC for the last interval before it went on outage:

$$\begin{aligned}
 & (\text{MCP} - \text{Offer}) \times \text{MQSI} - (\text{MCP} - \text{Offer}) \times \text{DQSI} \\
 & = (\$25 - \$20) \times 8.33 - ((\$25 - \$20) \times 6.25) \\
 & = \$5 \times 8.33 - \$5 \times 6.25 \\
 & = \mathbf{\$10.40 \text{ for the interval}}
 \end{aligned}$$

Therefore, Gen B would have its CMSC for the interval clawed back from \$331.25 to \$10.40.

¹ To simplify the CMSC examples in this document, we have assumed that the generators produced according to their dispatch schedules.

² 75 MW produced over a 5-minute period is equivalent to 6.25 MWh. The market is settled based on MWh.

Summary

Replacement offers allow hydroelectric and combined cycle natural gas facilities to 'replace' the energy production that would be lost due to a forced outage or forced de-rate with energy from another unit at the same facility. Our systems will process replacement offers as soon as possible. In the meantime, as long as we approve, you can increase the output of the replacement facility.

Additional Information

- For details on the compliance deadband, see the Interpretation Bulletin *Compliance with Dispatch Instructions Issued to Dispatchable Generators* available on the IESO [Compliance](#) web pages
- For an explanation of CMSC, market schedules, and dispatch schedules, see the *Introduction to Ontario's Physical Markets* workbook available on the [Marketplace Training](#) web pages
- For more information on the mandatory window, see Market Manual 4.2 *Submission of Dispatch Data in the Real-Time Energy and Operating Reserve Markets*, available on the [Rules and Manuals](#) web page
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