FLUENCE
A Siemens and AES Company

Dispatchable Energy Guarantee

Battery asset owners need a clear view of their system's energy to make confident trading decisions — but technical limitations make accuracy a challenge. Here's how Fluence is leading on tackling this problem with our Dispatchable Energy Guarantee.

The Problem

When it comes to battery energy storage systems (BESS), asset owners are missing an accurate view of how much energy is available for them to use and trade. At Fluence, we call this the dispatchable energy—in other words, the amount of energy your system can discharge at full power into the market.

Without a clear view of dispatchable energy, owners risk penalties, lost revenue, or energy left unused. Limitations inherent to the physics and chemistry of batteries make it surprisingly easy to build up inaccuracies around dispatchable energy. This is especially true for lithium-iron-phosphate (LFP) chemistries. Depending on the use case, the uncertainty can be greater than 20%, compounding the effects of:

1 INACCURATE STATE OF CHARGE (SOC)

LFP batteries have flat open-circuit voltage (OCV) curves, which are used to estimate SOC from voltage measurements. As a result, even small voltage inaccuracies can lead to large uncertainties in SOC. In addition, SOC estimates are influenced by hysteresis effects and environmental factors.

2 UNCERTAINTY IN STATE OF BALANCE (SOB)

Cell imbalances can make a significant portion of a battery's energy inaccessible. Yet, current battery systems typically fail to monitor and report real-time SOB, leaving operators in the dark on whether they are overestimating charge and discharge capacity.

3 IMPRECISION IN OTHER MEASUREMENTS

Availability and state of health (SOH) determine the maximum capacity of the battery system, yet measurements are not always real-time, adding error to dispatchable energy estimates.

KEY TERMS

State of charge (SOC)
Battery energy currently stored

State of balance (SOB)
Differences in voltage across cells in the same group

State of health (SOH)
Remaining energy capacity as battery degrades

As a result, asset operators are forced to use inexact data about current dispatchable energy when making a commitment for the day-ahead or spot markets. Because the current dispatchable energy often differs from the system's telemetry, operators report that power and performance are unreliable toward the top and bottom of the SOC range.

Then, owners may face penalties or—if consistently underdelivering—even a derating of asset capacity by the grid operator. Since the most valuable hours usually align when assets push to the top and bottom of their range, a mistake at this time can cost a significant proportion of their annual revenue.

Operators often attempt to mitigate these risks by imposing buffers at the top and bottom of their SOC range, regularly withholding 10–25% of MWhs of energy capacity. This reduces the revenue they make from the market. In addition, these eyeballed buffers can be incorrect and do not fully remove the risk of penalties, as the accuracy of dispatchable energy is variable. Without Fluence's systems to keep inaccuracy at bay, customers rely on time-intensive and disruptive manual recalibrations.

10–25% Buffers

Operators withhold up to 25% of energy due to uncertainty.

Lost Revenue

Imprecise dispatch leads to missed opportunities in peak hours.

Manual Recalibrations

Operators rely on time-intensive, disruptive processes.

The Solution

To minimize uncertainty and halve the average buffer seen in the industry, Fluence has invested in our Smartstack battery energy storage system's technological innovations that address all three main causes of imprecise dispatchable energy.

First, high-accuracy BMS sensors and algorithms allow Smartstack to get more accurate voltage measurements and SOC estimates, tackling a fundamental measurement challenge of LFP systems.

Then, Fluence's AI-powered models are deployed to constantly monitor state of charge drift, imbalance, and state of health at a granular level. This information then feeds smart controls within the Fluence OS, which guide automated passive rebalancing and recalibration. To the maximum extent possible, these operations occur during natural usage to minimize disruptions. Additionally, predictive maintenance tools give foresight on availability. Together, these tools prevent stranded energy from accumulating and help Fluence calculate more precise dispatchable energy in real-time.

These technical innovations allow Fluence to be the first to financially back the accuracy of our systems via the Dispatchable Energy Guarantee. This means operators can bid more with confidence, as any penalties they face impact Fluence too.

The Value Added

Ultimately, the Dispatchable Energy Guarantee aims to increase the asset owner's revenue while reducing the risk of penalties and the time spent optimizing operations. To estimate its impact on an asset's internal rate of return (IRR), it is important to model how dispatchable energy uncertainty—and the buffers used to manage it—affects the asset's annual energy throughput. Fluence calculates that the Dispatchable Energy Guarantee leads to an average 7% increase in throughput per asset. This results in significant IRR improvements, as shown in the table.

These calculations do not include the potential cost of penalties incurred from inaccurate, manual estimation and management of dispatchable energy. They also exclude the labor costs associated with monitoring and maintaining system optimization without the tools enabled by the Dispatchable Energy Guarantee.

MARKET	DURATION	CALCULATED IRR IMPROVEMENT
CAISO	4 hour	40 bps
ERCOT	2 hour	123 bps

The Guarantee

Fluence financially guarantees dispatchable energy within an accuracy of ±4%, exclusively available for Smartstack™ through a Smart Service Plan. This accuracy includes all the compounding errors of SOC, SOB, and other measurements stated above.

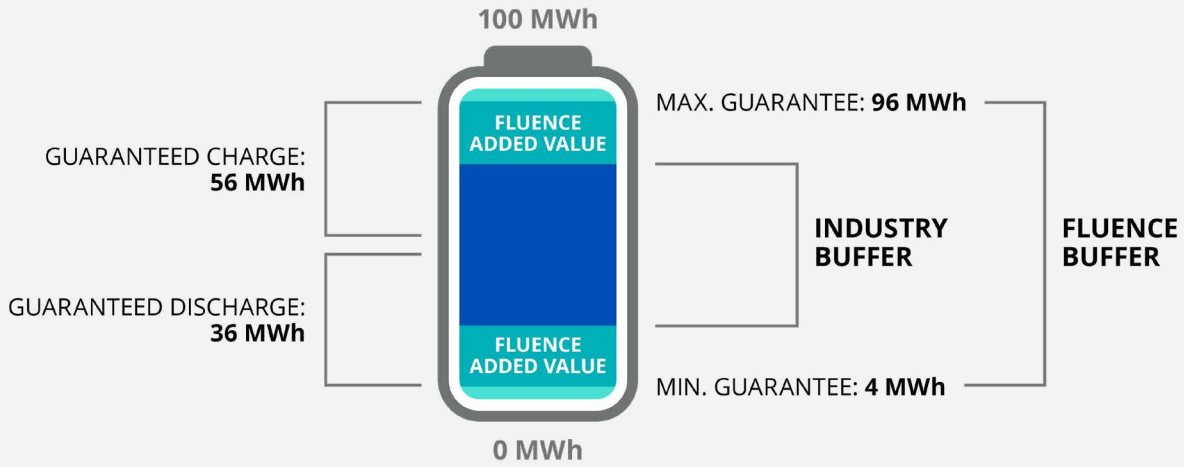
Thus, the guarantee ensures energy can be charged or discharged at full power within the available energy capacity, minus 4% at the top and bottom of the SOC range, as uncertainty only results in an inability to deliver at the extremes.

For any event where the asset's bids fall within this range, Fluence will pay liquidated damages (LDs) if the asset fails to deliver due to system inaccuracy.

For example, if an asset's current available capacity is 100MWh, Fluence would guarantee any charge or discharge event that brings the asset's dispatchable energy up to 96MWh or down to 4MWh. So, if its dispatchable energy is now 40 MWh, the asset bids to discharge 36MWh but can only deliver 35MWh, then Fluence would pay LDs for the 1MWh short.

The asset's operations are not constrained within the Dispatchable Energy Guarantee, so in this example it could choose to bid to discharge more, say 38MWh. However, if the asset falls short to 35MWh, then Fluence would still only pay LDs for the 1MWh short between what is delivered and the maximum guaranteed discharge of 36MWh.

Guaranteeing Dispatchable Energy Accuracy



1. Inversely, the maximum available energy capacity of your system minus the dispatchable energy would be what you could charge.
2. Data collected by Fluence shows a SOC buffer range from 10-25% of MWhs, with the industry average around 15%. Meanwhile, Fluence guarantees dispatchable energy accuracy down to 8% SOC buffer. The difference between the estimated industry buffer and Fluence guarantee results in a 7% increase in energy throughput. Based on back cast analysis for CAISO undertaken by Fluence Mosaic, the increase in energy throughput results in a near linear increase in merchant revenues attributable to energy and ancillary services, and as such the DEG is represented in the IRR analysis by an increase in merchant revenues (energy and ancillary services) linear to an increase in energy throughput.
3. Available energy capacity is not the assets nameplate capacity but rather the real-time value, which accounts for the impact of unavailability or imbalance.