

# Maximizing Energy Storage Value by AI-driven Optimization

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## Background

For the United States to reach its goal of 100% carbon pollution-free electricity by 2035, the nation will need to rely on energy storage solutions to fill the gap between renewable energy generation and peak power demand times. Energy storage is expensive and technically complicated due to rapidly evolving market needs, varying geographic and utility operational requirements, and uncertain market conditions and financial returns. Yet, it is absolutely essential at a massive scale to solve the long list of energy-related problems caused by increasing renewable energy penetration and an aging grid infrastructure. With the battery energy storage market growing at a compound annual growth rate (CAGR) of 16.3%<sup>1</sup> in the United States, new innovations in energy storage technologies will be absolutely critical in increasing the rate of energy storage adoption and application possibilities.

## Methods

WATTMORE is building innovative software solutions to manage the intermittent nature of renewable energy by applying energy storage in a reliable, cost-effective manner. WATTMORE is delivering groundbreaking and transformative AI-powered technology to accelerate impact by seamlessly integrating and managing distributed energy resources to improve storage system projections and system performance while saving money. As shown in Figure 1, WATTMORE’s Intellect™ Energy Management System (EMS) combines edge and cloud-based computing to implement a robust, secure cyclical process of forecasting, optimization, and control. Intellect EMS™ is layered on top of robust, industry-leading real-time controls and protections as a full stack EMS solution, as shown in Figure 2. It is implemented at the grid edge for flexible, local, resilient operation while also securely connected to cloud computing for non-critical functions such as machine-learning pipelines and remote monitoring.

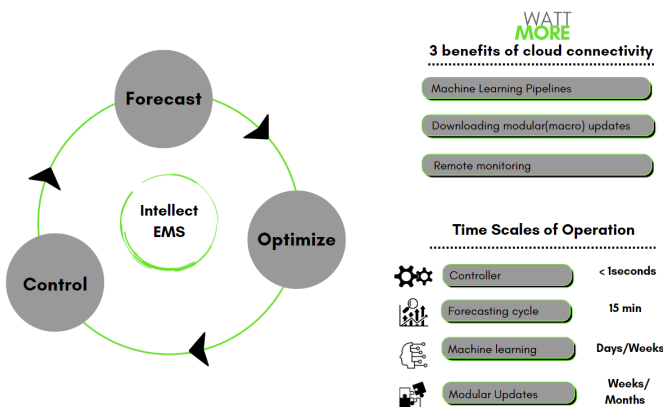


Figure 1: Intellect EMS™ employs an AI-driven process of forecasting, optimization, and control.

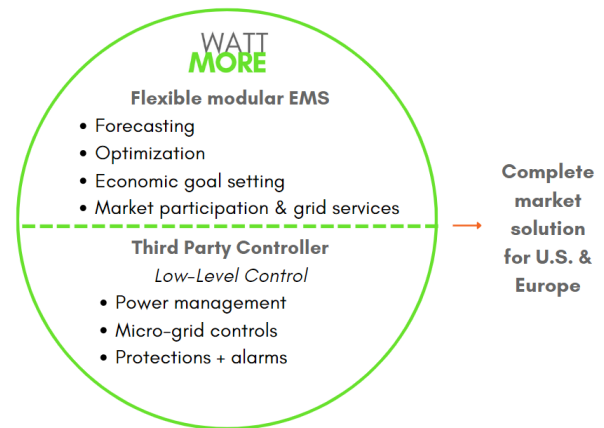


Figure 2: Layering of flexible, modular EMS and low-level controls as a full-stack EMS solution.

The optimization engine “value stacks” multiple use cases including peak shaving, energy arbitrage, back-up power, and grid services to maximize the overall revenue generated by the energy storage asset. Providing grid services (frequency regulation, capacity, etc.) unlocks lucrative revenue streams.

<sup>1</sup> “Battery Energy Storage Market Size, Share & COVID-19 Impact Analysis, By Type... – Fortune Business Insights, 2022-2029”.

However, as shown in Figure 3, the value streams are generally not directly additive on the basis of energy capacity. Through AI-driven optimization, Intellect EMS™ leverages the synergies among various use cases to improve the stacking and improve the profitability of the asset.

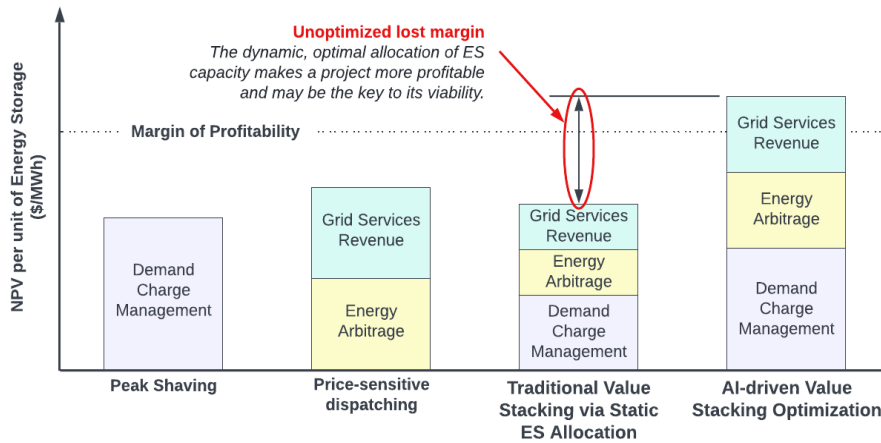


Figure 3: Optimal stacking of value streams for maximal profitability.

## Results

Tests of Intellect EMS™, shown in Figure 4, showed that the system successfully reduced peak demand to meet the competing objectives of maximizing cost savings and improving grid stability. During peak hours (gray area), the battery discharged (shaded pink) to reduce the demand on the grid. Then, as demand waned and the price of energy lowered, the battery began to recharge. Furthermore, the EMS forecasted the upcoming demand to optimally schedule the next charge and discharge cycles.

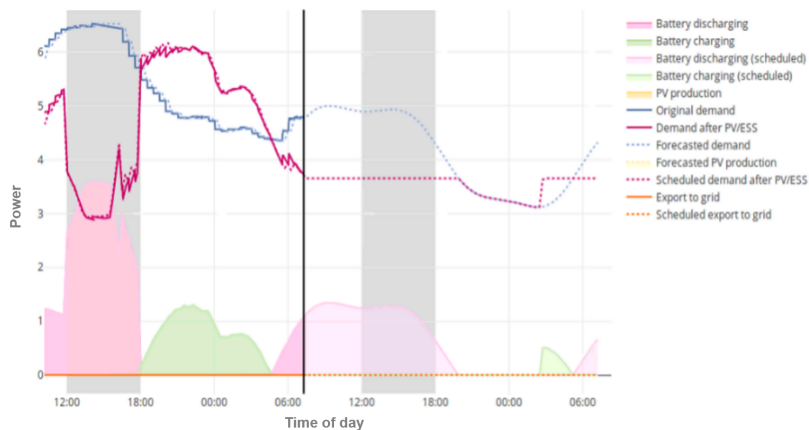


Figure 4: Results showing peak demand reduction and energy arbitrage.

## Conclusions

Battery energy storage is extremely versatile and has been noted to provide up to 13 distinct services.<sup>2</sup> However, the batteries remain a very costly asset and many projects require a multi-use energy storage asset to be profitable. Additionally, it is technically and economically challenging to fully capitalize on the numerous value streams given numerous stakeholders, wide range of timescales, and uncertainties in loads, variable renewable generation, and the market. With its Intellect EMS™, WATTMORE is providing an AI-driven solution that leverages edge and cloud-based computing in a robust, secure manner.

<sup>2</sup> G. Fitzgerald et al., "The Economics of Battery Energy Storage," Rocky Mountain Institute, October 2015.



## **Brief biography of the speaker**

J.W. Postal founded WATTMORE (formerly Nikola Power) in 2017, setting the startup to emerge as a leader in innovation solutions for the energy storage software industry with a recent successful Series A round in 2022. He was the co-founder of Main Street Power, a pioneer in the distributed generation power purchase agreement space and an innovator in clean energy finance. While at Main Street Power, J.W. spearheaded the first combined New Market and Investment Tax Credit portfolio in the country. He has worked on trailblazing legislation for distributed solar, community solar, and renewable energy finance and has traveled the country developing solar projects in AZ, CA, CO, MA, MN, NJ, NM, SC, and TX.