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## Tesla Comments on Barriers to DR Workshop

Comments of Tesla on the August 8 workshop on barriers to Demand Response.

*Additional submitted attachment is included below.*

TESLA

August 22, 2017

Commissioner Andrew McAllister, Energy Commission Staff
California Department of Energy
Dockets Office
Re: Docket No. 17-IEPR-12
1516 Ninth Street
Sacramento, CA 95814-55 12

RE: August 8, 2017 Staff Workshop on Barriers to Demand Response

Dear Commissioner McAllister and Energy Commission Staff:

Thank you for giving time and attention earlier this month to the issues that thus far have constrained demand response (DR) from reaching its full potential. Well-designed state policies, rates and tariffs can support DR programs that result in significant greenhouse gas emission reductions, greater grid reliability, and lower cost.

Critical to this effort will be the deployment of enabling technologies that allow for instantaneous, reliable DR with minimal disruption or effort on the part of the customer. Indeed, Southern California Edison (SCE) recently indicated that customer attrition is a significant problem in existing DR programs. In a presentation at a recent workshop, SCE noted that frequent DR events drive customers away and that "customers who de-enrolled in 2016 were among the highest performing customers in 2015."[1]

Battery Energy Storage devices located behind the customer meter can help solve this problem by delivering seamless, reliable and measurable demand reduction with no effort or disruption required of the customer. As costs have come down, customers have been deploying these devices in increasing numbers for backup power, time-of use management and demand-charge management. When aggregated together, these batteries could provide valuable energy capacity when the grid is strained. Current demand response rules, however, allow only a small fraction of total battery capacity to be available for DR events. In many cases, behind-the-meter (BTM) batteries are not able to participate in DR at all.

The primary roadblock limiting batteries from achieving their full potential in DR programs is an antiquated set of rules that prohibits BTM batteries from exporting energy to the grid. This problem, which we call the "net export constraint," allows BTM batteries to participate in wholesale DR programs only to the extent that the customer has positive load, which leaves a significant amount of battery capacity unused. For BTM batteries paired with solar PV systems, participation is usually impossible as a result of solar PV export during the day. Attached is a short paper that explains the nature and scope of the problem.

Sincerely,

Damon Franz
Associate Manager, Business Development and Policy
Tesla

[1] "A Look Back: 2016 DR Market Integration," Erica Keating, SCE. Presented on February 22, 2017. http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442452587

# Eliminating the Behind-the-Meter Net Export Constraint

*Fairly valuing exported energy from behind-the-meter energy storage systems facilitates unlocking their full potential to provide grid and customer benefits*

## Introduction

This report serves as a high-level primer on the rules, policies, and issues that prevent behind-the-meter battery energy storage systems from exporting to the grid during times of grid or market need – an obstacle that we call the "net export constraint."[2]

Behind-the-meter (BTM) battery energy storage systems are being deployed by residential customers in increasing numbers. These customers are utilizing batteries to provide backup power, deliver time-of-use savings, enable solar PV self-consumption, and other increasingly innovative use cases. Beyond these host customer uses, BTM batteries can also provide valuable grid benefits to utilities and grid operators by delivering services to meet wholesale, transmission and distribution needs. In turn, utilizing batteries to provide these grid services reduces operating costs and delivers savings for all customers.

Despite the demonstrated ability of BTM batteries to provide valuable grid benefits, administrative roadblocks currently prevent them from being fully utilized. In particular, utility programs and wholesale markets frequently limit the ability of BTM batteries to deliver their full potential value to the grid. Specifically, these programs and markets often treat BTM batteries as Demand Response assets, a limitation that results in these assets being compensated only for the amount of host customer load drop that they enable. This approach, rooted in historical Demand Response programs, attributes no value to any energy exported beyond a customer's meter, even if that energy is usefully delivered during times of high grid need. This net export constraint is dated and acts as an arbitrary limit that prevents BTM batteries from reaching their full potential.

In order to leverage the expanding customer base of batteries to benefit the grid, the limitation of legacy demand response rules must be lifted, allowing behind-the-meter batteries to be fairly compensated for energy that they export to the grid.

### Key Takeaways

- The rapidly expanding deployments of behind-the-meter *batteries have the potential to provide significant value to the electric grid*. Industry forecasts anticipate increasingly large fleets of deployed customer-sited batteries,[3] and these assets can provide a wide range of wholesale, transmission, distribution, and customer benefits.[4]

- *The Net Export Constraint is limiting behind-the-meter batteries* from delivering their full value to the electric grid and customers. This administrative limitation is based on dated characterizations of Demand Response assets and prevents BTM batteries from being fairly compensation for exports delivered to the grid. Under most existing utility program and wholesale market rules, BTM batteries are only compensated for load drop observed at the host customer site, not the full discharge that these batteries are capable of delivering in times of high grid need.

- *Removal of the Net Export Constraint could drive ratepayer savings in the range of $600 per battery per year*[5] by bringing significant additional flexible capacity onto the system to help address a range of growing grid needs (e.g. system ramping, over-generation, system and local capacity, voltage regulation support).

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[2] Net export occurs when the instantaneous power produced by a distributed energy resource located on a particular site is greater than the instantaneous load of the site, and some power thus flows back onto the grid (i.e. is "exported" from the site to the grid)
[3] "The behind-the-meter energy storage landscape 2016-2021: market trends, frameworks and evolution", GMT Research, December 2016
[4] "The Economics of Battery Storage", Rocky Mountain Institute (RMI), October 2015
[5] Net cost of new energy for gas peaker calculation ($120/kW-year avoided cost of peak capacity * 5kW of battery capacity).

## Challenge: Demand Response Rules Limit Behind-the-Meter Batteries

Historically, utility programs and wholesale market products for behind-the-meter distributed energy resources have largely been limited to legacy demand response programs that were designed to only encourage on-site load reduction. Compensation within these programs has thus been confined only to the amount of load that can be reduced onsite, and any excess energy exported to the grid goes unrecognized and uncompensated. The possibility that a BTM resource can provide additional value by exporting energy beyond the customer meter is not recognized. Since BTM battery capacities are most often significantly larger than a customer's instantaneous load, this historical paradigm severely limits the benefits that BTM batteries can provide to the grid.

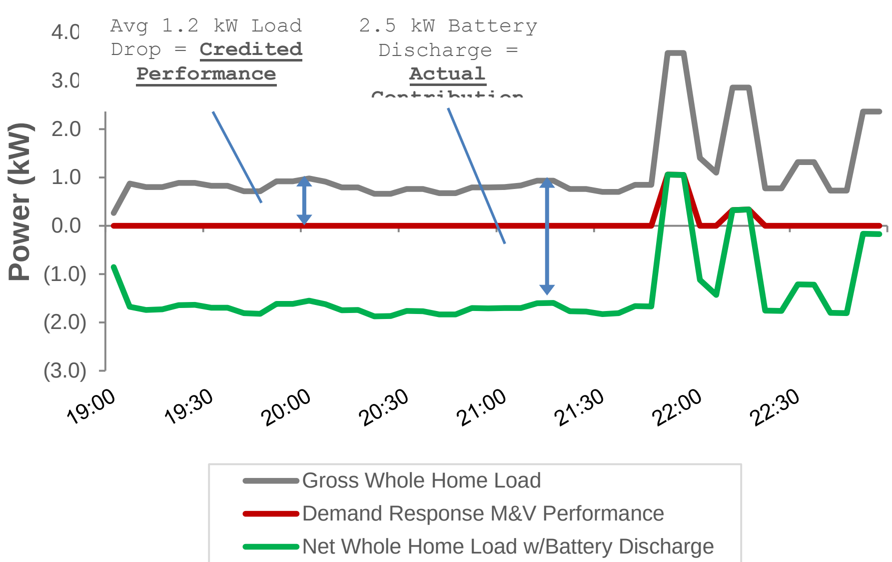
### Residential Battery Example

To illustrate the limitations of the net export constraint, consider a single residential home with a 5 kilowatt (kW) / 10 kilowatt hour (kWh) battery. While the battery may have been purchased by the customer primarily to help reduce their energy bills under time-of-use rates, or to provide back-up power in the event of a grid outage, the battery has the additional capability to provide dynamic and flexible dispatch of energy in times of grid need. For example, the battery could discharge during the distribution system's peak and the broader system's peaks (often occurring in early evening), while charging during times of low system demand (e.g. in the middle of the night). If the battery were to discharge at peak demand times, it would reduce the need for both distribution and system capacity.

However, while the battery is capable of providing up to its nameplate capacity of 5 kW for two hours during the system peak, most residential homes have significantly lower instantaneous demand during these times. In this illustrative example, consider a home with load on average of 1 kW, which is typical of an average U.S. residential demand. Under the existing demand response paradigm, the battery would be compensated only for discharging 1 kW of energy during this peak, or the equivalent of the amount of customer demand that is dropped to zero during that period. However, with a 5 kW nameplate capacity, the battery would be able to provide an additional 4 kW of capacity to the grid if administratively allowed. Thus, due to the net export constraint, 80% of the potential value of the battery is left stranded during these times of high grid need.

The chart below depicts this discrepancy between potential battery performance and administratively credited performance, showing an illustrative residential customer's gross load (~1.2 kW), battery dispatch (2.5 kW), net load (0 kW), and resulting recognized performance under demand response rules (~1.2 kW) during a battery dispatch event.

*Sample Residential Load and Discharge Profile*




The challenge of the net export constraint is magnified when examining a portfolio of thousands of aggregated BTM batteries deployed across the grid. Today, nearly 80% of the value of those deployed batteries sits unutilized due to rules that were meant for a previous generation of customer technologies. If these underutilized batteries could be tapped to provide flexible and dynamic capacity to utilities and grid operators, many hundreds of megawatts of latent resources could be leveraged to improve grid operations, reduce costs, and drive ratepayer savings.

## Potential Concerns from Eliminating the Net Export Constraint

While few would argue about fully utilizing and fairly compensating grid assets such as behind-the-meter batteries, reasonable concerns regarding eliminating the net export constraint may exist. Commonly raised concerns regarding elimination of the net export constraint are listed below, along with potential approaches to address each concern:

*BTM batteries under Net Energy Metering tariffs would be over-compensated by utility programs and wholesale markets*

A common concern voiced in regards to eliminating the net export constraint is whether BTM batteries located at customer sites under net energy metering (NEM) tariffs would receive 'double compensation' for exported energy: once from utility programs and/or wholesale markets, and a second time from payment under the NEM tariff. For starters, unfair or over-compensation is not the aim of removal of the net export constraint, and ensuring fair compensation for BTM batteries is critical. In practice, however, incremental compensation for BTM batteries under NEM for participation in utility programs and wholesale products does not over-compensate for delivered performance.

Behind-the-meter batteries co-located with solar PV systems under NEM tariffs indeed are compensated for energy exported beyond the customer meter. However, these customers must also pay retail enery prices when their BTM batteries charge from the grid (or, when charging directly from onsite solar, surrender the retail value that the solar generation would have received had it exported or offset consumption). Furthermore, batteries lose a percentage of energy to efficiency losses when charging and discharging. Taken together, batteries paired with onsite solar under flat NEM tariffs actually lose customers money when the charge and discharge.

Furthermore, NEM tariffs compensate customers at fixed retail rates that represent average energy costs over multiple years. During times of high grid need – such as daily peaks, summer peaks, reliability events, and other discrete grid events – the value of batteries providing dynamic capacity is significantly higher than these average retail rates. Therefore, compensation for exports under NEM (even ignoring the cost of charging a battery under NEM and efficiency losses) significantly undervalues battery contributions during these periods of high need. While the introduction of time-of-use NEM rates can increase compensation for exported energy, these rates still reflect system average energy costs and would under-compensate batteries that provide dynamic capacity during times of high grid need.

In short, when it exists, NEM compensation does not fairly compensate batteries for their contribution to grid events. Additional compensation is therefore prudent to fairly value the contribution of BTM batteries during these periods.

*BTM batteries fully discharging could negatively impact the distribution system*

Safe and reliable operation of the grid is of utmost importance to grid operators and customers alike. Some concerns exist related to whether the dispatch of BTM batteries, especially in response to system-level dispatch requests, could negatively impact the local distribution system. These are valid concerns, yet are mitigated by existing grid planning and operational requirements and readily managed at higher battery penetrations in the future.

All exporting BTM batteries undergo an interconnection review by the utility or grid operator. During this review, the utility evaluates the impact of the battery on the distribution system during worst case conditions. Therefore, batteries that gain interconnection have already received approval to dispatch their capacity at any time. As grid operations become more complex, evaluating that complexity during interconnection reviews is prudent. Indeed, many regulators are requiring more nuanced interconnection reviews that use advanced methodologies like integrated capacity analyses.

There are of course real-life scenarios that could occur which were not modeled by the utility during interconnection reviews, such as grid outages and abnormal configurations of grid equipment. In these circumstances, new coordination methodologies to ensure visibility across the distribution and transmission systems (sometimes referred to as 'T&D Coordination') are being developed to mitigate operational concerns. Although these frameworks are still being developed, BTM batteries are already allowed to fully dispatch during any of these abnormal conditions as a result of their interconnection approval. Limiting fair compensation for battery contribution to grid events therefore offers no benefit to grid operations or T&D coordination. Going forward, as BTM battery penetrations increase, coordination methodologies will surely mature and help provide necessary visibility while also further unlocking the value of batteries.

## Recommended Next Steps

To unlock the unutilized capacity of existing and future behind-the-meter batteries, utility program and market rules need to change to assess performance of behind-the-meter assets on the basis actual contribution of those assets, rather than just the amount of local host load drop delivered. While the details of unlocking the full stack of benefits of BTM batteries will vary from state to state and across ISOs/RTOs, the following recommended next steps begin to resolve the net export constraint:

1. Re-evaluate traditional utility program and market product rules that are based on historical demand response rules. *Eliminate the net export constraint* from utility programs and market product rules so as to fairly value the full contribution of behind-the-meter batteries during periods of high grid need.

2. *Evaluate compensation methodologies* to ensure that behind-the-meter batteries co-located with solar PV on net energy metering tariffs do not receive unfair compensation.

3. *Evaluate the need for improved interconnection and transmission and distribution coordination processes* to mitigate against the risk of negative impacts on grid operations.