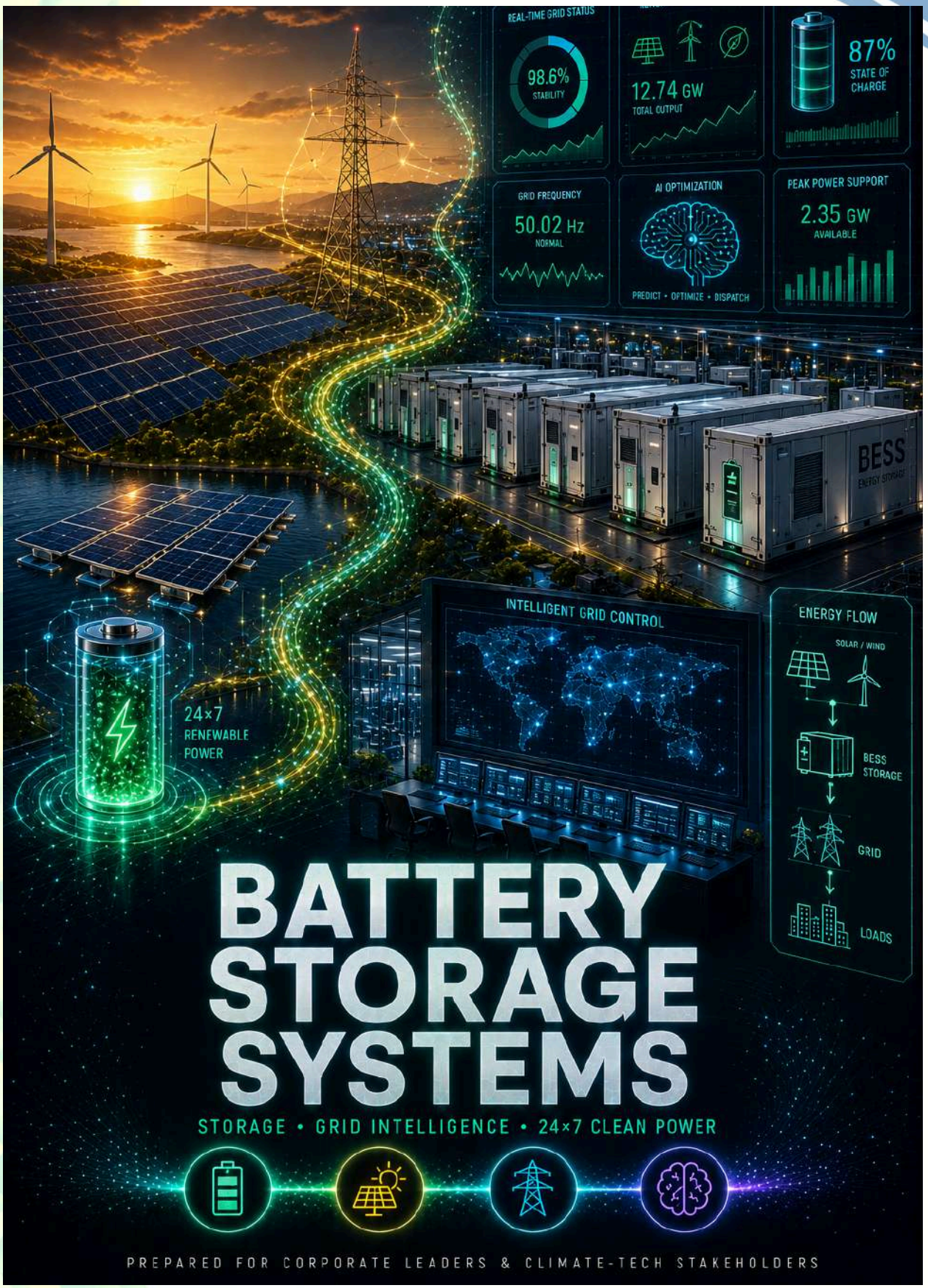
REAL-TIME GRID STATUS
98.6%
STABILITY
12.74 GW
TOTAL OUTPUT
87%
STATE OF CHARGE
GRID FREQUENCY
50.02 Hz
NORMAL
AI OPTIMIZATION
PREDICT • OPTIMIZE • DISPATCH
PEAK POWER SUPPORT
2.35 GW
AVAILABLE
BESS
ENERGY STORAGE
INTELLIGENT GRID CONTROL
ENERGY FLOW
SOLAR / WIND
BESS STORAGE
GRID
LOADS
24×7
RENEWABLE
POWER
BATTERY STORAGE SYSTEMS
STORAGE • GRID INTELLIGENCE • 24×7 CLEAN POWER
PREPARED FOR CORPORATE LEADERS & CLIMATE-TECH STAKEHOLDERS

Energy Storage

Battery Storage + Solar & BESS Projects

This section provides key inputs on Indian Battery + Solar & BESS Projects Opportunities for corporate leaders.

Opportunity Snapshot: Battery+ Solar (BESS Projects)

Integrates batteries with solar to store energy and provide reliable power supply.

Market Signal

- Need for **grid balancing & storage** driven by increasing renewable energy penetration
- SECI and state tenders are driving **BESS and Solar hybrid projects**
- **Annual Market size by 2030:** 45,000 - 50,000 ₹ Cr

What Makes or Breaks It?

- **Ability to secure long term** contracts (RTC, peak power, ancillary services)
- **Optimal system designs** (battery sizing, duration, integration with solar power systems
- Access to **low-cost batteries** and efficient lifecycle management capability

Why It Matters NOW?

- Due to intermittency of solar power, **storage is critical** for reliability
- Falling battery prices improving **project viability**
- Policy push for **RTC renewable energy and peak power supply**

Well Aligned Opportunity for

- **IPPs and renewable developers** (solar and hybrid portfolios)
- **Energy storage developers/integrators**
- **Utilities and grid operators**

Key Challenges

- **High capex**; current range lies between ₹4-6 Cr/MWh
- Lack of **mature storage market** mechanisms
- Battery degradation and lifecycle management

Business Model

- SECI RTC/Hybrid tenders (solar+BESS)
- Develop C&I storage and solar solutions (peak shaving, backup)
- Partnering with battery suppliers for tech and cost optimization

Introduction and Business Case

Battery + Solar projects combine low-cost renewable generation with energy storage, creating firm and dispatchable power. While solar is intermittent, coupling it with BESS ensures round-the-clock supply, peak shaving, grid stability and renewable integration.

For India, using batteries along with solar power plants or using standalone battery storage to stabilize the grid during times of excess solar power generation will comprise a critical component of achieving 24×7 green power, reducing curtailment, meeting renewable purchase obligations and unlocking new revenue streams for utilities and corporates through hybrid PPAs.

Market Potential for Battery + Solar & BESS Projects in India

Year	Market Size (₹ Cr)	Capacity Outlook	Drivers
2025	8,000-10,000	~3-4 GWh BESS paired with solar	Early SECI/NTPC tenders; corporate pilots.
2030	45,000-55,000	~20-25 GWh BESS integrated with ~50-60 GW solar	RTC renewable tenders; corporate 24×7 PPAs.
2040	1,00,000-1,20,000	50+ GWh storage + 100+ GW solar hybrid	Deep penetration of renewables; coal replacement.

Market Segments and Applications

Segment	Applications	Business Model	Key Drivers
Utility-scale solar + BESS	Grid-connected power generation, peak shifting	IPP ownership with long-term PPAs	Grid reliability needs & renewable mandates
Merchant hybrid power plants	Energy arbitrage, ancillary services	Merchant revenues + optimization software	Volatile power prices & flexibility value
Firm renewable power (24/7)	Baseload-like clean power supply	Contracted firm-power agreements	Corporate 24/7 clean-energy commitments
Renewable energy hubs	Multi-GW solar + storage clusters	Platform-scale infrastructure ownership	Transmission optimization & scale economics

C&I hybrid systems	Behind-the-meter power, demand charge reduction	Energy-as-a-Service (EaaS)	Rising commercial power tariffs
Grid-services-focused BESS	Frequency regulation, voltage support	Capacity + service payments	Increasing grid complexity
Solar-plus-storage retrofits	Upgrading existing solar assets	Asset enhancement / repowering	Curtailment reduction & revenue uplift
Islanded & microgrid hybrids	Remote power, resilience	Turnkey + O&M contracts	Energy security & diesel displacement
Storage-led hybridization	Battery-first with solar add-on	Storage platform + dispatch optimization	Need for fast-responding capacity
Policy-auction-driven hybrids	Solar-storage capacity tenders	Bid-to-build under regulated auctions	Government-led energy transition programs

Typical Project Capacities & Investments Required in India

Project Type	Typical Size	Storage Duration	Indicative CapEx (₹ Cr)
C&I rooftop/ground-mount + BESS	1-10 MWp PV + 1-20 MWh	1-2 hr	PV: 3.5-4.5 Cr/MW; BESS: 4.5-6.5 Cr/MWh
Industrial microgrid (diesel displacement)	0.5-5 MWp + 1-10 MWh	2-4 hr	PV: 3.8-4.8 Cr/MW; BESS: 5-7 Cr/MWh
Utility solar + BESS (peak supply)	50-200 MWp + 100-400 MWh	2-4 hr	PV: 3-3.8 Cr/MW; BESS: 4-6 Cr/MWh
RTC/firm power hybrid (solar-led)	200-500 MWp + 400-1,500 MWh	4-6 hr	PV: 3-3.6 Cr/MW; BESS: 4-6 Cr/MWh
Distribution-level storage + feeder solar	5-50 MWp + 20-200 MWh	2-4 hr	PV: 3.2-4.0 Cr/MW; BESS: 4.5-6.5 Cr/MWh

Underlying Technologies & Processes

Element	Options	Key Traits
Solar Generation	Utility-scale PV, floating solar	Lowest-cost RE, scalable, location-flexible.
Battery Storage	Li-ion (LFP/NMC), sodium-ion (emerging), flow batteries	Provides energy shifting, peak shaving, ancillary services.

Hybrid System Design	DC-coupled, AC-coupled, standalone storage	Optimises efficiency, CAPEX and grid integration.
Energy Management	AI/EMS platforms, smart inverters	Ensures optimal dispatch, demand response, grid services.
Applications	RTC supply, peak power, C&I backup, ancillary markets	Monetises multiple revenue streams.

Key Challenges

Challenge Area	Key Issues	Business Impact	India Specific	Strategic Implications
High Capital Cost & Financing Structure	Battery systems significantly increase project capex; uncertain revenue models	Long payback periods; financing challenges without clear revenue stacking	Early-stage BESS market; tariff discovery still evolving	Innovative financing, hybrid PPAs, and multi-revenue models (ancillary services, peak shaving) needed
Revenue Certainty & Offtaker Framework	Lack of mature markets for capacity payments and ancillary services	Revenue risk affects bankability	Indian grid still developing policies for storage compensation	Secure long-term contracts with utilities, C&I clients, or RTC tenders
Supply Chain Dependence & Geopolitics	Heavy reliance on imported lithium-ion cells and critical minerals	Price volatility and supply disruptions impact project economics	China dominates battery manufacturing; India building domestic ecosystem	Local manufacturing initiatives and diversified sourcing reduce risk
Technology Evolution & Operational Complexity	Rapid battery chemistry evolution; degradation management; safety risks	Technology obsolescence risk; O&M challenges over lifecycle	Skill gaps in storage system integration and lifecycle management	Focus on system design, advanced energy management software, and safety standards
Policy, Grid Integration & Regional Constraints	Regulatory clarity evolving; grid infrastructure	Project delays and uncertain returns	Some states more advanced in storage adoption	Early engagement with grid operators and strategic site selection critical

	limitations; land and interconnection issues		(Gujarat, Rajasthan, Tamil Nadu)	

Prominent Players in the Indian Market

Company / Entity	Project Details
NTPC Renewable Energy Ltd.	Developing solar + BESS hybrids across RE parks; pilots in RTC supply.
SECI (Solar Energy Corporation of India)	Anchor for tenders and policy support for RE + storage hybrids.
Adani Green Energy	Large RE developer; bidding for solar + storage hybrid projects in multiple states.
Tata Power Renewable Energy	Building solar + BESS systems for C&I and utility segments.
ReNew Power	Developing solar + wind + BESS projects under SECI RTC bids.
Greenko Group	Deploying multi-hour storage (PSP + BESS) linked with solar and wind for 24×7 supply.
JSW Energy	Investing in solar + battery projects; building hybrid RE parks.

Innovation Perspectives

Innovation	Business Opportunity	For Senior Management
Dispatchable renewables	Firm clean-power contracts, capacity markets	Replaces peakers with zero fuel risk
Software-defined power plants	Energy optimization platforms	Revenue stacking across markets
24/7 clean-energy solutions	Subscription-based firm renewable power	Premium corporate demand
Hybrid repowering of solar assets	Asset-upgrade portfolios	Unlocks stranded value
Merchant hybrid trading desks	Power trading & flexibility desks	Higher upside vs fixed PPAs
Energy-as-a-Service (EaaS)	C&I decarbonization	Sticky, long-term relationships

	platforms	
Resilience-first microgrids	Defense, data center, hospital power	Mission-critical reliability
Battery-first capacity platforms	Capacity-as-a-service models	Fast response, multi-market
Policy-optimized hybrid bidding	Regulated hybrid infrastructure	Predictable returns
Digital twins & asset intelligence	AI-driven O&M services	Performance advantage

Concentric & Satellite Opportunities

- Hybrid project EPC & integration services: Specialist firms designing and executing co-located solar + BESS plants with unified grid management systems.
- Energy management & dispatch software: AI-driven control platforms for peak shaving, arbitrage and frequency response tailored to Indian grid codes.
- Battery module assembly & containerization: Local fabrication of modular, climate-controlled BESS containers for C&I and utility projects.
- Grid connection & substation EPC: Concentric services for transformers, SCADA and protection systems enabling seamless hybrid integration.
- Renewable asset financing & InvITs: Investment vehicles bundling solar + BESS portfolios for yield-seeking institutional investors.
- Reused EV battery storage applications: Satellite opportunity repurposing aged EV packs for distributed hybrid projects.
- Solar tracker gear drives: Supply slew drives + motor assemblies for 1-axis tracking; 20-25% yield uplift.

Key Takeaway for Senior Management

Takeaway	**Details**
Storage turns renewables from energy assets into capacity assets	• Solar + BESS projects are valued not just for energy generation but for dispatchable capacity and grid services • ***Examples****:* RTC tenders, peak shaving, frequency regulation, backup power contracts • **Competitive advantage:** firms that optimize dispatch earn premium capacity payments competitors miss
Revenue stacking is the core profitability engine	• Successful BESS projects monetize multiple streams simultaneously

	• ***Sub-components**:* energy arbitrage, ancillary services, capacity payments, carbon premiums • **Suggested innovation focus:** AI-driven market participation and optimization engines
Battery lifecycle management determines real IRR	• Degradation, replacement timing, and thermal management drive lifetime economics • ***Examples**:* advanced BMS, predictive degradation analytics, modular replacement strategies • **Innovation focus:** digital battery health intelligence • **Competitive advantage:** superior lifecycle management reduces capex risk and improves returns
Digital asset management is a platform moat	• Distributed storage portfolios require centralized intelligence • ***Examples**:* fleet-wide monitoring, predictive maintenance, portfolio analytics • **Competitive advantage:** achieve scale efficiency while lowering O&M costs

Next Steps for Corporate Leaders

Solar-plus-storage and standalone BESS projects are advancing as corporates seek resilience, peak shaving, renewable firming, and improved power quality alongside decarbonization goals. Hybrid configurations are being deployed across C&I facilities, logistics hubs, campuses, data centers, and industrial sites, with value streams ranging from time-of-use arbitrage and diesel displacement to grid support and open access RE firming. As policy, OEM maturity, and financing structures evolve, batteries are becoming a strategic asset class rather than an auxiliary component.

This could be an attractive climate tech opportunity for industries and firms in specific sectors and industries keen on catering to this fast growing market.

Connect with Team EAI to know more about this opportunity and take your corporate's initial steps. Send a note to consult@eai.in or talk to Muthukrishnan - 9952910083