

# Energy Storage: The Next Step to Drive Renewable Energy Penetration to 100 Percent

# Executive Summary

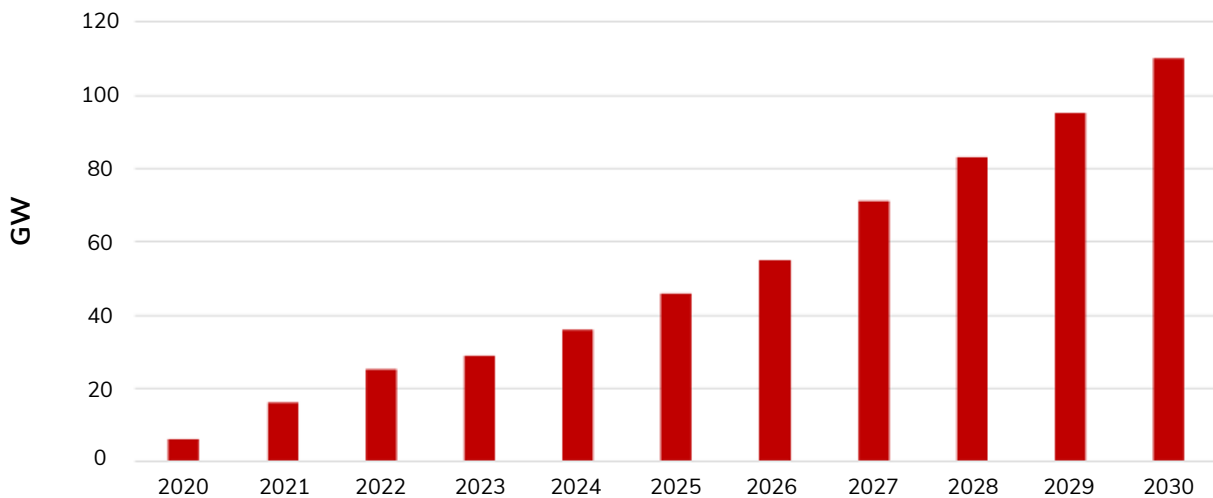
Battery Energy Storage Systems (BESS) are a crucial part of transitioning from fossil fuels to renewable energy, with the primary goal of reducing CO2 emissions. This white paper highlights how BESS solutions optimise renewable energy integration, reduce waste, ensure a reliable power supply, and reduce reliance on the grid. Solutions for environmentally-friendly energy storage are already in place, such as Lithium Iron Phosphate (LFP) batteries, which are known for their enhanced safety, longer lifespans, and lower environmental footprint. Emerging technologies like Sodium batteries hold promise for even greater energy storage efficiency, sustainability, and cost-effectiveness. This multi-pronged approach underlines the dedication to advancing clean and responsible energy solutions.

Furthermore, the integration of BESS with Energy as a Service (EaaS) offers consumers greater customisation, efficiency, and cost-effectiveness when choosing an energy solution. Selecting reliable service providers like BECIS, who can assess load consumption, design equipment, and provide real-time monitoring and reporting, ensures optimal performance and long-term efficiency.

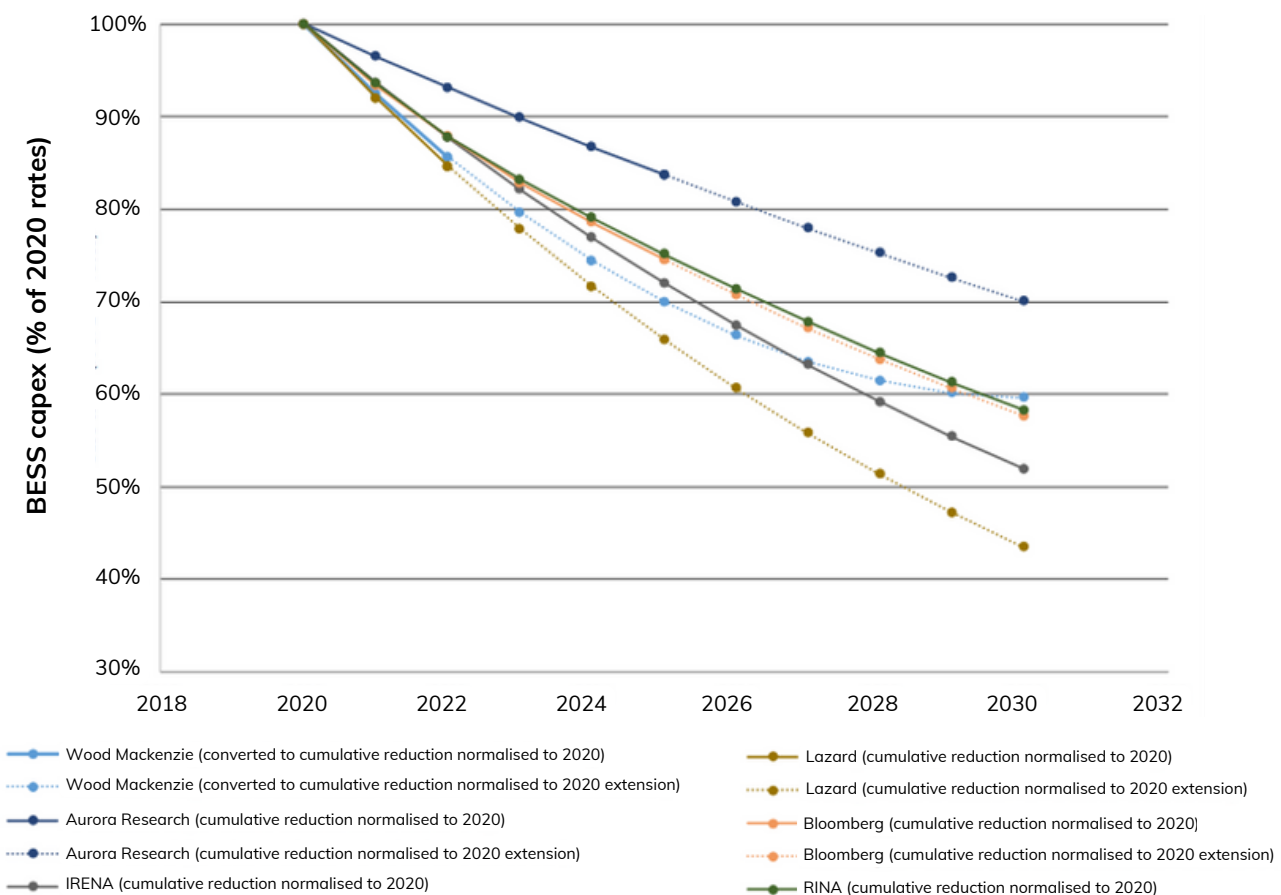
# Introduction

Battery energy storage is not only a contributor to a stable energy supply; these systems are also instrumental in lowering costs and meeting the growing demand for sustainable energy solutions. We will explore how BESS is a critical component of renewable energy integration, as well as a key driver of cost reduction trends and a response to the growing global demand for clean, reliable energy.

**Market Demand for BESS**



**BESS CAPEX**



# The Role of BESS in Renewable Energy Integration

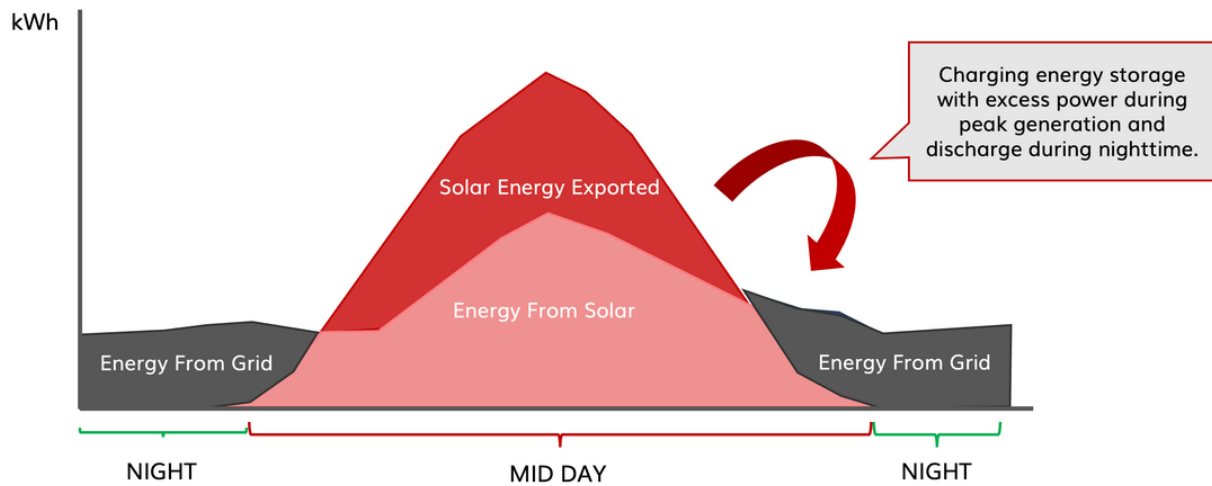
Renewable energy sources, such as solar, wind, and hydropower, have emerged as sustainable solutions to reduce our reliance on fossil fuels and combat the adverse effects of climate change. However, the intermittent and variable nature of these renewable sources presents a unique challenge: how to efficiently capture, store, and distribute this energy to ensure a constant and reliable power supply. This is where Battery Energy Storage Systems come into play as indispensable enablers of the clean energy transition.

## 1.

### Balancing Energy Production & Integration

BESS plays a pivotal role in optimizing the use of renewable energy sources, especially in the context of solar photovoltaic (PV) systems. Solar PV systems generate electricity during daylight hours, but their energy production is intermittent and dependent on weather conditions and time of day. Excess solar energy generated during sunny periods often goes to waste if not used immediately.

BESS addresses this intermittency challenge by capturing surplus energy generated when sunlight is abundant and storing it in batteries for later use. This stored energy is then released during times of high energy demand or when solar energy production is reduced, for example during the night or on cloudy days. This symbiotic relationship between BESS and solar PV systems ensures a consistent and reliable energy supply, effectively reducing reliance on the grid and lowering electricity bills. Moreover, it maximizes the utilization of solar energy, minimizing waste and enhancing overall energy self-sufficiency. This integration exemplifies the synergy between renewable energy and advanced energy storage technologies, ultimately advancing the clean energy transition.



## 2.

### Grid Support

BESS can provide grid support by rapidly responding to fluctuations in energy demand, enhancing grid stability, and reducing the need for standby generators, making the grid more resilient and efficient. Batteries connected to solar systems can also provide grid support by regulating frequency and voltage, responding quickly to grid demand. These grid support services bolster overall grid stability.

## 3.

### Off-Grid Support

In off-grid systems, Battery Energy Storage Systems have a vital role in increasing the use of renewable energy while reducing reliance on backup generators. Off-grid setups often depend on generators, which are expensive and environmentally harmful. BESS allows for storing excess renewable energy from sources like solar and wind, ensuring a stable power supply. By doing so, it cuts down on the need for generators, curbing emissions and lowering operational costs, all while fostering a more sustainable energy mix. This shift aligns with global efforts to reduce the carbon footprint and transition to cleaner, greener energy solutions.

## 4.

### Backup Energy

The combination of solar panels and battery storage provides energy resilience. In the event of power outages or disruptions in the grid, a solar system with batteries can continue to operate, enhancing system reliability and safety. This also minimises disruptions in production and potential losses, for example from food spoilage.

## 5.

### Increased Sustainability

Battery energy storage indirectly reduce CO2 emissions by enabling a greater use of renewable energy sources. BESS stores excess renewable energy, preventing it from going to waste at times of low demand and ensuring a stable supply during intermittent periods. This reduces the need for fossil fuel backup, leading to a higher share of clean energy in the mix and a significant decrease in CO2 emissions. BESS supports a more environmentally friendly energy system.

## 6.

### Economic Benefits

BESS offers substantial cost savings in regions where electricity generation heavily depends on fossil fuels. On many islands and remote locations, electricity is traditionally generated using costly and environmentally detrimental fossil fuels, such as diesel.

BESS introduces a more cost-effective and sustainable alternative. By storing excess energy during periods of renewable generation and using it during peak demand, BESS reduces the need for continuous reliance on fossil fuel-based power generation. This transition lowers the operational costs associated with fuel procurement, transportation, and maintenance of generators.



# Case Study

## Ennovie — A Sustainable Approach to Jewelry Manufacturing with BESS

Ennovie, a leading jewelry manufacturer, places sustainability at the core of its operations. Recognizing the need for responsible innovation, Ennovie established the world's first 100 percent renewable jewelry manufacturing hub in Thailand. The goal was not just energy cost savings but a clean and sustainable solution that aligns with the company's sustainability objectives.

In partnership with BECIS, Ennovie implemented a hybrid solar solution that included rooftop solar panels and energy storage batteries. This approach ensures a consistent and clean energy supply for Ennovie's manufacturing needs. One of the key benefits of this setup is its ability to save excess energy during the day when solar production is high and use it to reduce the load during other times. Excess electricity generated is stored in batteries, preventing waste and ensuring a reliable power supply.

Despite facing technical challenges and regulatory considerations, the project has been a success. Today, Ennovie fulfills a significant portion of its energy needs through on-site renewable generation. This commitment to renewable energy has not only contributed to sustainability but also delivered tangible business benefits, including significant growth.

Ennovie continues to push for sustainability, introducing practices like blockchain-based tracking of raw materials to end products for responsible sourcing. With the support of BECIS, the company looks forward to an even greener and more sustainable future.

# Off-Grid Power Transformation with Solar and BESS

In Indonesia, a large-scale coconut milk production factory currently uses off-grid electricity generated by a turbine that runs on coal, along with a generator system for emergency power. By integrating a solar system and Battery Energy Storage System, they can increase their electrical system's reliability and reduce pollution levels. This project can unlock several benefits.

## 1.

### Technical Benefits



#### **Enhanced Reliability:**

The addition of a solar system and BESS can provide a stable source of electricity, reducing dependence on coal turbines and diesel generators. This means fewer power outages and improved energy security.



#### **Balanced Load:**

The BESS can store excess energy generated by the solar system during the day and release it during high-demand periods or when solar production is low, effectively balancing the load and optimizing energy supply.





## 2.

### Cost Benefits



#### Operational Savings:

By reducing the consumption of coal and diesel fuel, the project can achieve significant operational cost savings. The maintenance and fuel costs associated with coal turbines and diesel generators can be minimised.



#### Long-Term Cost Efficiency:

Solar panels and BESS have a longer operational lifespan compared to traditional power generation equipment. This translates into long-term cost efficiency, with reduced replacement and maintenance expenses.

## 3.

### Environmental Benefits



#### Emissions Reduction:

Introducing solar and BESS to the energy system significantly reduces the reliance on coal, a carbon-intensive energy source. This transition leads to a substantial decrease in CO2 emissions, contributing to a cleaner environment and aligning with global efforts to combat climate change.



#### Improved Air Quality:

The reduced reliance on coal and diesel generators leads to improved air quality in the region, benefiting the health and well-being of the local population.



#### Preservation of Local Ecosystems:

Decreased emissions and reduced environmental impact mean a smaller ecological footprint, preserving local ecosystems and biodiversity.

# Energy as a Service (EaaS) with BESS

The Energy as a Service (EaaS) model represents a dynamic approach to energy provision, where end users access energy services tailored to their needs. This model integrates seamlessly with BESS to offer customers greater control, flexibility, and sustainability in their energy consumption.

EaaS transforms energy into a customizable service, offering consumers a range of energy solutions. EaaS providers leverage advanced technologies to optimize energy management, reduce waste, and enhance efficiency. Consumers can monitor real-time energy usage, select preferred energy sources, and participate in demand response programs.

## Benefits of BESS and EaaS Contracts



### Capital Barrier Mitigation:

EaaS contracts alleviate the need for upfront investment, making BESS adoption financially viable for industries with limited capital budgets.



### Risk Transfer:

The service provider assumes operational risks and maintenance responsibilities, ensuring consistent system performance and reducing downtime.



### Predictable Costs:

Industries pay a fixed fee for the energy consumed, enabling accurate budgeting and eliminating the volatility of fossil fuel prices.



### Energy Efficiency:

BESS, coupled with EaaS, provide industries with energy-efficient renewable generation, leading to potential cost savings and reduced environmental impact.



### Scalability:

EaaS contracts offer the flexibility to scale the system as needed to meet changing industrial demands.

# Implementation Strategy

**1.****Service Provider Selection:**

Choosing a reputable service provider like BECIS with experience in renewables makes the maintenance and improvement of renewable energy systems smoother and easier.

**2.****Assessment:**

The service provider can analyze the load consumption and design the equipment setup needed to optimize performance based on business needs.

**3.****Monitoring and Reporting:**

Robust physical and digital tools allow real-time tracking, monitoring, and reporting to support efficiency and performance improvements over time.

## Conclusion

Battery Energy Storage Systems are at the forefront of transitioning from fossil fuels to renewables. They optimize integration, reduce waste, ensure reliability, and lessen grid dependence. Existing technologies like Lithium Iron Phosphate batteries, as well as emerging innovations, hold promise for environmentally friendly and efficient battery use.

The combination of BESS with Energy as a Service (EaaS) empowers sustainable industry growth. As the battery market grows, costs decrease and renewable energy integration expands. This synergy supports the shift to clean, reliable energy solutions, enabling progress toward global and corporate sustainability goals.

EaaS provides consumers with greater control over their transition to clean energy. By overcoming capital barriers, transferring risks, ensuring predictable costs, and enhancing energy efficiency, BESS and EaaS foster scalable, responsible energy consumption. Together, they offer a pathway to a cleaner, more sustainable future where renewables replace fossil fuels and CO2 emissions significantly decrease.