Storage bid cost recovery (BCR) and default energy bid (DEB) enhancements discussion

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Market Surveillance Committee Meeting
General Session
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Agenda

- Initiative motivation
- Background on bid cost recovery (BCR)
- Storage BCR issues
- Simplified buy- and sell-back examples for storage
- Discussion on the proposed solution

Initiative motivation

- Energy storage has unique operational characteristics compared to conventional thermal generators and variable energy resources (VERs)

- The ability of energy storage resources to provide energy products and services when scheduled is determined by its ability to secure the state of charge (SOC) needed to support its awards and schedules

- Due to these unique operational characteristics, the bids of energy storage resources do not result merely from their costs to produce energy in a given interval, they also reflect storage resources' desire to be dispatched at a given time based on their opportunity costs in future intervals

Initiative Motivation

- In 2022, the ISO noted that the then-applicable provisions related to bid cost recovery (BCR) for energy storage did not align with the overall objectives and intent of the BCR construct, specifically underscoring the potential for unusually high BCR payments to storage resources (*see* the Ancillary Services State of Charge [ASSOC] Constraint filing)

- As the penetration of energy storage resources continued to grow within the ISO's footprint, additional concerns related to how BCR provisions apply to energy storage resources were raised by stakeholders, including the Department of Market Monitoring (DMM) and the MSC

BCR background

- Bid Cost Recovery (BCR) is the CAISO settlements process through which Eligible Resources recover their bid costs
  - Bid costs include start-up bid cost, minimum load bid cost, energy bid cost, transition bid cost, pump shut-down cost, pumping cost, ancillary services bid cost, and RUC availability payment
  - To calculate BCR, the commitment costs and the energy and AS bid costs are used as inputs to calculate a resource's net difference between costs and revenues in separate pre-calculations for the integrated forward market (IFM), the residual unit commitment (RUC) process, and the real-time market (RTM)

BCR background

- Bid cost recovery (BCR) is the CAISO settlements process through which eligible resources recover their bid costs
  - If the difference between the total costs and the market revenues is positive in the relevant market, then the net amount represents a Shortfall; if the difference is negative, the net amount represents a Surplus
  - Shortfalls and surpluses are then netted over all hours of a trading day, with the IFM shortfalls and surpluses netted separately from the RUC and RTM shortfalls and surpluses
  - If the net amount over the trading day is positive (a shortfall), then the resource receives a BCR uplift payment equal to the net trading day amount.

BCR Background

- BCR is designed to provide “uplift payments” to a resource when revenues from the sale of energy and AS do not cover the resource’s bid costs over the course of a day

- Without BCR, resources would have an incentive to add a risk premium to their offers, leading to inefficient market outcomes, with higher overall costs for energy

- BCR was initially designed with conventional thermal assets in mind
  - When a thermal power plant starts up, it incurs certain costs such as fuel costs to reach the desired output level
  - Since conventional resources with a DA schedule may incur in some costs prior to the intervals when they are expected to generate electricity (*i.e.*, during the commitment period), BCR is a necessary mechanism to recover those costs over the trading day

Storage BCR issues

- Storage resources are fundamentally different from conventional thermal assets; as recognized by FERC in its Order Accepting the ASSOC Constraint filing, storage resources have neither start-up nor minimum load costs, and generally have fast ramp rates, thus lacking the conventional drivers for BCR (*i.e.*, commitment)

- Energy storage resources' bids do not result merely from their costs to produce energy in a given interval; instead, they also reflect storage resources' desire to be dispatched at a given time based on their opportunity costs in future intervals
  - The bids submitted by storage resources are not equivalent to those submitted by conventional thermal assets as they do not only represent actual bid costs but also include an implied opportunity cost

Storage BCR Issues

- Despite the fundamental differences of storage resources relative to conventional thermal generators, the BCR construct does not adequately consider attributes such as state of charge (SOC) constraints, which determine whether an asset can support its awards and schedules

- This results in materially different treatment with regards to conventional generators
  - If a conventional thermal asset is unable to perform and fulfill its DA schedule due to unavailability (*i.e.*, an outage), the expected energy from that asset is categorized as uninstructed imbalance energy (UIE), thus making it ineligible for BCR
  - In contrast, when a storage resource is unable to meet its DA schedule due to physical limitations, like having a SOC that cannot support the schedule, the market instructs the storage asset to a 0 MW dispatch due to the SOC being binding, resulting in the energy to be categorized as optimal energy (OE) which is eligible for BCR.

Storage BCR issues

- This differentiated treatment of unavailable energy between conventional and storage assets creates two concerns:
  - Storage assets are not exposed to RT prices for deviating from DA schedules
  - Storage assets may be incentivized to bid inefficiently to maximize the combined BCR and market payment

- Given these conditions, some BCR payments to storage resources have materialized despite not being aligned with the intent of BCR, particularly those related to the buy- and sell-back of day-ahead (DA) schedules when SOC constraints are binding

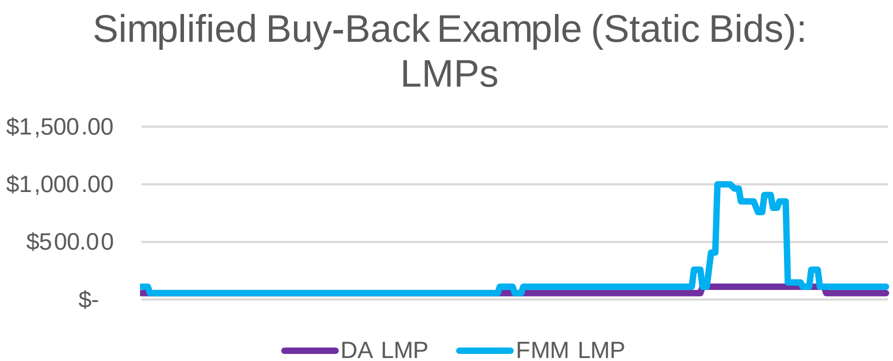
Storage BCR Issues

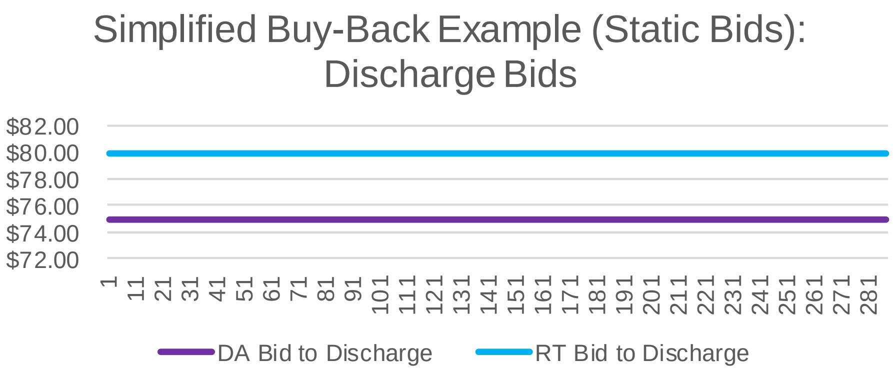
- A buy-back of a discharge DA schedule can occur when a storage asset’s real-time SOC is too low to support it

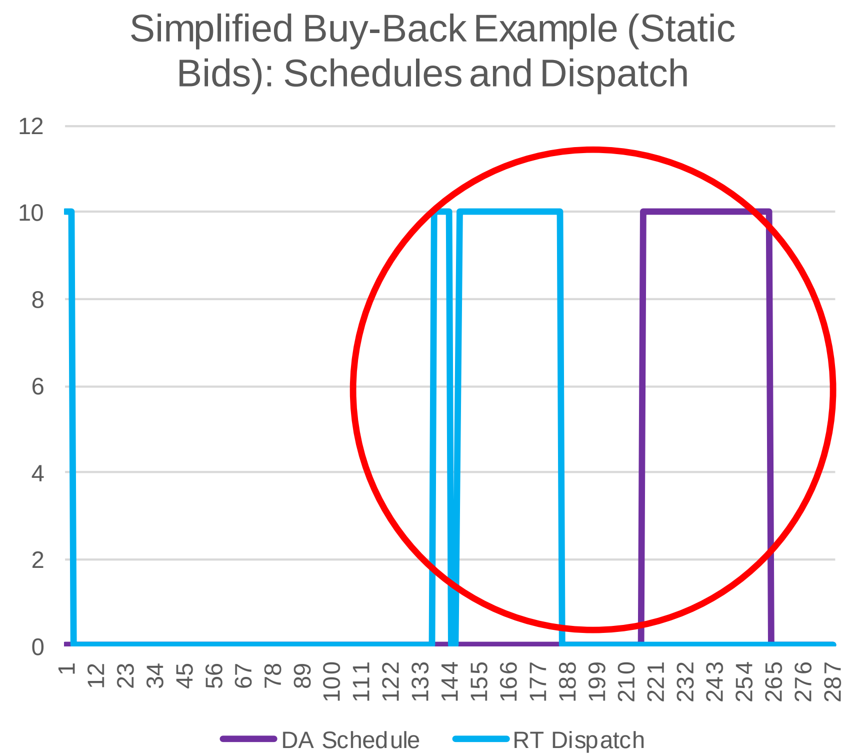
- A sell-back of a charge DA schedule can occur when a storage asset’s real-time SOC is too high to support it

Simple buy-back examples – static bids

- Bids that do not reflect RT conditions result in the resource being depleted ahead of DA schedule, triggering a buy-back

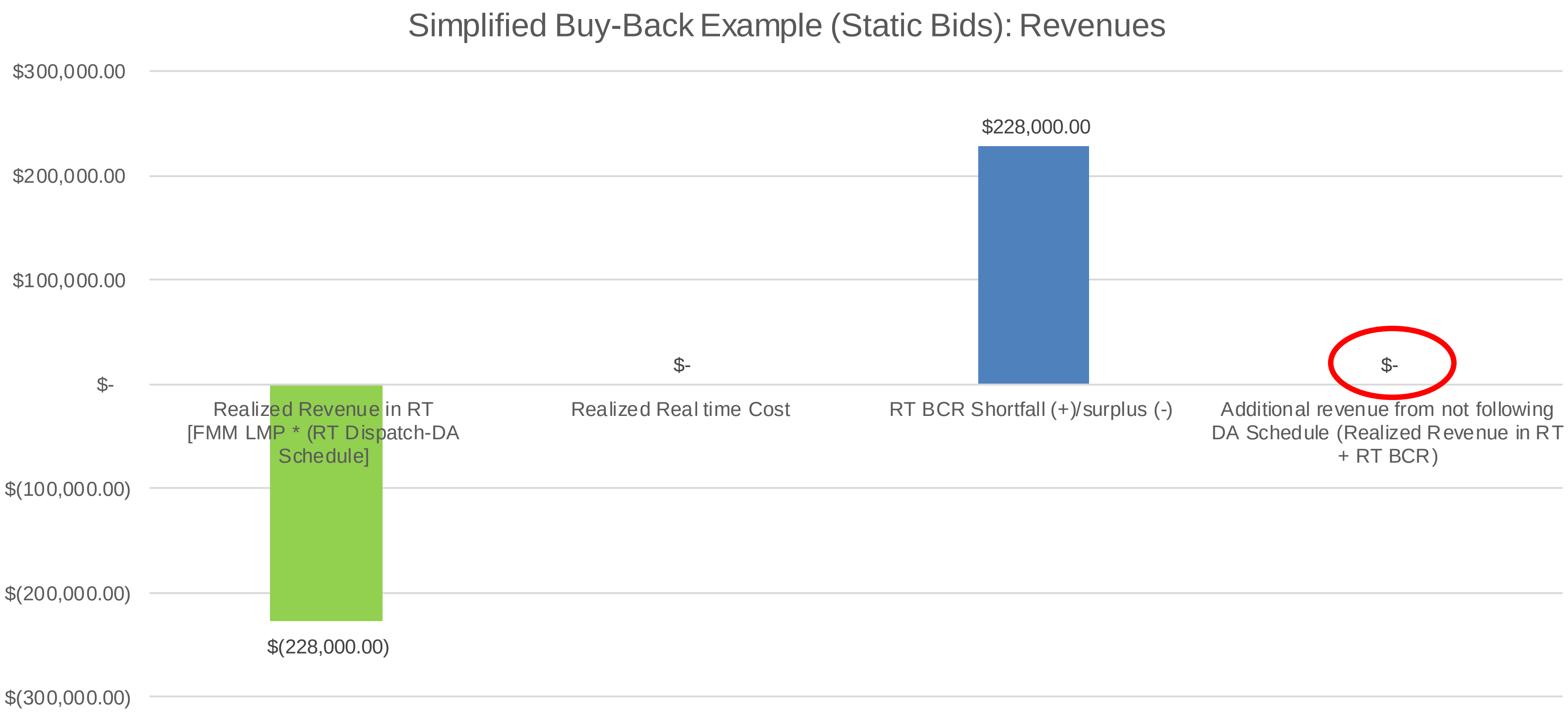






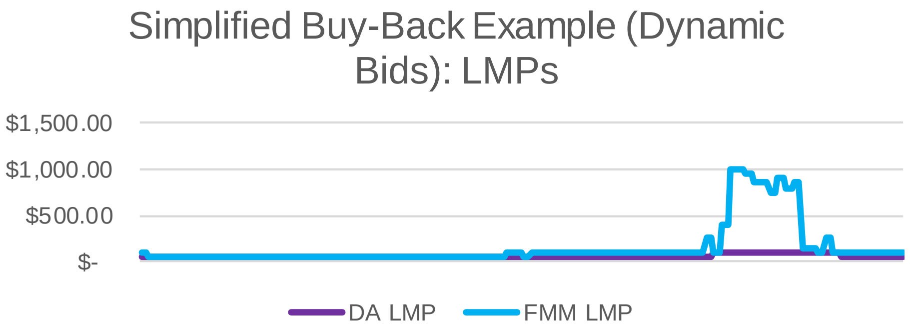
Simple buy-back examples – static bids

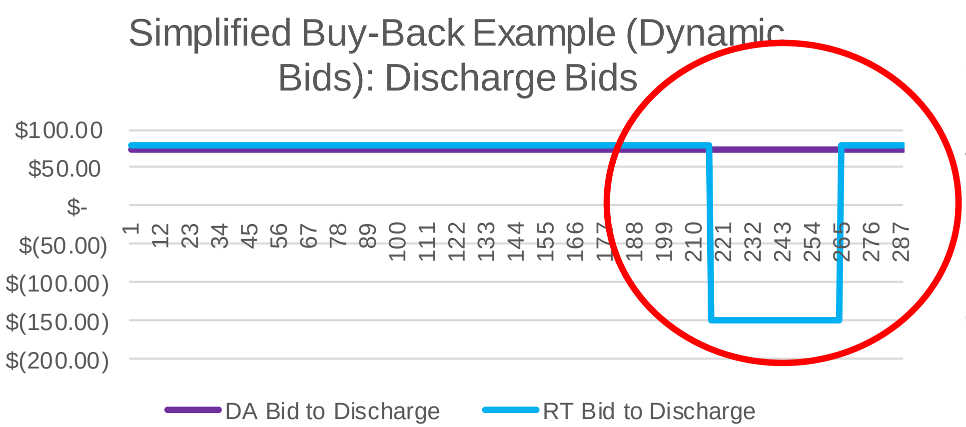
- As bids remain static, asset does not make additional revenue from RT BCR, but BCR eliminates exposure to RT LMPs

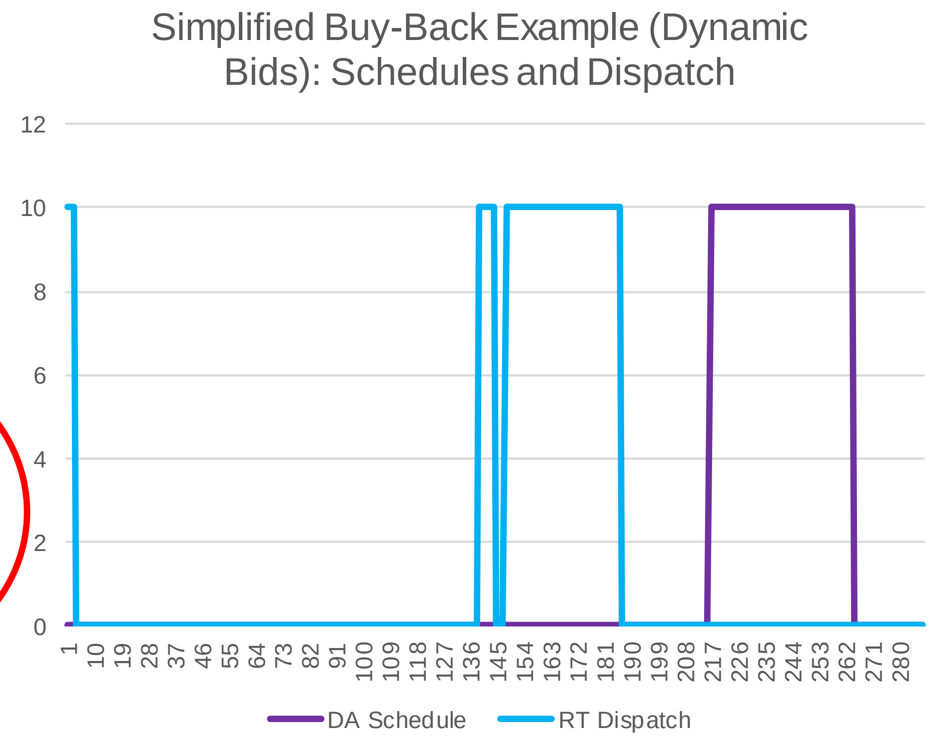


Simple buy-back examples – bids to -$150

- The asset modifies its RT bids to discharge to -$150 to increase the BCR related to the buy-back

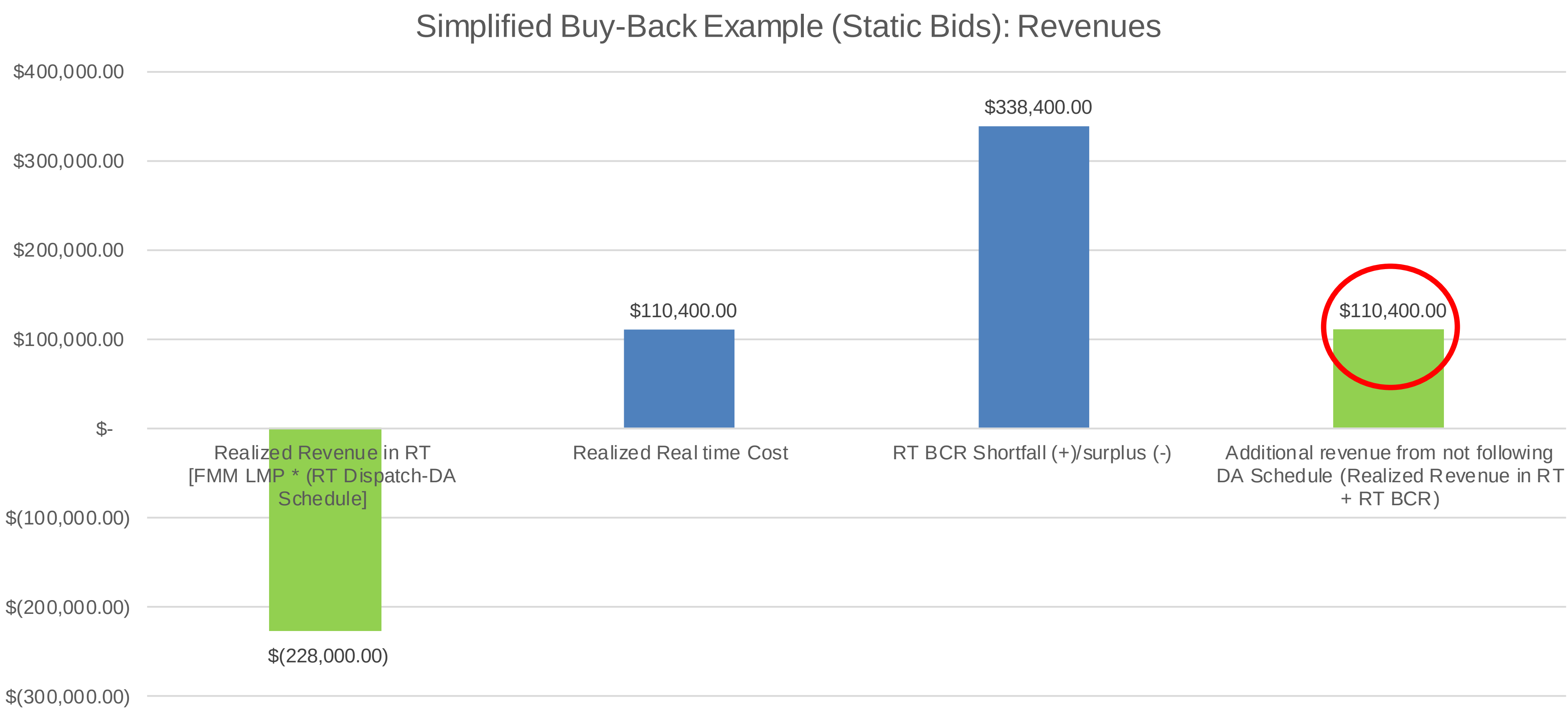






Simple buy-back examples – bids to -$150

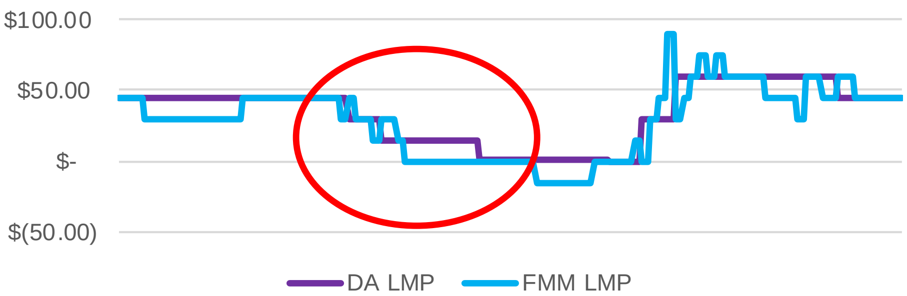
- By modifying its bids to the bid floor, the asset gets $110,400 of additional revenue for triggering buy-back and bidding strategically



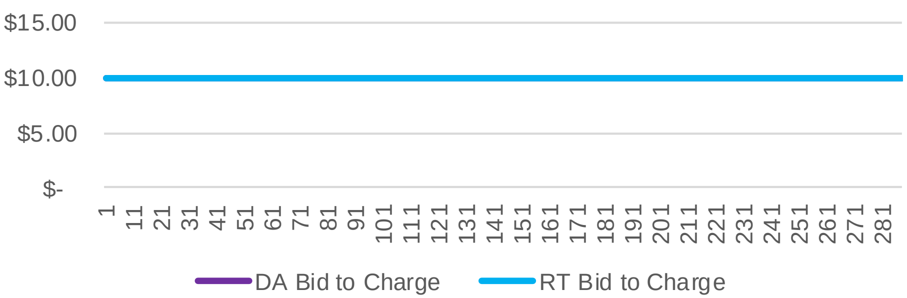
Simple sell-back examples – static bids

- Bids that do not reflect RT conditions result in the resource being fully charged ahead of DA schedule, resulting in a sell-back

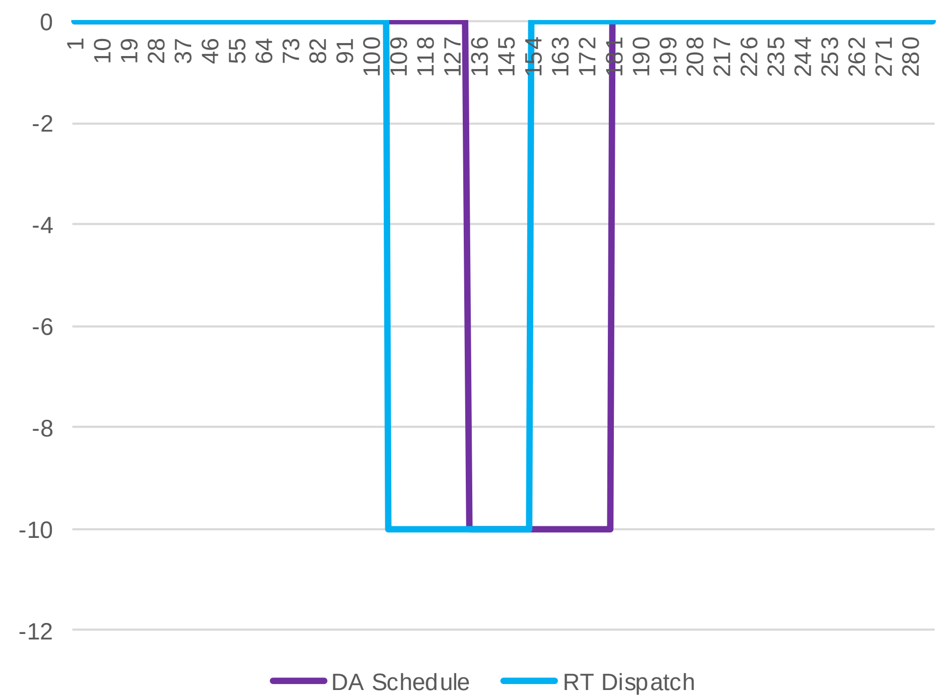
Simplified Sell-Back Example (Static Bids): LMPs



Simplified Sell-Back Example (Static Bids): Charge Bids

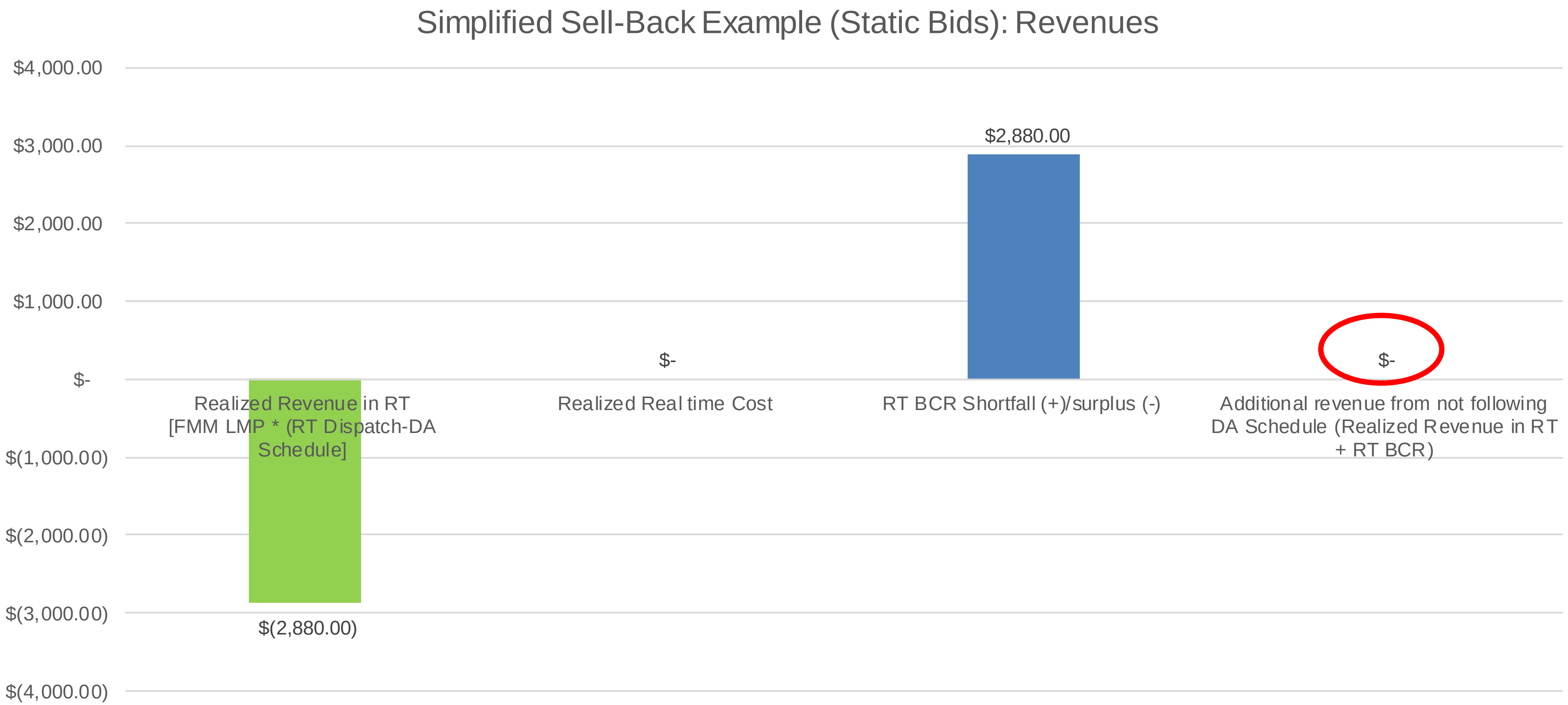


Simplified Sell-Back Example (Static Bids): Schedules and Dispatch



Simple sell-back examples – static bids

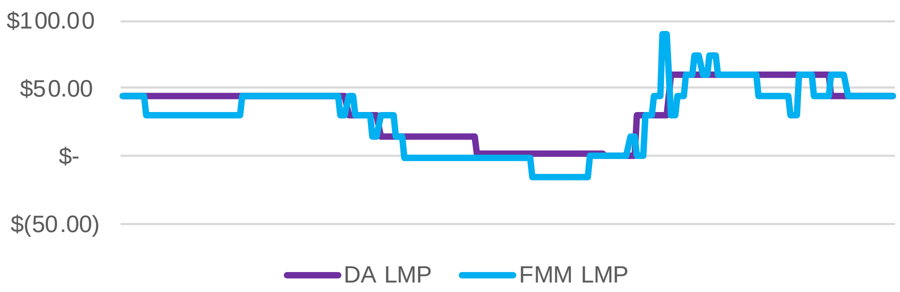
- As bids remain static, asset does not make additional revenue from RT BCR, but BCR eliminates exposure to RT LMPs



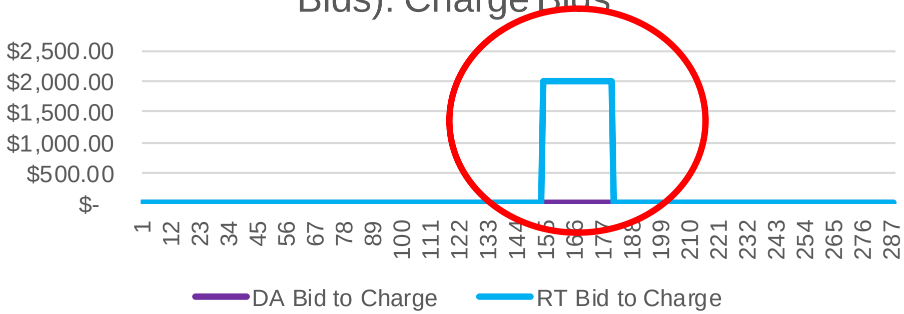
Simple sell-back examples – bids to $2,000

- The asset modifies its RT bids to charge to $2,000 to increase the BCR related to the sell-back

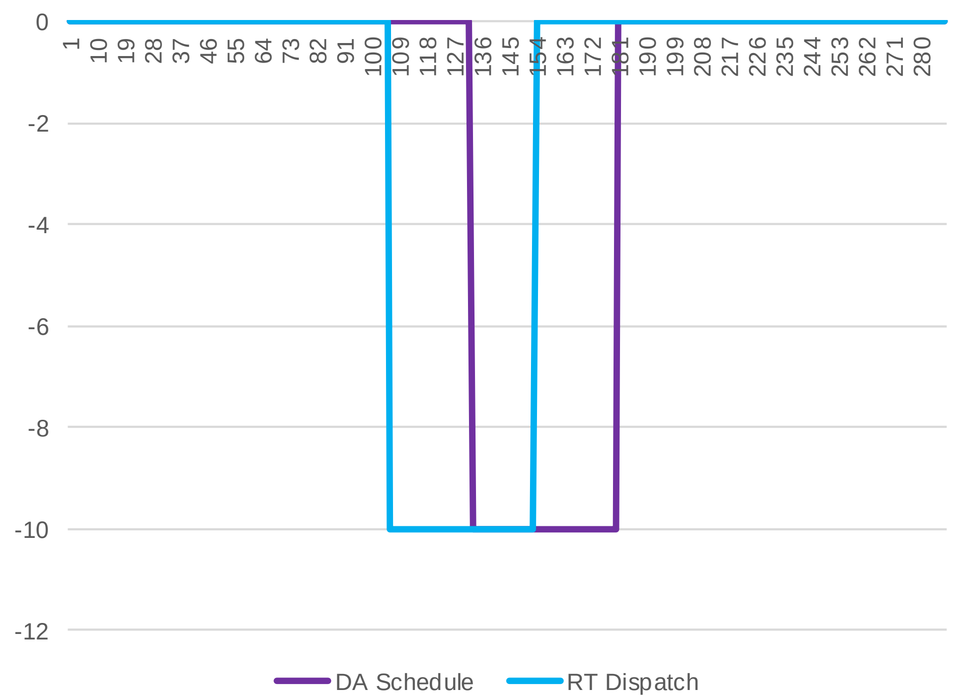
Simplified Sell-Back Example (Dynamic Bids): LMPs



Simplified Sell-Back Example (Dynamic Bids): Charge Bids

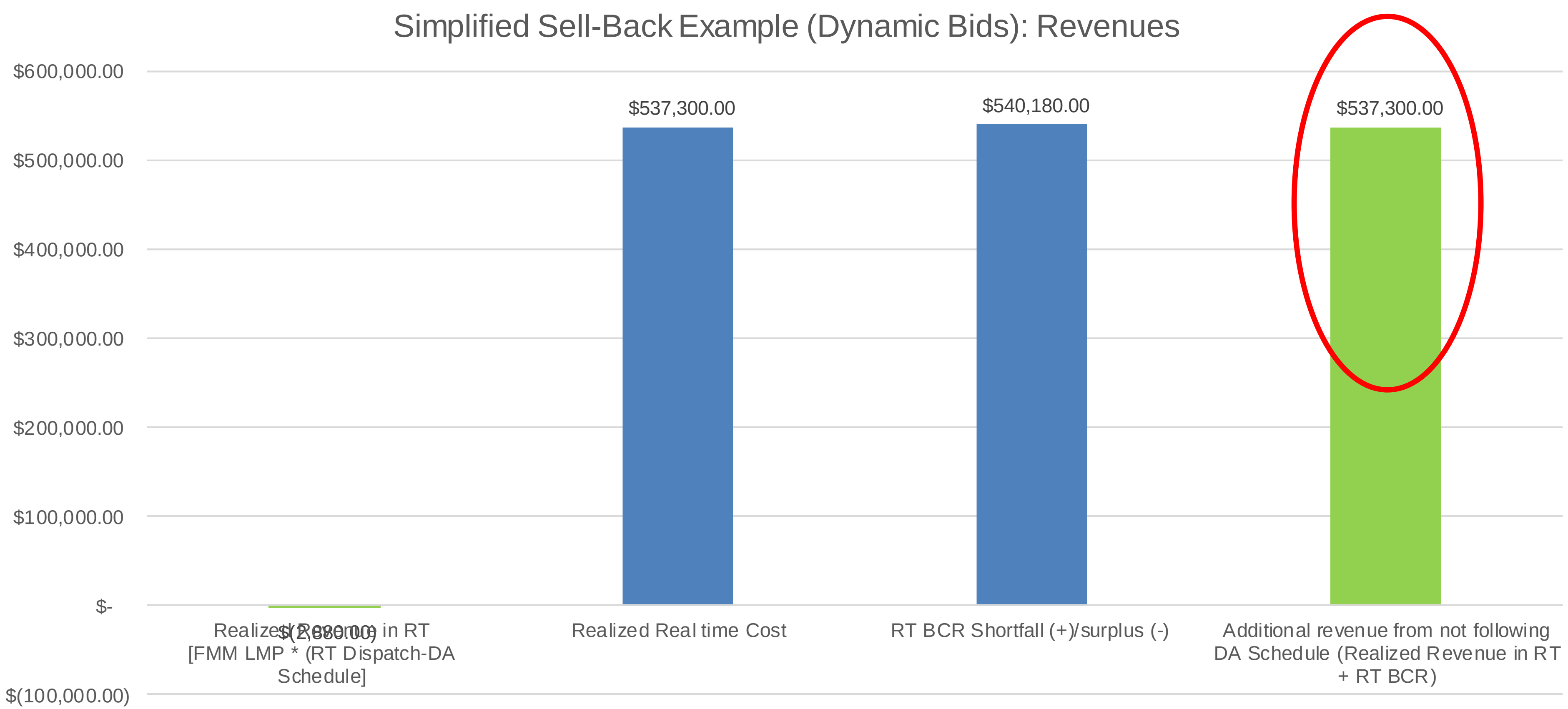


Simplified Sell-Back Example (Dynamic Bids): Schedules and Dispatch



Simple sell-back examples – bids to $2,000

- By modifying its bids to the bid cap, the asset gets $537,300 of additional revenue from triggering sell-back and bidding strategically



Track 1 proposes refining BCR provisions for standalone storage resources

- The ISO proposes to redefine dispatch unavailable due to SOC constraints in the binding interval as “non-optimal energy,” which would be ineligible for BCR

- The ISO proposes to identify whether storage resources can support their awards and schedules in the real-time binding interval on a resource-by-resource basis

Track 1 proposes refining BCR provisions for standalone storage resources

- If a given storage resource's SOC at the start of the binding interval is equal to its minimum or maximum value, then the market would rerate or derate the PMax or PMin to 0 in order to capture that the asset is completely full or empty
  - This would be done in the post-market process when expected energy is calculated and the expected energy allocation results are generated from market results
  - This would consider the ASSOC constraint, the End-of-Hour SOC constraint, upper and lower charge limits, and the attenuated SOC constraint

- The proposed solution would lead to the reclassifying any energy associated with buy-backs or sell-backs in that binding interval as non-optimal due to physical limitations as it is not available for dispatch, excluding it from the BCR calculation

Track 1 proposes refining BCR provisions for standalone storage resources

- The proposed solution would materially limit the chances of unwarranted BCR derived from DA schedule buy- and sell-backs

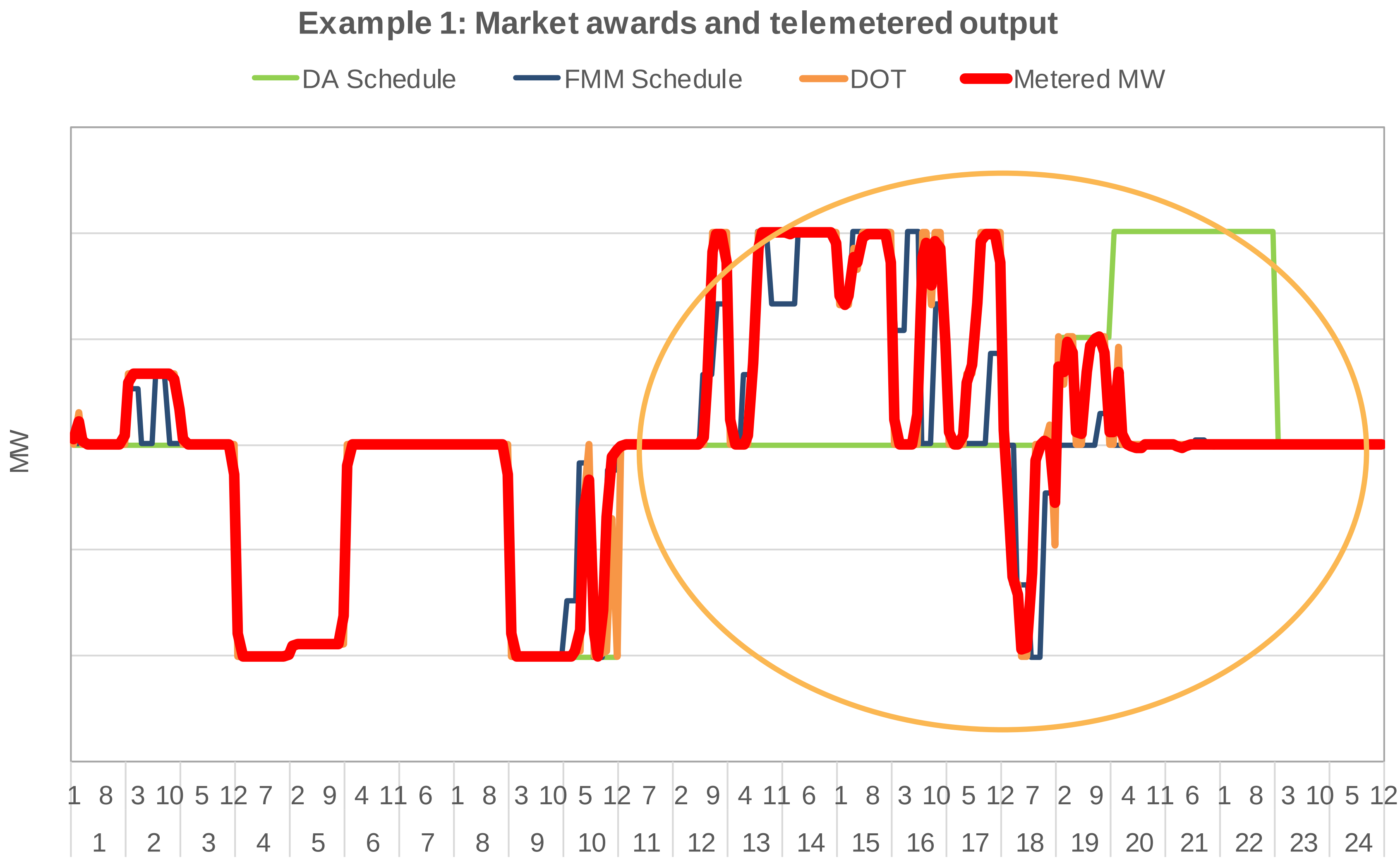
- The proposed solution would align the treatment of unavailable energy from a storage asset to that of a conventional thermal asset, which has its expected energy categorized as UIE when it is unable to perform and fulfill its DA schedule due to unavailability (i.e., an outage), thus making it ineligible for BCR

Appendix: More Complex Examples on Storage BCR

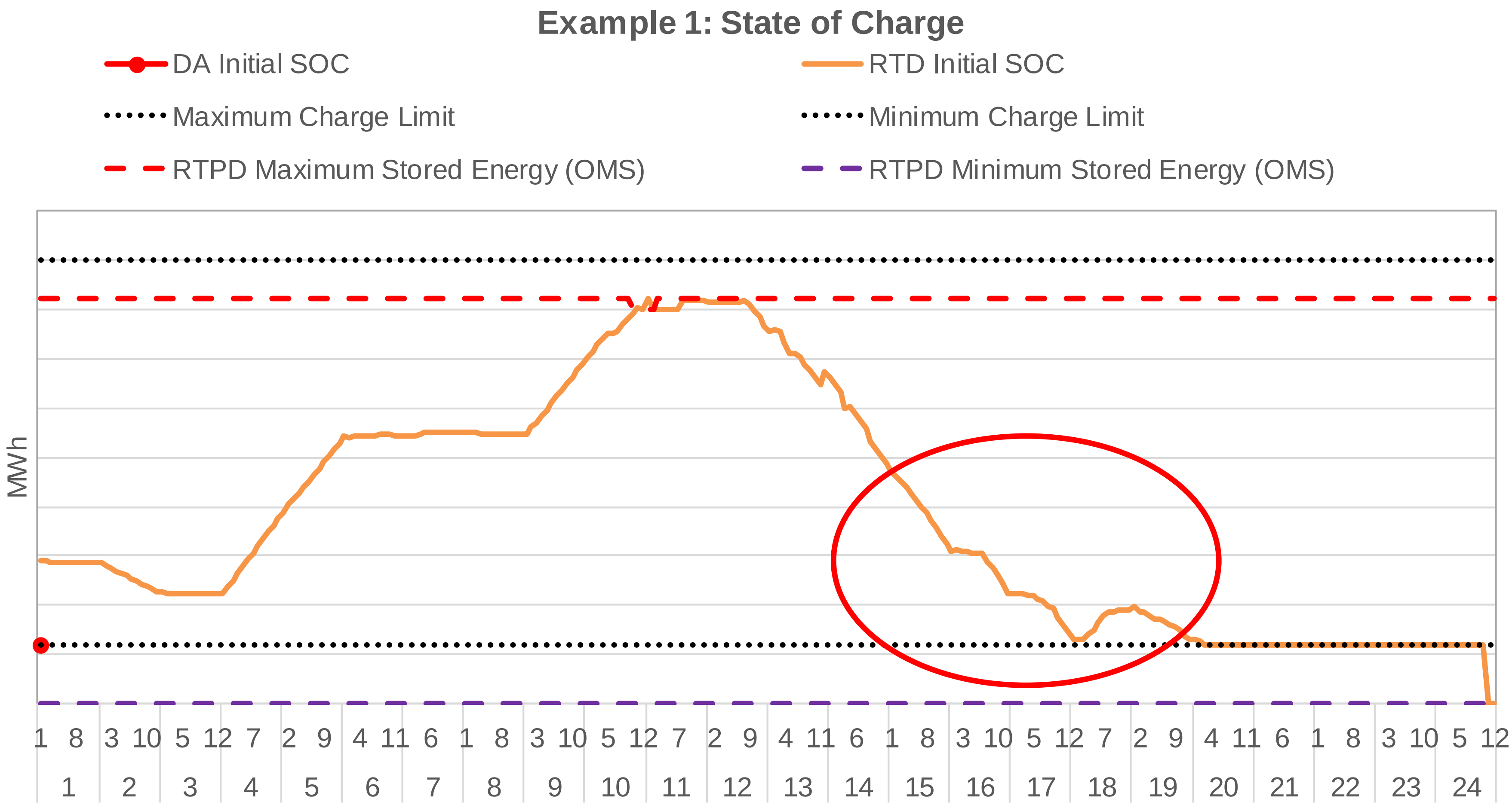
Example 1

- Example 1 illustrates how BCR can be paid out as a result of discharge prior to the DA schedule given the current lack of incentives to consider/reflect real-time conditions in bids
- Consider a resource with a DA discharge schedule over the net load peak hours of HE 19 through HE 22
- In real-time, the resource submits discharge bids in a manner generally aligned with the peak net load hour price from DA; however, real-time conditions indicate that real-time prices may be much higher than in day-ahead in the net load peak hours
- The asset has no incentive to reflect updated expectations in real-time energy bids given the current BCR provisions; as a result, the resource is discharged economically in HE 13 through HE 17, thus leaving the resource with limited recharge opportunities before reaching the peak net load hours with the aforementioned DA discharge schedules

Example 1 – Asset Discharges Prior to DA Schedule



Example 1 – Asset Discharges Prior to DA Schedule

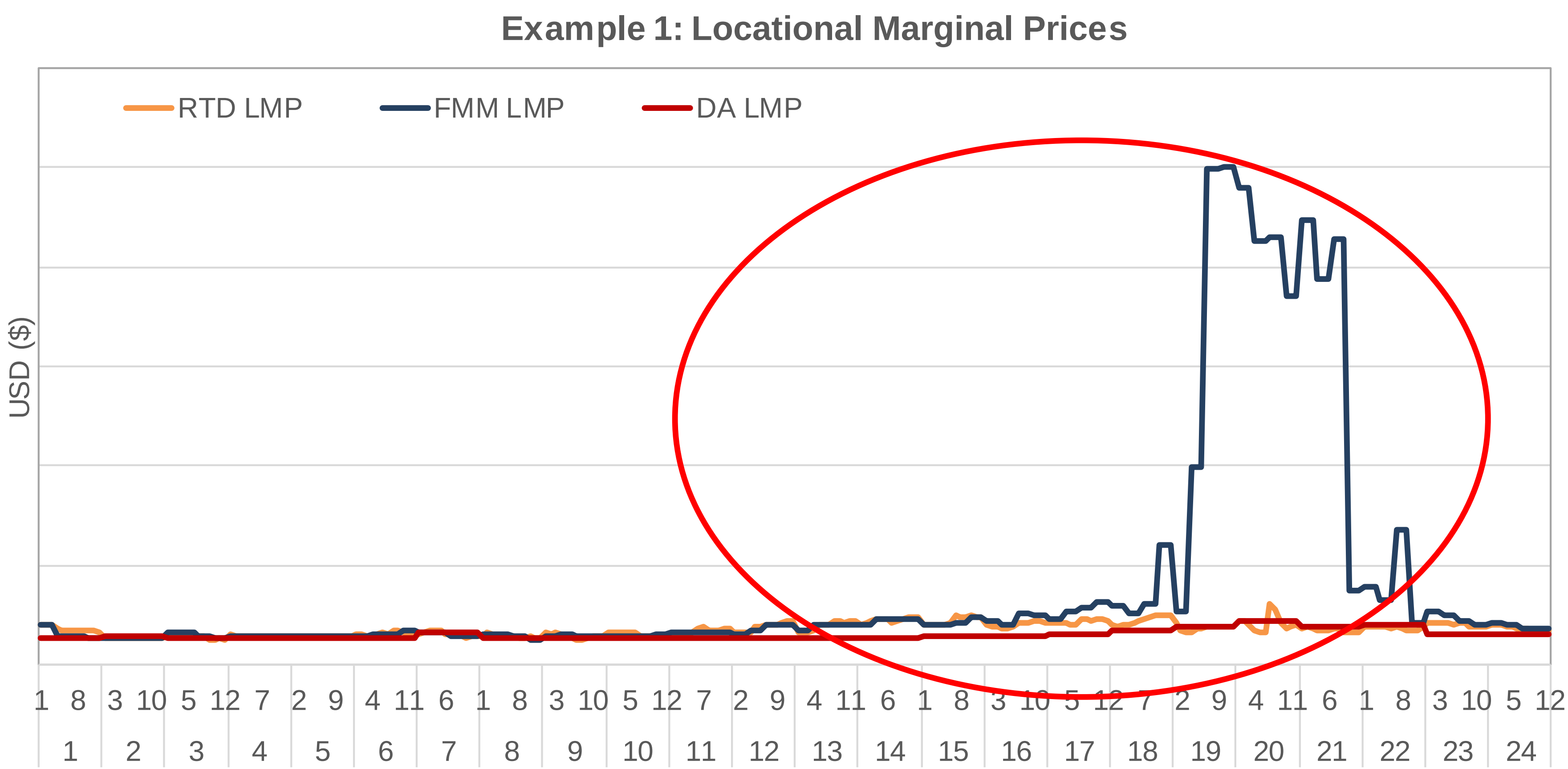


Example 1

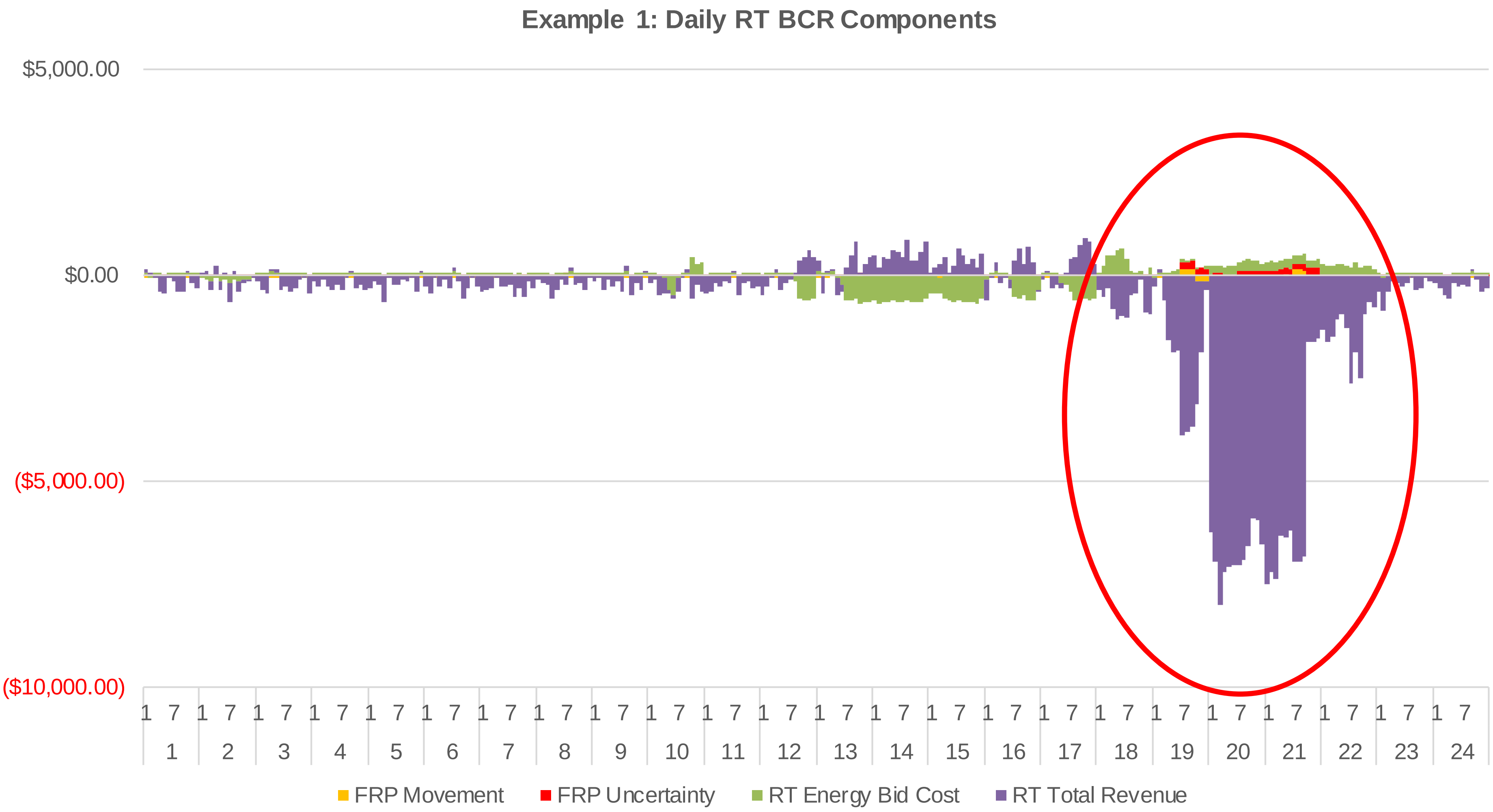
- Example 1 illustrates how BCR can be paid out as a result of discharge prior to the DA schedule given the current lack of incentives to consider/reflect real-time conditions in bids

- Because the resource submits discharge bids in a manner generally aligned with the peak net load hour price from DA, the SOC of the resource has been depleted before the DA schedule, triggering a buy-back for most of the DA discharge schedule at higher LMPs during tight supply conditions

Example 1 – ≈ $200,000 in RT BCR due to high LMPs



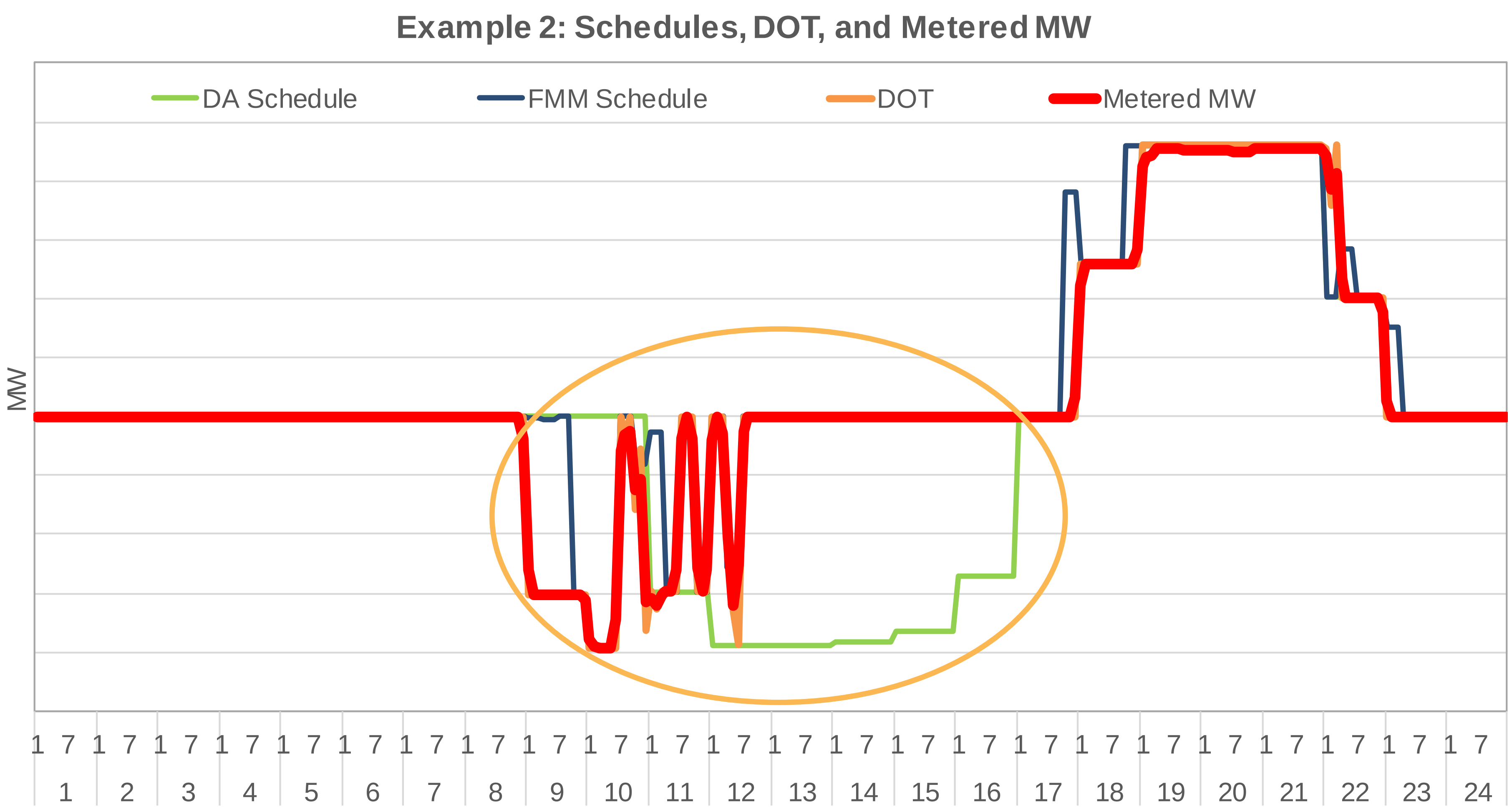
Example 1 – ≈ $200,000 in RT BCR due to high LMPs



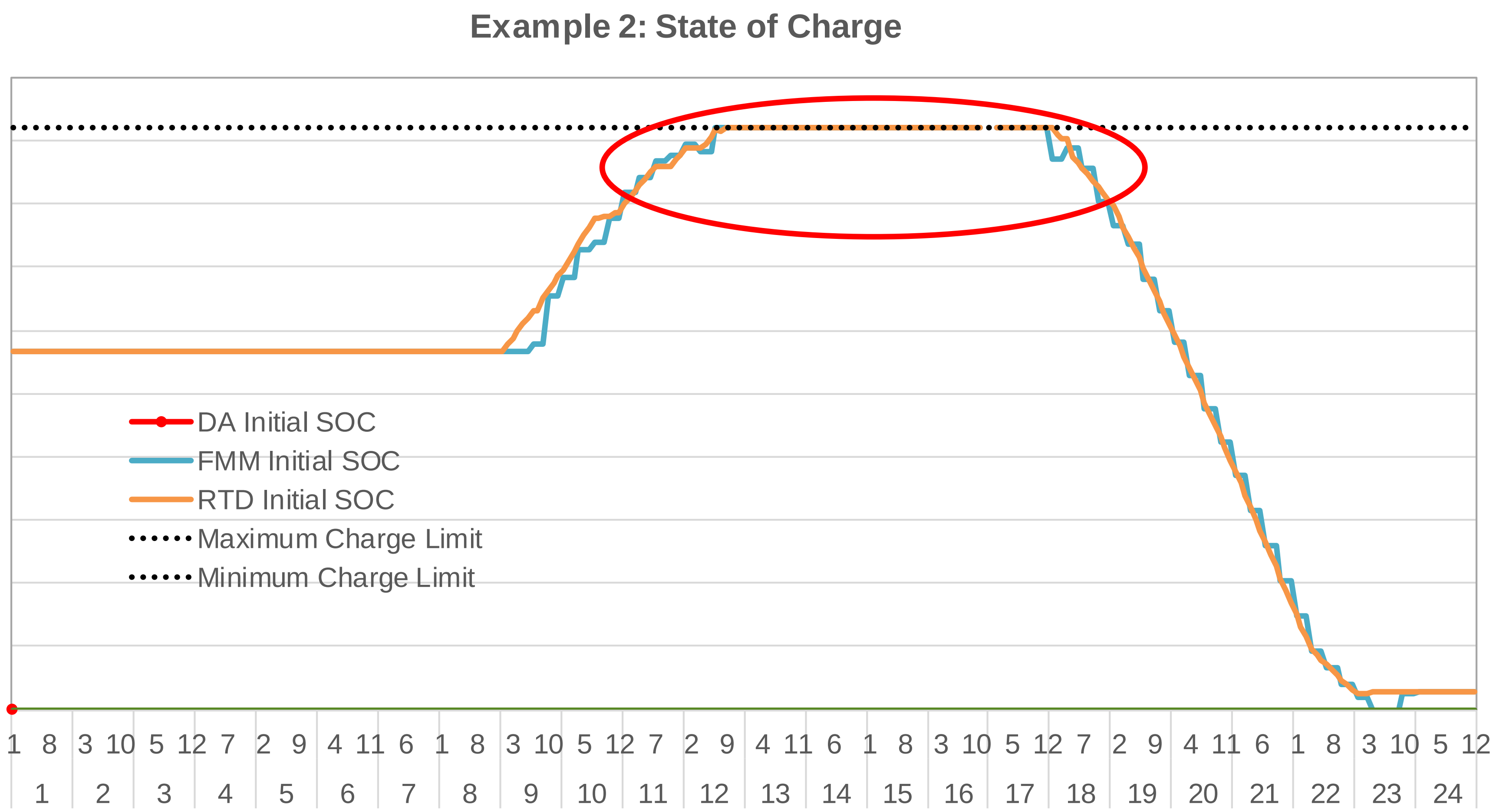
Example 2

- Example 2 illustrates how BCR can be paid out as a result of charging prior to the DA schedule given the current lack of incentives to consider/reflect real-time conditions in bids
- In this example, the energy storage resource enters the real-time market with SOC significantly higher than what was specified for the beginning of the DA market
- The resource then conducts additional charging as a result of real-time market awards, before reaching the hours of DA charging awards
- By the time day-ahead charging awards are reached, the resource is at 100% SOC and further charging is not possible, leading to the buyback of DA charging awards

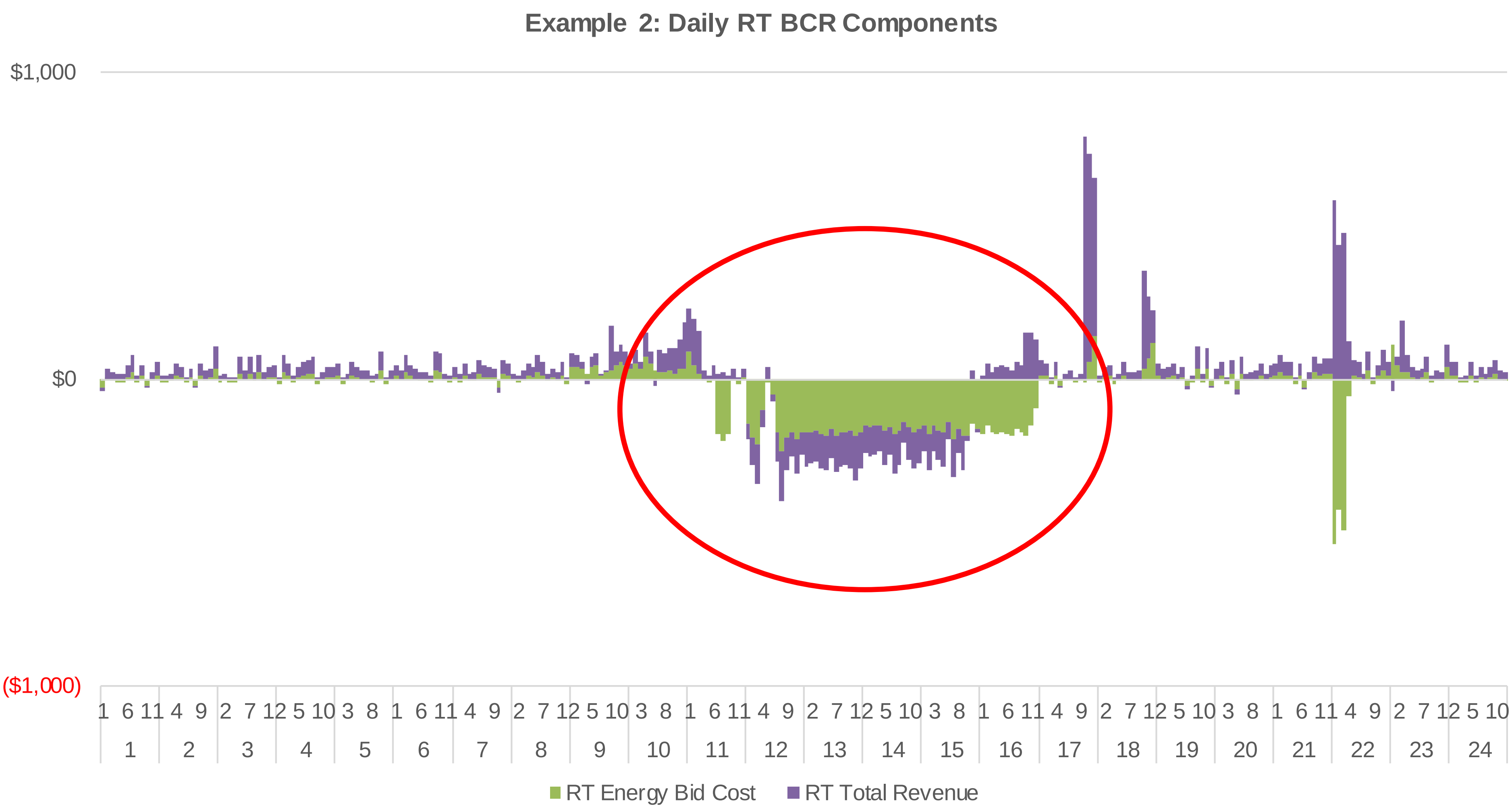
Example 2 – Asset Charges Prior to DA Schedule



Example 2 – Asset Charges Prior to DA Schedule



Example 2 – ≈ $15,000 in RT BCR due to sell-back



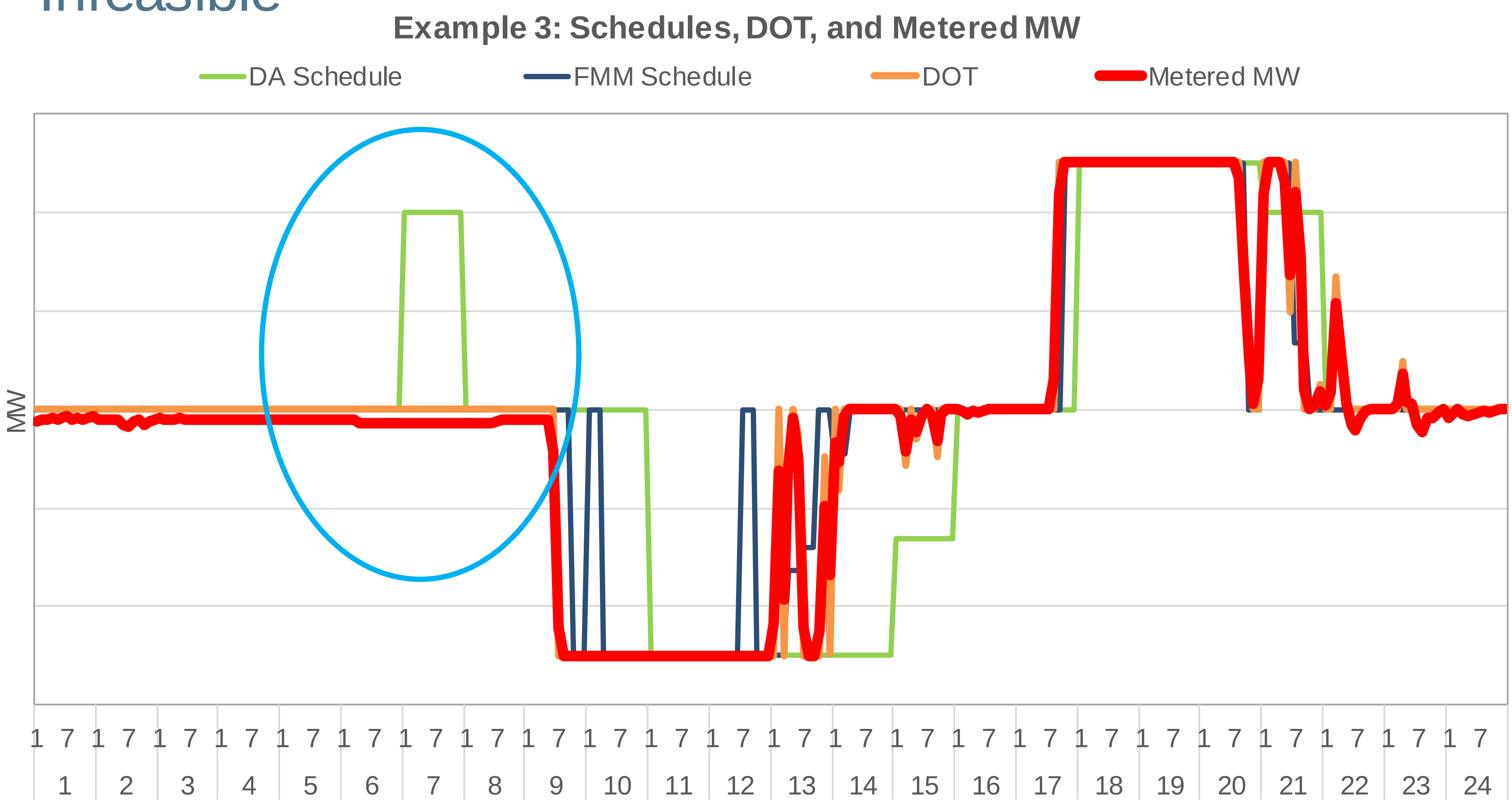
Example 3

- Example 3 illustrates how BCR can be paid as a result of Day-Ahead SOC submissions that differ from what's realized in RT

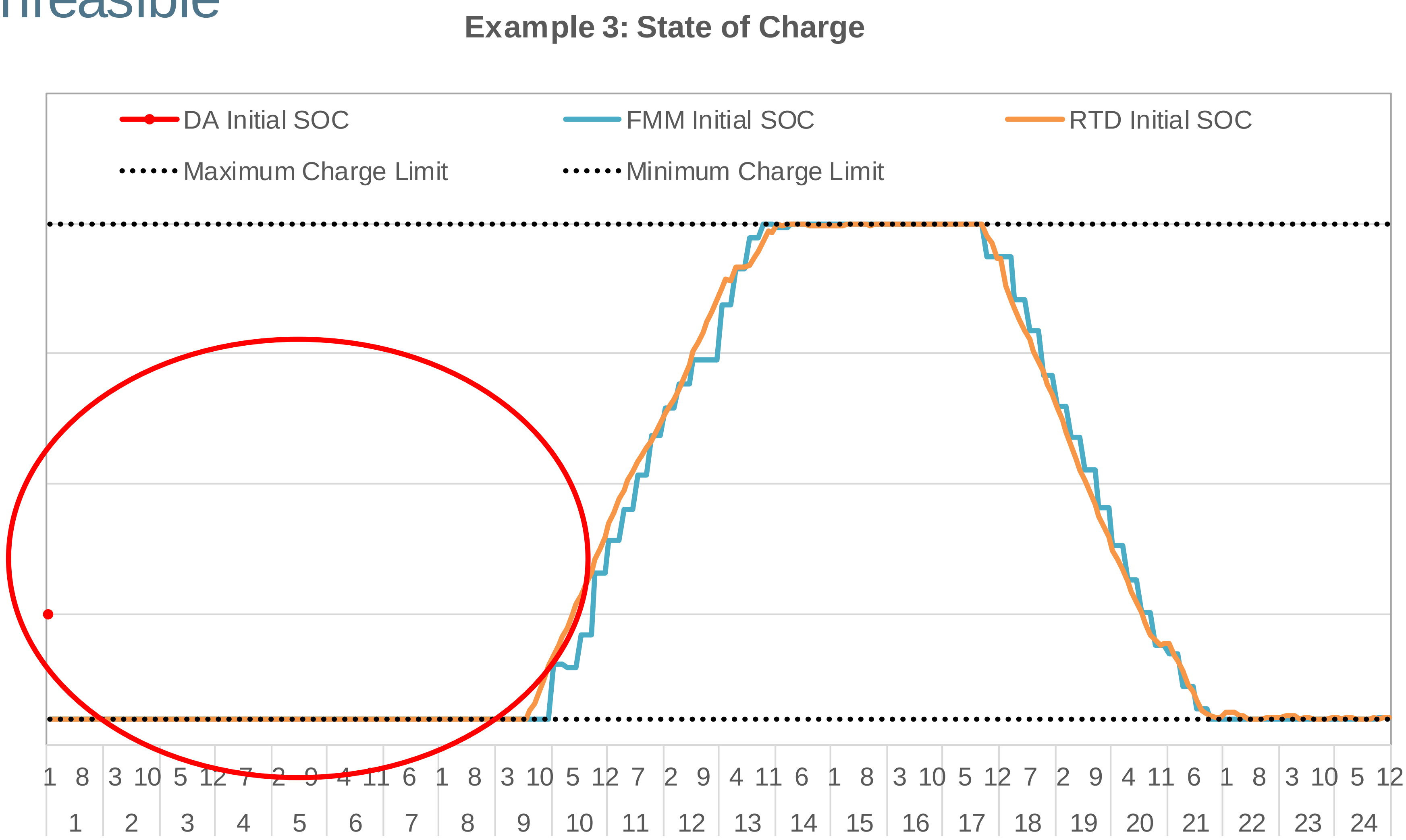
- In this example, the scheduling coordinator submits an initial DA SOC at approximately 25% of the battery's capacity, allowing a DA discharge schedule for one hour in the morning before any charging occurs in the day

- In real-time, the battery started the operating day with much lower SOC, leading to the energy discharge award in the morning hours to be infeasible in real-time and contributing to real-time bid cost recovery payments, a strategy that could be replicated across multiple days thus accruing significant BCR

Example 3 – BCR is Paid Because Discharge is Infeasible



Example 3 – BCR is Paid Because Discharge is Infeasible



Example 3 – BCR is Paid Because Discharge is Infeasible