

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE
STATE OF CALIFORNIA

Order Instituting Rulemaking to consider
policy and implementation refinements to the
Energy Storage Procurement Framework and
Design Program (D.13-10-040, D.14-10-045)
and related Action Plan of the California
Energy Storage Roadmap.

Rulemaking 15-03-011

(Filed March 26, 2015)

COMMENTS OF SOUTHERN CALIFORNIA EDISON COMPANY
ON JOINT STAFF PROPOSAL ON MULTIPLE USE
APPLICATIONS FOR ENERGY STORAGE

Appendix A

Proposed Rules and Protocols for BTM Wholesale Charging

The following is an excerpt from a Southern California Edison filing with the CPUC. It can be found in full at the following address:

[http://www3.sce.com/sscc/law/dis/dbattach5e.nsf/0/DBE6029617F56522882581420000D854/\\$FILE/R1503011-SCE%20Comments%20on%20Joint%20Staff%20Proposal%20on%20Multiple%20Use%20Applications.pdf](http://www3.sce.com/sscc/law/dis/dbattach5e.nsf/0/DBE6029617F56522882581420000D854/$FILE/R1503011-SCE%20Comments%20on%20Joint%20Staff%20Proposal%20on%20Multiple%20Use%20Applications.pdf)

Proposed Rules and Protocols for BTM Wholesale Charging

Rules and General Principles

Wholesale and Retail Charging must remain separate and distinct

Customers may not use wholesale energy to serve retail load. Therefore, at all times, it must be clear whether the battery is performing a retail activity or wholesale activity, for both charging and discharging. If a battery charges as a wholesale load, the battery is then considered to be charged with wholesale energy, which may not be simply discharged to serve retail load without further adjustment to billing. Therefore, it is necessary for the IOU to calculate quantity (kWh) of wholesale energy stored in the battery. A retail adjustment will be made to credit the bill for the retail charges that occurred during wholesale charging. Finally, if the battery discharges wholesale energy to serve retail load, a retail bill adjustment must be made to add charges for the energy used at retail.

Retroactive modifications to transactions are strictly prohibited

If a battery charges at wholesale, a wholesale settlement with the CAISO is created for the interval of charging and the CAISO will presumably treat the load as a wholesale load for all relevant wholesale charges, including ancillary services. (The issue of distribution service, which is subject to different jurisdictions depending on whether load is wholesale or retail, is discussed below). Regardless of what happens to that energy in the future, that wholesale settlement remains unchanged: If the wholesale energy is later used to serve retail load, then additional retail energy will need to be added to the bill. However, the original wholesale settlement will not be “voided” or “unwound” or otherwise cancelled. Similarly, if the battery charges at retail and exports to the grid, the customer cannot create a wholesale settlement at the time of retail charging: this energy is retail energy and is ineligible for wholesale settlement. There is absolutely no opportunity for an after-the-fact true-up, in which past transactions are modified to accommodate actual activity.

This is consistent with the current functioning of the CAISO market: once a day-ahead award is issued, that settlement will occur regardless of what a generator does during the scheduled generation. If the generator does not generate, they do not void the original award: rather, the generator must buy the energy back at real time prices. Similarly, if a battery charges at wholesale, but does not provide this energy back to the grid, the battery does not get to void out the previous wholesale transaction. Instead, if the wholesale energy is used to serve retail load, the customer must buy the retail energy at current TOU rates. The mechanism is discussed in more detail in the protocols that follow.

The rationale for this is that the ability to change the status of a past transaction opens a huge gaming opportunity. If a customer could retroactively create or void wholesale settlements, then the customer could charge the battery and make an after-the-fact decision about whether the charging would be more favorable at wholesale or retail, given the wholesale prices in that interval and the discharge interval. The ability to void a previous wholesale settlement that turned out to be unfavorable and the ability to retroactively create a new wholesale settlement at favorable prices creates huge gaming and manipulation opportunities.

Wholesale activity may only occur according to a CAISO schedule, which must be established in advance

In order to prevent retroactive transactions, it must be clear in each interval whether the storage operation is considered wholesale or retail. Practically speaking, this means that the wholesale schedule must be established in advance. More specifically, this schedule must be a CAISO day-ahead schedule that is determined through bids and awards or through self-scheduling.

Distribution costs must be appropriately recovered under the appropriate FERC or CPUC tariff.

Currently, distribution service for retail loads and wholesale loads are subject to CPUC and Federal Energy Regulatory Commission (FERC) jurisdiction (and tariffs) respectively. Thus, distribution costs are recovered differently from retail loads than from wholesale loads. Because a device engaged in charging may not be solely a retail or wholesale load, the distribution service to the device will need at some times to use *retail* distribution service and at other times *wholesale* distribution service. It is not clear how both FERC and the CPUC having jurisdiction over distribution service to the device depending on the nature of the load will be addressed. However, it is important that a BTM resource pay its fair share for use of the distribution grid and that any issues arising as a result of the dual jurisdiction be resolved through cooperation with FERC. The existing WDAT may require changes to address wholesale service to storage devices' loads.

Because the resource is participating directly in the wholesale market, a FERC-jurisdictional interconnection agreement will be required and distribution costs may be recovered through this vehicle. Wholesale distribution service from the device to the market will be subject to FERC jurisdiction and the WDAT.

Protocols

Overview

This section provides the required protocols necessary to enable behind the meter wholesale charging. The protocols implement the above rules and principles into specific requirements, accounting mechanisms, and bill adjustment procedures. These protocols are required to ensure the above principles are not violated.

The protocols assume that, as described above, a CAISO schedule is required for wholesale charging and discharging activity. Either the CAISO or the customer must provide the schedule to the IOU, and the IOU must be able to verify its accuracy. Furthermore, if the storage device is aggregated, the IOU must also be able to verify the specific instruction from the aggregator to the individual customer. For simplicity, the protocols that follow assume the storage device is participating directly in the market. (Virtually all CAISO activity involves the use of a Scheduling Coordinator, but to simplify the discussion, the customer is assumed to be the relevant Scheduling Coordinator.) However, additional or modified administrative steps may need to be added for resources participating via aggregation.

Additionally, CAISO will need to ensure that the wholesale load used to charge the storage device is not inadvertently also included in the load of the host utility

Furthermore, the total scheduled charging must equal the total scheduled discharging over the course of day. (This is of course not exactly accurate, as ultimately, efficiency losses must be taken into account. For simplicity, these protocols ignore efficiency losses; (efficiency will ultimately need to be accounted for in the final version of the protocols.) The following protocols assume a customer has a schedule to charge at wholesale during one hour (the “charging interval”) and discharge during a future interval (the discharge interval).

The “Standard Protocols” immediately below describe the basic procedures, accounting mechanisms, and bill adjustments that would occur assuming the storage device charges and discharges exactly as expected according to the CAISO schedule. The “Imbalance Protocols” that follow consider a number of alternative cases, including cases where the storage operation does not match the schedule, and cases where the CAISO schedule changes between the charging and discharging cycle. Each set of protocols is divided into protocols that are applied during the charging interval, and protocols that are applied during the discharge interval.

Standard Protocols

The protocols in this section provide the basic accounting mechanisms and bill adjustments, assuming the battery operates according to the CAISO schedule.

Charging Interval

CAISO Settlement

- During the charging interval, the customer will pay for the wholesale energy and all other load-based charges, via a settlement with CAISO, according to the day ahead award or schedule. Charging is measured at the battery sub-meter.

Retail Bill adjustment

- During the charging interval, the customer receives a retail bill credit for the retail charges that accrue during retail meter spin during the wholesale charging activity.
- As noted above in the Rules and Principles section, it may be appropriate to charge the customer for wholesale distribution service. This would be a FERC-jurisdictional rate.

Discharge Interval

Note: Export to the grid is not required. However, if the wholesale energy is not exported to the grid, a retail bill adjustment will occur. Note that the wholesale payment (CAISO settlement) is *not* impacted by whether or not the energy is exported to the grid, because from a system perspective this does not matter. However, from a retail perspective, it does matter whether the energy was consumed on site, and so retail adjustments will vary based on grid export.

CAISO Settlement

- During the charging interval, the customer will receive compensation for energy at a wholesale rate, via a settlement with CAISO according to the day-ahead award and schedule. Measurement for the

wholesale settlement is based on the battery sub-meter. (This measurement also is important because of FERC's jurisdiction over sales into the CAISO energy markets by batteries and the quarterly reporting that will be required by batteries under relevant FERC regulations and the batteries' FERC-jurisdictional tariffs.)

Retail Bill adjustment

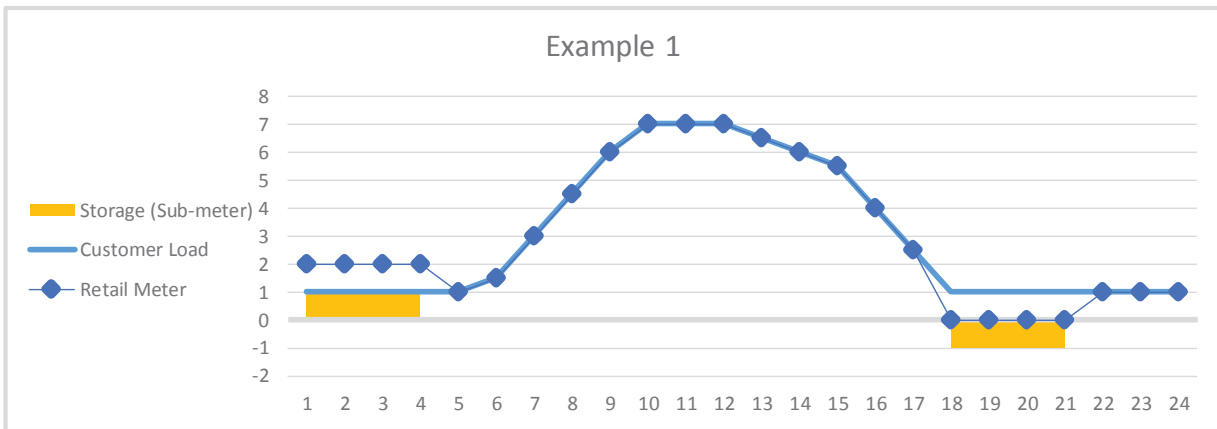
- During the discharge interval, if the entire quantity of wholesale energy is exported to the grid, there is no need for retail adjustment. For this to occur, the battery discharge must be equal to the sum of the wholesale discharge plus the retail load from customer facilities.
- **For any wholesale discharge energy consumed as retail load on the customer site, a retail bill adjustment takes place: the full retail charge, based on the current TOU rate, is added to the retail bill, equal to the volume of wholesale energy settled with CAISO that is actually consumed as retail energy on site.**
- Wholesale energy consumed on site is measured by taking the difference of the wholesale discharge settlement (measured at the battery sub-meter), and total energy exported to the grid (measured at main retail meter). If there is no grid export (i.e., battery discharge never exceeds customer load), then the entire volume of the wholesale charging has been consumed on site, and the retail adjust occurs accordingly.

Examples following Standard Protocols

Example 1

Assumptions

- Battery size: 1 MW, 4 MWh
- Customer load: 1MW in off peak periods, peaking at 7 MW during the middle of the day.
- Wholesale Schedule: Charge 1MW for 4 hours from HE1-HE4; Discharge 1MW for 4 hours from HE18-HE21. (Total wholesale activity of 4 MWh charge and 4 MWh discharge.)



HE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
<i>Wholesale Award</i>	1	1	1	1														-1	-1	-1	-1			
Customer Load	1	1	1	1	1	2	3	5	6	7	7	7	7	6	6	4	3	1	1	1	1	1	1	1
Storage (Sub-meter)	1	1	1	1														-1	-1	-1	-1			
Retail Meter	2	2	2	2	1	2	3	5	6	7	7	7	7	6	6	4	3	0	0	0	0	1	1	1

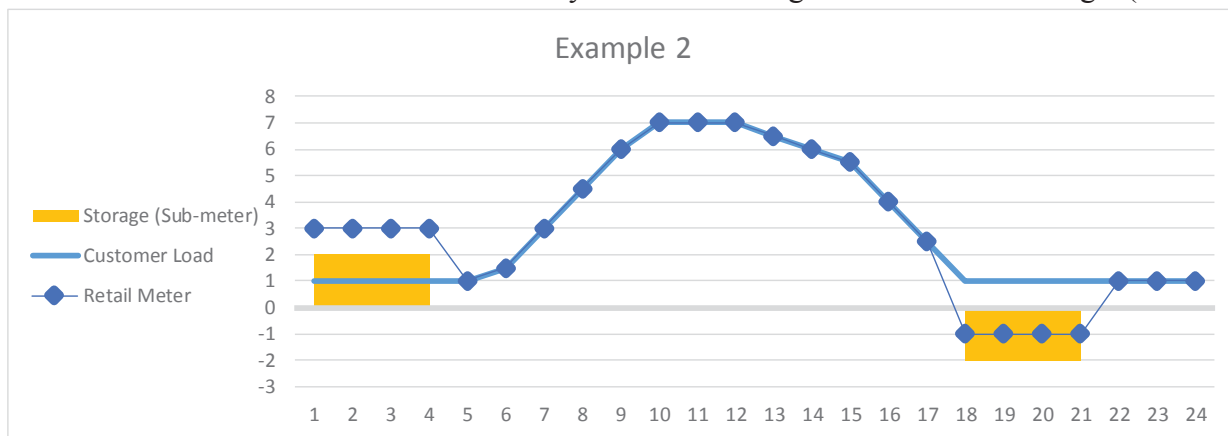
Description

- The Customer has received a CAISO schedule for both charging and discharging. The schedule requires using the entire capacity of the battery to meet the CAISO award.
- During the charging period, the battery charges as expected.
 - Measured at the sub-meter, the battery exactly follows the CAISO schedule, and so there is no imbalance with CAISO.
 - A retail bill adjustment is performed for the wholesale charging: A credit is applied to the bill equal to the retail charge for 1 MWh at the appropriate TOU rate for each of the 4 hours of charging.
 - As discussed above, a wholesale distribution service charge may be added.
- During the discharging period, the battery discharges as expected.
 - Measured at the sub-meter, the battery exactly follows the CAISO schedule, so there is no imbalance with CAISO.
 - In this case, no energy was exported to the grid; therefore all of the wholesale energy was all used on-site. A retail adjustment is therefore necessary. Thus, a charge is added to the bill equal to the full retail charge for 1 MWh at the appropriate TOU rate for each of the 4 hours of charging.

Example 2

Assumptions

- Battery: 2MW, 8 MWh (double the size of Example 1)
- Customer load: 1MW in off peak periods, peaking at 7 during the middle of the day (same as Example 1)
- Wholesale Schedule: Charge 1MW for 4 hours from HE1-HE4; Discharge 1MW for 4 hours from HE18-HE21. Total wholesale activity of 4 MWh charge and 4 MWh discharge. (same as Example 1)



HE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
<i>Wholesale Award</i>	1	1	1	1														-1	-1	-1	-1			
Customer Load	1	1	1	1	1	2	3	5	6	7	7	7	7	6	6	4	3	1	1	1	1	1	1	1
Storage (Sub-meter)	2	2	2	2														-2	-2	-2	-2			
Retail Meter	3	3	3	3	1	2	3	5	6	7	7	7	7	6	6	4	3	-1	-1	-1	-1	1	1	1

Description

- This example is similar to example 1, except the battery is larger. Because the CAISO schedule is the same, the wholesale settlements are the same. The battery does not receive any additional wholesale compensation because its operation exceeded the wholesale schedule. However, the increased discharge will impact the retail bill, for a different outcome than Example 1.
- During the charging period, the battery charges double the CAISO schedule. This is not a problem; the excess charging is simply retail activity.
 - Measured at the sub-meter, the battery has sufficiently charged to meet the CAISO schedule, and so there is no imbalance with CAISO. The extra 1MWh in each hour is considered retail. The customer settles with CAISO according to its day-ahead award or schedule. (Same wholesale outcome as Example 1.)
 - A retail bill adjustment is performed for the wholesale charging: A credit is applied to the bill equal to the retail charge for 1 MWh at the appropriate TOU rate for each of the 4 hours of charging. As noted above, a wholesale distribution service charge may be added. (Same adjustment as Example 1.)
- During the discharging period, the battery discharges double the CAISO schedule.
 - Measured at the sub-meter, the battery has met or exceeded CAISO schedule, so there is no imbalance with CAISO. The battery does not receive additional wholesale payments for the extra 1MWh in each hour; the battery simply is compensated according to its day ahead award or schedule. (Same wholesale outcome as Example 1.)
 - In this case, 1MWh was exported to the grid in each hour; therefore none of the wholesale energy was used on-site. Thus, there is no retail adjustment to add energy back to the retail bill (This is different than Example 1.)

Imbalance Protocols

These protocols account for when the storage device deviates from the CAISO schedule, or when the CAISO discharge schedule is modified after wholesale charging occurs.

Charging Interval Imbalance.

- **Case 1: Charging is greater than CAISO schedule.**
 - This is technically not an imbalance and was detailed in Example 2 above. The wholesale energy is limited to the scheduled quantity. All Standard Protocols apply for the scheduled quantity. Additional charging is retail charging with no special treatment required
- **Case 2: Charging is less than CAISO schedule.**
 - The wholesale charging settlement is handled as any other wholesale deviation from schedule.
 - The retail adjustments occur according to the Standard Protocols, but they are limited to the actual wholesale charging.
 - This charging imbalance will impact the discharge interval: For the discharge interval, *wholesale discharging is capped at the measured wholesale charging*. Regardless of what the battery actually discharges during the discharge interval, the maximum wholesale discharge is limited to the measured wholesale charging energy.

Discharge Interval Imbalance

- **Case 3: Discharging is greater than CAISO schedule.**
 - This is technically not an imbalance and was detailed in Example 2 above. Measured wholesale discharge, for both CAISO settlement and retail purposes, is limited to the actual CAISO schedule.
 - Any additional discharge energy is considered retail energy, and no additional process is required.
- **Case 4: Discharging follows the schedule, but is greater than measured wholesale charging.**
 - This is the situation on the discharge interval that occurs when Case 2 occurs during the charge cycle.
 - As discussed in Case 2, measured wholesale discharge, for both CAISO settlement and retail purposes, is limited to the actual CAISO schedule.
 - The Standard Protocols will apply up to the new maximum wholesale discharge. Any additional discharge energy is considered retail energy, and no additional process is required.
- **Case 5: CAISO discharge schedule increases after wholesale charging is already complete.**
 - CAISO rules should not allow this scenario, but if this is allowed to occur, the protocol is actually the same as in Case 4: measured wholesale discharge, for both CAISO settlement and retail purposes, is limited to the actual wholesale charging energy.
 - The Standard Protocols apply up to this maximum. Any additional discharge energy is considered retail energy, and no additional process is required
- **Case 6: Actual wholesale discharge is less than measured wholesale charging energy**
 - In this scenario, following the period of the scheduled wholesale discharge, the battery contains *excess wholesale energy* that has not been used. This occurs if the battery did not fully discharge as expected. [This could also occur as a result of the discharge schedule being reduced after charging has occurred, which is Case 7 below.]
 - It is assumed that this energy will eventually be discharged to serve retail load. Therefore, the retail adjustments described in the Standard Protocols apply to the entire quantity of wholesale energy. (i.e., a full retail charges are added to the bill at the TOU rate that applies during the wholesale discharge interval.)
[An alternative protocol is to state that the battery may not be discharged until the next wholesale discharge interval, but this requirement unduly limits battery operation and would be challenging to enforce without direct control of battery operations.]
- **Case 7: CAISO schedule is reduced after charging has occurred, such that the new discharge schedule is less than actual wholesale charging energy.**
 - [Note: this case assumes the schedule reduction creates a situation such that the scheduled discharge is less than the charging that already took place. If the wholesale charging had also been reduced, then this case may not apply.]
 - For wholesale settlement purposes, measured wholesale discharge is limited to the CAISO schedule.
 - The upshot is that, because wholesale discharge is limited to the CAISO schedule, there will be excess wholesale energy, and so the situation is actually similar to case 6: For retail adjustment, any “excess” wholesale energy is considered to be used for retail purposes.

Therefore, the retail adjustments apply to the full quantity of wholesale charging energy, even though the wholesale settlement only applies to the scheduled quantity.