SUMMARY FACTSHEET

BEHIND-THE-METER BATTERIES (BTM)

EMERGING TECHNOLOGIES FOR THE RENEWABLE ENERGY SECTOR

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CONTENT

SUMMERY

1. What are Behind the Meter (BTM) batteries?

Behind the Meter (BTM) batteries are installed behind the utility meter of commercial, industrial, or residential consumers, with the primary goal of reducing electricity bills (ESA,2018). They are often beyond the distribution system operator's direct control; nevertheless, there are numerous schemes where consumers are compensated for allowing the distribution system operator to withdraw electricity from the battery as needed. These applications have been dominated by lead-acid and lithium-ion battery technologies, whose costs have been driven down by the deployment of BTM batteries in residential and commercial PV systems, resulting in cost savings on electricity bills (where time-of-use tariffs are in place).

BTM is also called small-scale stationary batteries. A BTM battery can range from 3 kilowatts (kW) to 5 megawatts (MW). Residential consumer batteries can typically exceed 5 kW to 13.5 kilowatt-hours (kWh), whereas commercial or industrial system batteries are often 2 MW to 4 megawatt-hours (MWh).

3. Applications of BTM in the Energy Sector

1. Applications on the Electricity Consumers' Side

Increased self-consumption

The extra electricity generated can be stored in BTM batteries and used for local consumption, maximizing the local use of such variable generation while minimizing exports to the grid could help the distribution system operator.

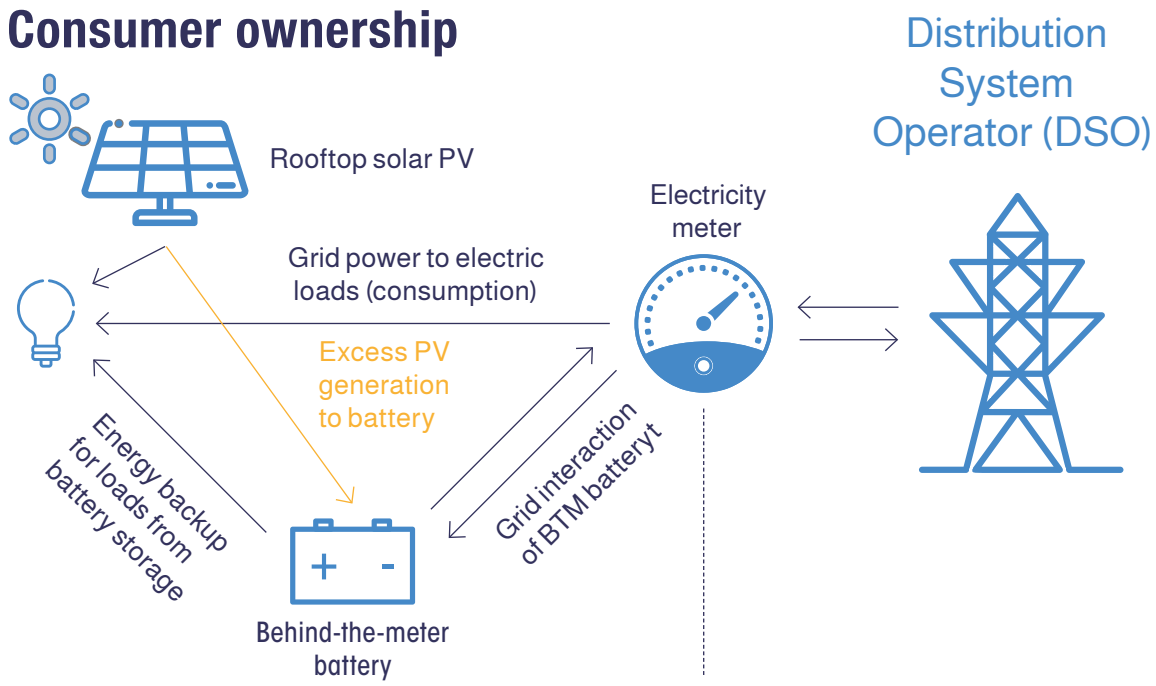

Figure 1:Grid-connected BTM energy storage configuration (IRENA,2019)

2. The Role of BMT in the power sector

BTM facilitates the integration of local renewable energy generation by increasing self-consumption and profitability. It can also provide voltage and frequency support, as well as other services, to system operators, allowing for greater VRE integration in the grid.

Back-up power

BTM batteries can provide backup power in the event of a grid outage on various scales, from sub-second-level power delivery for critical industrial activities to 24-hour back-up by pairing with an on-site solar PV system.

Savings on the electricity bill

Increased self-consumption through rooftop solar PV paired with BTM battery systems can result in significant savings on electricity bills. When time-of-use tariffs are adopted, BTM battery storage systems enable consumers to save money on power by charging the batteries during off-peak hours when tariffs are cheaper and discharging them during peak time intervals when tariffs are higher.

Demand charge reduction

Demand charges are typically determined based on the consumer's maximum electricity usage need (kW) over a given period. Demand charges can be high for commercial and industrial consumers, particularly during peak demand periods. With on-site battery storage systems, peak load management and demand charge reduction can be accomplished.

2. Applications on the system operators' side

Frequency Regulation

BTM storage systems can provide frequency support to the grid by rapidly ramping up or down their power output, which helps smooth the production of VRE generation. One prerequisite for these services is BTM storage's ability to engage in the ancillary service market, typically through a third party.

Deferred network investment

Operators of distribution and transmission systems invest in system upgrades to meet expected demand growth, typically to fulfill peak demand, which occurs for a limited number of hours throughout the year. BTM can assist consumers in shifting their consumption in order to minimize the system's peak demand, hence reducing the need for grid reinforcements.

Deferral of peak capacity investment

System operators require peak capacity resources to fulfill peak demand in the power system. However, the utilization level of such peak capacity is relatively low, resulting in a high power cost to customers. BTM storage systems can assist delay investments in these expensive peak capacity resources in two ways. First, they can minimize peak demand by supplying stored energy to consumers at peak hours. Second, BTM can participate in capacity markets through a third party and compete for capacity with other players and lower prices.

3. Applications for mini-grids

In renewable energy-based mini-grids, BTM storage devices can replace diesel generators. They can be used to provide backup power when renewable energy is unavailable, as well as to support the fluctuation of renewables. BTM batteries can smooth fluctuating generation and change the generation curve of small solar PV and wind systems connected at the consumer end to satisfy peak demand.

4. Challenges and Enabling Factors

Capital Cost

A further reduction in the initial costs of BTM batteries would be a critical facilitator for the growth of this market at this stage. The expansion of this market depends on the price structures and incentives provided to BTM customers and the initiative of local retailers and system operators.

Enabling regulatory framework

A regulatory framework in the retail market that tries to maximize advantages for consumers while incentivizing demand-side flexibility is a crucial enabler for BTM batteries. Time-of-use rates allow consumers to alter their electricity consumption to lower their bills.

Net billing schemes may also be advantageous, particularly when batteries are combined with generation technologies. The kWh value consumed or injected into the grid is used to calculate net billing compensation. It incentivizes customers to provide stored energy to the grid when reimbursement is high and store generated electricity during low-demand intervals.

Reducing soft costs

Interconnection, permitting, and development expenses are examples of "soft costs," which can account for a sizable portion of the installed cost of BTM storage systems, particularly when the industry has not yet reached the tipping point. Regulators should think about shortening the procedure time for Interconnection and authorization.

5. Projects and Services

• Sonnen Community in Germany

The sonnenCommunity is a German aggregator of roughly 10,000 customers who have battery storage, solar PV generation, or both. The sonnenCommunity, which debuted in 2015, was primarily used for peer-to-peer trade within the virtual power plant. The virtual power plant was made available to the electrical grid in 2017 to enable frequency regulation. In comparison to other options, such as pumped hydropower storage, this distributed "virtual" storage resource can respond very quickly (sub-second), making it an excellent provider of primary frequency services (sonnenCommunity, 2018).

• Stem in the United States

Stem, a US energy services business, assists commercial and industrial customers to lower their energy bills by utilizing energy stored in their batteries during high-demand periods.

To determine the ideal moment to draw energy from the battery storage, the company integrates the battery storage with a cloud-based analytics system (Colthorpe, 2017). It also employs a fleet of deployed customer-sited storage systems to provide grid services to system operators.

References

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