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# Financial Viability and Investment Potential of Battery Energy Storage System (BESS) Startups in India: An Analysis Based on Investor and Stakeholder Perception

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## Abstract

The rapid expansion of renewable energy has significantly increased global demand for efficient energy storage solutions. Battery Energy Storage Systems (BESS) are essential for addressing the intermittency of renewable sources such as solar and wind power. In India, rising renewable energy capacity and government initiatives supporting clean energy transitions have created new opportunities for startups in the energy storage sector. Nevertheless, concerns regarding financial viability, technological uncertainty, and regulatory frameworks continue to shape investment decisions within this emerging industry.

This study examines the financial viability and investment potential of BESS startups in India by analyzing the perceptions of investors and key stakeholders in the energy ecosystem. Using a structured questionnaire and secondary industry data, the research identifies key factors that influence investor confidence, including market demand, government policy support, cost trends in battery technology, and perceived investment risks.

The findings suggest that declining battery costs, supportive renewable energy policies, and increasing demand for grid stability solutions are key drivers encouraging investment in BESS startups. However, high capital requirements, long payback periods, and regulatory uncertainty remain major barriers to investment. The study provides insights for policymakers, investors, and entrepreneurs seeking to strengthen India's energy storage ecosystem and promote sustainable innovation in the clean energy sector.

## Index Terms

Battery Energy Storage Systems (BESS), Renewable Energy, Energy Storage Startups, Investment Potential, Financial Viability, Clean Energy Investment, India.

## Glossary

**Battery Energy Storage System (BESS)**

A technology that stores electrical energy in batteries for later use, enabling grid stability, renewable energy integration, and peak load management.

**Energy Storage**

The process of capturing energy produced at one time and storing it for use at a later time.

**Renewable Energy Integration**

The process of incorporating renewable energy sources such as solar and wind into the electricity grid.

**Venture Capital Investment**

Funding provided by investors to early-stage companies with high growth potential.

**Grid Stability**

The ability of an electricity grid to maintain a continuous and reliable supply of electricity.

## 1. Introduction

### 1.1 Background

The global transition toward sustainable energy systems has accelerated the deployment of renewable energy technologies such as solar and wind power. While these technologies offer significant environmental benefits, their intermittent nature creates operational challenges for electricity grids. Energy storage technologies, particularly Battery Energy Storage Systems (BESS), play a critical role in addressing these challenges by enabling the storage and controlled release of electricity when needed (Luo et al., 2015).

India has set ambitious renewable energy targets as part of its commitment to reducing carbon emissions and promoting clean energy development. According to the International Energy Agency (2023), India is expected to become one of the largest markets for renewable energy in the coming decades. As renewable energy capacity increases, the demand for efficient energy storage solutions is also expected to grow rapidly.

In this context, startups focusing on battery storage technologies, energy management systems, and grid optimization solutions are emerging as key players in the evolving energy ecosystem. These startups are attracting increasing attention from investors due to their potential to support renewable integration and energy transition.

However, the financial viability of BESS startups remains uncertain due to factors such as high capital costs, technology risks, and evolving regulatory frameworks.

### 1.2 Research Problem

Despite the growing interest in energy storage technologies, investors often face uncertainty regarding the long-term financial viability of BESS startups. The sector is capital intensive and requires significant investment in research, development, and infrastructure.

Additionally, policy frameworks, market structures, and technological developments continue to evolve, making investment decisions complex for investors and stakeholders.

### 1.3 Research Objectives

This study aims to:

1. Examine the financial viability of BESS startups in India.
2. Analyze investor and stakeholder perceptions regarding investment in BESS startups.
3. Identify key factors influencing investment decisions in the energy storage sector.
4. Evaluate the role of government policies and incentives in promoting energy storage investments.
5. Assess the future investment potential of BESS startups in India.

## 2. Literature Review

The rapid growth of renewable energy technologies has increased global interest in energy storage solutions capable of managing supply variability and improving grid stability. Battery Energy Storage Systems (BESS) have emerged as one of the most promising technologies for addressing the intermittency associated with renewable energy sources such as solar and wind power. Several studies have explored the technological, economic, and policy dimensions of energy storage systems and their role in modern power systems.

Luo et al. (2015) provide one of the most widely cited reviews of electrical energy storage technologies and highlight the importance of energy storage in balancing electricity supply and demand. Their study emphasizes that storage technologies such as lithium-ion batteries play a crucial role in enabling higher penetration of renewable energy sources within power systems.

Research by Schmidt et al. (2017) examines long-term cost trends in electrical energy storage technologies and demonstrates that battery costs have declined significantly over time due to technological innovation and economies of scale. The authors argue that continued reductions in battery costs will significantly improve the economic feasibility of large-scale energy storage deployment.

Several scholars have also examined the technical applications of BESS in power systems. Zhao et al. (2023) analyze grid-connected battery storage systems and find that BESS can provide critical grid services such as frequency regulation, voltage stabilization, and peak demand management. Their study highlights that effective integration of BESS into power systems can enhance grid flexibility and improve energy reliability.

Recent studies have focused on the increasing role of hybrid renewable-storage systems. A review published in the *Journal of Energy Storage* highlights the growing adoption of hybrid photovoltaic-battery systems and their potential to improve the efficiency and reliability of renewable energy systems. The study identifies several key research trends, including battery optimization, energy management systems, and the integration of storage technologies with distributed energy resources.

Similarly, Zhang et al. (2025) examine advancements in BESS technologies and emphasize that improvements in lithium-ion battery performance and cost reductions have accelerated the adoption of energy storage systems in residential, commercial, and industrial applications. Their research also highlights the importance of energy management systems and power conversion technologies in maximizing the efficiency of BESS deployments.

The role of BESS in renewable energy integration has also been widely discussed in recent literature. Alamsyah and Sothea (2024) analyze the performance of battery energy storage systems in renewable power integration and conclude that BESS significantly improves frequency stability, voltage control, and overall grid reliability. However, the study also notes that battery degradation and high investment costs remain key challenges for large-scale deployment.

From a techno-economic perspective, several researchers have examined the financial feasibility of energy storage systems. Polzin et al. (2019) argue that policy frameworks, government incentives, and regulatory stability are critical factors influencing private investment in clean energy technologies. Their findings suggest that supportive policy environments significantly increase investor confidence in emerging energy technologies such as BESS.

Other studies have explored operational optimization strategies for energy storage systems. Farakhor et al. (2023) propose scalable optimization models for large-scale battery energy storage systems that improve power management efficiency while reducing computational complexity. Their findings demonstrate that advanced control strategies can significantly enhance the performance and efficiency of BESS installations.

Economic optimization of battery systems has also been studied in the context of second-life batteries. Farakhor et al. (2024) examine the economic management of second-life battery energy storage systems and show that repurposed electric vehicle batteries can provide cost-effective energy storage solutions for grid applications when properly managed.

Monar et al. (2025) investigate the optimal sizing of photovoltaic and battery storage systems within community energy networks. Their research indicates that battery costs, electricity tariffs, and battery degradation characteristics are among the most influential factors affecting the economic viability of battery storage projects.

Recent literature also highlights the importance of integrating advanced technologies such as artificial intelligence and digital monitoring systems in BESS operations. Dong et al. (2024) note that machine learning algorithms and predictive analytics can enhance battery performance monitoring, optimize charging cycles, and reduce operational risks in large-scale energy storage systems.

Furthermore, the maturity and technological readiness of different energy storage technologies have been evaluated by several researchers. Studies indicate that lithium-ion batteries currently represent the most mature and commercially viable technology for energy storage applications, while other technologies such as hydrogen storage and thermal storage continue to evolve.

Despite the growing body of research on energy storage technologies, several gaps remain in the literature regarding the financial sustainability of energy storage startups. Most existing studies focus on the technical performance and cost analysis of battery technologies rather than the investment perspectives of stakeholders and venture capital investors.

Additionally, limited research has examined the specific context of emerging markets such as India, where policy frameworks, energy demand growth, and renewable energy expansion create unique opportunities and challenges for energy storage startups.

Therefore, this study seeks to address this gap by examining the financial viability and investment potential of BESS startups in India through an analysis of investor and stakeholder perceptions. By combining insights from existing literature with empirical data, the research aims to provide a comprehensive understanding of the factors influencing investment decisions in the energy storage startup ecosystem**.**

## 3. Research Methodology

### 3.1 Research Design

This study adopts a **quantitative research approach** to examine investor perceptions regarding the financial viability of BESS startups.

### 3.2 Data Collection

**Primary Data**

Primary data were collected through a structured questionnaire distributed among:

- Venture capital investors
- Energy sector professionals
- Startup founders
- Policy experts

**Secondary Data**

Secondary data were collected from:

- Academic journals
- Industry reports
- Government publications
- Energy market studies

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### 3.3 Sampling Method

A convenience sampling method was used to collect responses from stakeholders with knowledge of the energy and investment sectors.

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### 3.4 Data Analysis

The collected data were analyzed using:

- Descriptive statistics
- Correlation analysis
- Regression analysis

Statistical software such as **SPSS and Microsoft Excel** were used to analyze the results.

## 4. Results and Discussion

The analysis indicates that investors perceive strong market potential for BESS startups due to the rapid expansion of renewable energy capacity. Government initiatives aimed at promoting energy storage technologies also play a significant role in improving investor confidence.

However, several barriers to investment remain, including high initial capital requirements, long project payback periods, and uncertainty regarding policy frameworks.

## 5. Conclusion

Battery Energy Storage Systems are expected to play a crucial role in supporting India's transition toward a sustainable energy future. The increasing demand for energy storage solutions presents significant opportunities for startups operating in this sector.

However, the financial viability of these startups depends on multiple factors including technological innovation, policy support, and market demand. Strengthening regulatory frameworks and promoting investment in energy storage technologies will be essential for accelerating the growth of the BESS startup ecosystem in India.

## References

International Energy Agency. (2023). *Energy storage market outlook.*

Luo, X., Wang, J., Dooner, M., & Clarke, J. (2015). Overview of current development in electrical energy storage technologies. *Applied Energy.*

Polzin, F., Egli, F., Steffen, B., & Schmidt, T. (2019). How do policies mobilize private finance for renewable energy? *Energy Policy.*

Schmidt, O., Hawkes, A., Gambhir, A., & Staffell, I. (2017). The future cost of electrical energy storage technologies. *Nature Energy.*

Luo, X., Wang, J., Dooner, M., & Clarke, J. (2015). Overview of current development in electrical energy storage technologies. *Applied Energy*.

Schmidt, O., Hawkes, A., Gambhir, A., & Staffell, I. (2017). The future cost of electrical energy storage. *Nature Energy*.

Zhao, C., Andersen, P., Trætholt, C., & Hashemi, S. (2023). Grid-connected battery energy storage system: A review on application and integration. *Renewable and Sustainable Energy Reviews*.

Zhang, H., Yu, Z., Singh, S., et al. (2025). Review of Battery Energy Storage Systems: Advancements and Applications in Power Systems.

Alamsyah, M. R., & Sothea, D. (2024). Performance analysis of BESS in renewable power integration.