CALIFORNIA ISO

Market Design 2002 Phase 1B
Telemetry / Ramping Credit Effect on Resource Dispatch, DOP and Expected Energy

Version 1.4

Revision History

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1. Introduction

1.1 Purpose

The purpose of this white paper is to describe and present information associated with a system feature known as "credit" in RTMA resource dispatch instructions. The credit calculation compares the current telemetered output of the unit against the last GOTO. If the unit is deviating from the GOTO amount, the system will calculate additional unit capability in the direction of the deviation.

This document is intended to clarify how this feature relates to dispatch instructions, the expected Dispatch Operating Points (DOPs) and resulting expected energy, as well as provide enough detail to begin development of back-end processes.

The paper also contains a description of the algorithm or guidelines for determining when the credit will be applied to a dispatch instruction. The last half of the paper includes examples of dispatch scenarios where the credit is taken into account.

1.2 Scope

The scope of this document is limited to the concept of Crediting, how it is used in Real-Time Dispatch, and its impacts on DOP and the Expected Energy Calculations.

1.3 Overview

This document is organized to accomplish the following:

Section	Title	Description
2.1	Crediting Concepts	General description of what crediting is and why it is used.
2.2	Simple Example	A simple example which illustrates the concept of crediting
2.3	Detailed Description	More detailed description of the crediting process
2.4	Crediting Algorithm	Business rules that can be used to develop calculations and back end processes
2.5	Detailed Examples	Detailed examples of crediting situations.

1.4 References

- Expected Energy resulting from ADS Dispatch – This paper describes the process used to calculate expected energy.

2. Crediting and Examples

The following section will explain the concept of credit, detail some steps to analyzing the data to determine when and where the credit is applied and provide some examples of crediting.

2.1 Crediting Concepts

Generally, the ISO dispatches based on the previous DOT, or Dispatch Operating Target also known as the GOTO. This means that for future dispatches, the possible operating range of the unit will be based on the previous GOTO, and not the actual output of the unit. We expect that under normal conditions, resources will be able to comply with these dispatch instructions, and resource telemetry will closely follow the GOTO. The reason is because the ISO, in cooperation with Market Participants, has designed the Phase 1B systems to acknowledge operating constraints and limitations. The limitations can be modeled through the use of SLIC Pmin and Pmax re-rates, minimum operating times, forbidden regions, operating ramp rates that vary by output, etc.

There is an exception to this rule, however. If a unit is deviating and economics suggest that more capability could be utilized than is limited by ramping capability, the ISO may take advantage of these deviations. This feature is known as “Credit”.

As mentioned in the introduction, the credit calculation compares the current telemetered output of the unit against the last GOTO. If, based on a calculation to determine whether or not the unit will be deviating from the GOTO amount, the system will calculate additional unit capability in the direction of the deviation. This capability will be applied to the current dispatch.

This feature has the following advantages for the Market Participant and the ISO: a) the ISO can dispatch additional capacity when a unit is deviating and it is desirable to dispatch the unit in that direction, and b) the Market Participant can see a reduction in the amount of uninstructed energy, and resulting Uninstructed Deviation Penalties, when a unit had been deviating but is now considered by RTMA to be at an economic operating point.

Note that this feature is not a substitute for reporting accurate operating limits to the ISO. If the resource is physically incapable of being dispatched above its actual loading level, the resource has the responsibility and obligation to inform the ISO of this operational de-rate via the SLIC logging process. Given this information, the resource would be dispatched accordingly.

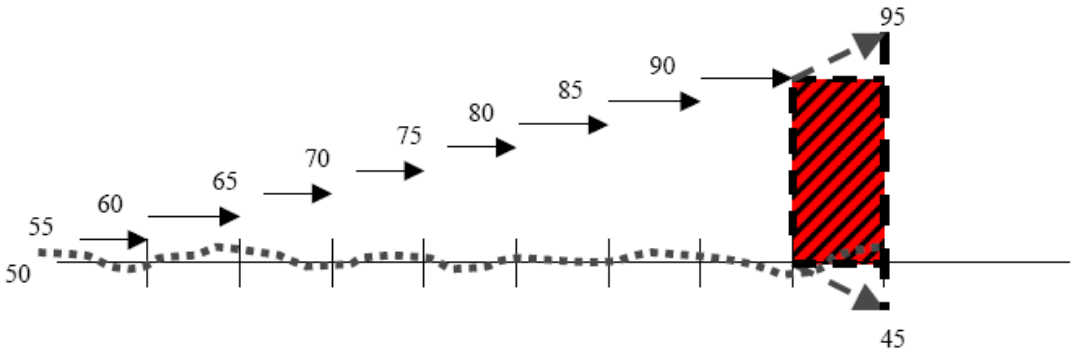
2.2 Simple example

Let’s consider a specific unit which has bids of, say 100 MWs, and the unit is currently loaded at 50 MWs with a ramp rate of 1 MW/Minute. Providing it is economic and within the zonal constraints to do so, RTMA will continue to dispatch the unit every five-minutes an additional 5 MWs until the instructions reach 100 MWs regardless of the actual output of the unit at each interval calculation.

Now suppose the unit never followed the dispatch instructions and instead operated in the vicinity of 50 MW. If based on the actual telemetry and system imbalance requirement it is determined that the most economic point for the resource to be loaded is where the resource is currently loaded at, SCED will provide a “go to” instruction at or near its telemetered level. In the “RTMA Sample Diagram”, where the previous instructed level becomes uneconomic, but becomes economic at or near it actual operating point based on its telemetry, RTMA will use the actual telemetry of 50 MW to determine where the resource should be economically dispatched for the next interval. As a result the next economic dispatch could be for a load level as low as 45 MW based on the resources 1 MW/min ramp rate.

SCED Sample Diagram

This diagram shows what SCED will consider for the next interval (heavy red arrows). If the resource is still economic SCED will instruct the unit to 95. If for some reason the unit is no longer economic the instruction could go as low as 45.



The dotted line is the unit's actual output while each "step" arrow indicates where the unit is expected to go based on bid and economics.

The inverse would also be true for a unit that is over-supplying as a result of an uninstructed deviation. That is, if a unit is continually over its instruction and for some reason becomes economic the next instruction could be at, or exceed the current metered output (assuming of course there were sufficient offers associated with the resource at the time).

2.3 Detailed description

The diagram used in the above example is used for illustration purposes only. The actual calculation of credit is a little more complicated. To start out, consider that RTMA dispatches start 10 minutes before the target time in order to provide time to calculate the dispatch, allow operators to review the dispatch, and allow Market Participants time to comply with the dispatch, which usually starts 5 minutes before the target time. Secondly, consider the information available at this time. At the start of the dispatch run, RTMA has the latest telemetry, and knows the previous GOTO, which currently is 5 minutes in the future. The diagram below should help in understanding the timeline.

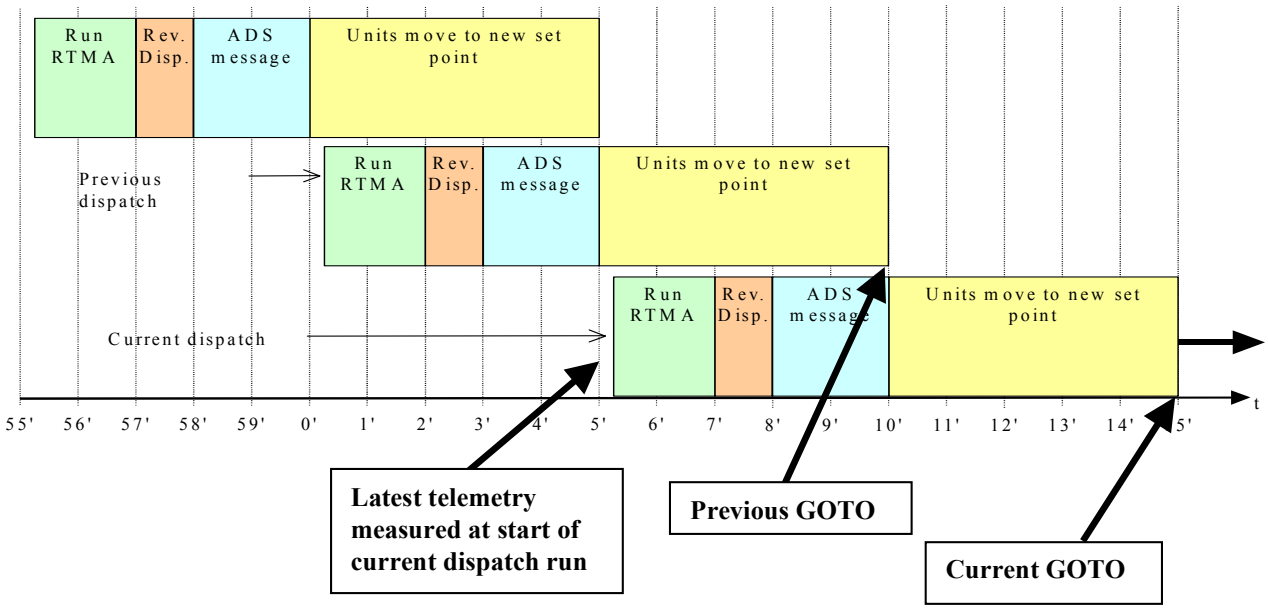


Figure 1: Dispatch Timing Sequence

In the credit calculation, RTMA will take the unit's current telemetry and determine whether or not a unit can comply with the previous GOTO, assuming the unit does attempt to comply at their operational ramp rate. In other words, RTMA checks if the unit can make the previous GOTO in five minutes. For example, assume a unit's previous GOTO was 55, and has a ramping capability of 1 MW/min, or 5 MW over five minutes. If the latest telemetry is 51 MW, then RTMA assumes the unit will comply and does not calculate a credit; the current dispatch will proceed as normal. However, if the latest telemetry is 49 MW then RTMA will assume that the unit cannot comply because it can only reach 54 MW. It calculates a credit of 1 MW, which can be applied to the current dispatch if it is economic to move the unit down.

Now the credit can be used in the current dispatch calculation. Continuing the example from the previous paragraph, if the telemetry was 51 MW there is no credit. RTMA can move the unit up by 5 MW to 60 MW, or move the unit down 5 MW to 50 MW. However, if the telemetry was 49 MW there is a credit of 1 MW in the downward direction. RTMA can still move the unit up by 5 MW to 60 MW, but can move the unit down 6 MW to 49 MW. Note that this last instruction should be attainable by the generator, because the most the unit can achieve is 54 MW, and would be capable of achieving a 5 MW reduction to 49 MW.

Effect on DOP's and Expected Energy

When applicable, the credit will adjust the Dispatch Operating Point (DOP) in the form of an instantaneous step at the beginning of the dispatch. In the example above, if the 1 MW credit was used, the DOP would change from 55 to 54 MW at the beginning of the instruction, then ramp uniformly from 54 MW to 49 MW at the 1 MW/min ramp rate.

The Expected Energy calculation would change to the extent that the area under the adjusted curve also changes. In the above example the total expected energy on the unit would be 1/12 MWH less than if the unit was expected to ramp from 55 to 50 MW.

2.4 Crediting Algorithm

The following steps can be used to help determine when crediting will be or has been applied to the dispatch instructions.

- Collect the telemetry reading at T-10 min, or 10 minutes in advance of the Target Minute. This value is provided in the ADS instruction as "Meter MW" for the current dispatch and represents the resources operating point at the time of the RTD run.
- Based on the current telemetry T-10 before the target time, determine if the resource can meet the previous dispatched GOTO target at T-5 min, based on the ramp rate. The previous dispatch GOTO is also provided in the ADS instruction as "Previous GOTO" for the current dispatch.
  - If the answer is YES, then no credit is applied (Case (a), Figure 2).
  - If the answer is NO then a possible credit may be applied. The measure of the credit is equal to the difference between the closest possible point to the previous GOTO, based on current telemetry, and the previous GOTO itself..
  - Keep in mind the direction of the credit
    - If unit highest possible output is less than previous GOTO, credit is in negative direction. (Case (b), Figure 2)
    - If unit lowest possible output is higher then previous GOTO, then credit is in positive direction. (Case (c), Figure 2)
- Determine if the dispatch at the Target Min (T) is in the same direction as the credit (see table)
  - If the answer is YES, then no credit is applied.
  - If the answer is NO, then the credit is applicable.

Direction of credit	Is current GOTO higher or lower than previous?	Credit applies?
Positive	Higher	Yes
Positive	Lower	No
Negative	Higher	No
Negative	Lower	Yes

- Amount of credit to be used cannot exceed the dispatch amount.
  - For example, if credit is 50 MW and dispatch goes down by 30 MW from previous GOTO, then only 30 MW of credit is used.

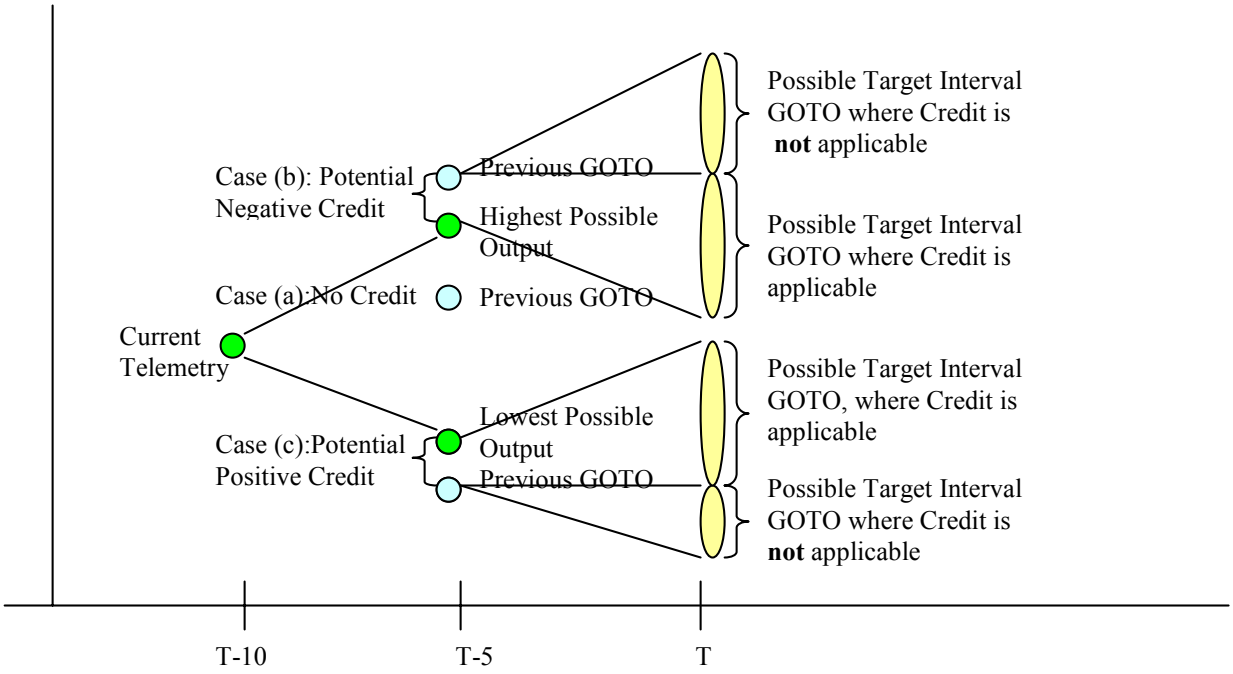


Figure 2: Credit Application

2.5 Detailed Examples

Let's look at a 10:50 dispatch for Generic_Unit_1 to a GOTO 296.02 (to be met at 10:55) from a previous GOTO of 416.00 (at 10:50). The unit has the following properties:

- Latest telemetry is 0
- Pmin is 130
- Ramp rate between 0 and Pmin is instantaneous
- Ramp rate above Pmin is 4.8 MW /min or 24 MW / 5 minutes

The latest telemetry was 0 measured at 10:45. Remember the system will assume that the unit tries to comply with the last dispatch of 416.00. It will calculate how close the unit can get to 416 over the time period from 10:45 to 10:50. In this case, the unit can get to 154 MW, assuming the unit can get to the Pmin of 130 instantaneously and then 4.8 MW / min over 5 minutes. The credit is calculated as 262 MW in the downward direction. Therefore the system can dispatch the unit down as high as 440 (previous GOTO 416 + 24 MW ramping capability) or as low as 130 (previous GOTO 416 – 24 MW ramping capability – 262 MW credit).

Note that the extended range only affects the side where there is deviation. For example, in the following interval, the telemetry is once again 0, so there is credit measured below the GOTO, and again the system can dispatch all the way down to 154. However, there is no credit measured above the GOTO, so the system can only dispatch as high as 320.02 (296.02 + 24 MW). In this case more output was needed from the unit, and so the maximum amount of 320.02 was dispatched.