

ENERGY STORAGE SYSTEM

Li-ion
HIGH ENERGY
HIGH POWER
LONG LIFE

CELL TO PACK ARCHITECTURE
CELL → MODULE → PACK

PRODUCTION EFFICIENCY
98.6%

PASS RATE
99.2%

AI VISION SYSTEM
±0.021%

92.1%

BMS INTELLIGENCE
VOLTAGE 398.7 V
CAPACITY 92.4 Ah
SOC 78%
SOH 96.3%
TEMP. 28.4 °C
HEALTH EXCELLENT

THERMAL MANAGEMENT
OPTIMIZED COOLING
MAX PERFORMANCE
EXTENDED LIFE

DIGITAL TWIN & QUALITY ASSURANCE
LASER WELD INSPECTION ✓
TORQUE MONITORING ✓
INSULATION TEST ✓
FINAL QA CHECK ✓

BATTERY PACK PRODUCTION

BATTERY SYSTEMS • THERMAL INTELLIGENCE • SMART ELECTRIFICATION

PREPARED FOR CORPORATE LEADERS & CLIMATE-TECH STAKEHOLDERS

Energy Storage Battery Pack Production

This section provides key inputs on India Battery Pack Production Opportunities for corporate leaders.

Highlights

- Explosive demand growth driven by EV adoption, stationary storage, and grid-scale BESS deployment
- Strategic manufacturing opportunity as countries push localization of battery supply chains
- Value lies in integration, safety, and performance, not just cell assembly
- Technology evolution in chemistry, BMS, and thermal management opening innovation space

Key recommendations for corporate leaders include:

- Invest in developing tech and IP capabilities in domains such as BMS, thermal design, safety systems
- Differentiate through performance-certified products for EV and grid applications
- Secure cell supply partnerships to stabilize input costs and scale production

Opportunity Snapshot: Battery Pack Production

Assemble battery cells into usable packs with management and safety systems.

Market Signals

- EV adoption and BESS growth driving strong demand for battery packs
- Strong policy push via PLI, EV incentives (FAME)
- Annual Market size by 2030: ₹ 40,000 - 50,000 Cr



What Makes or Breaks It?

- Supply chain access for reliable and cost-competitive cells
- Reliable system performance through high quality battery management systems and thermal management

Why It Matters NOW?

- EV penetration accelerating across 2W, 3W and fleet segments
- BESS demand scaling alongside renewable growth
- Near-term opportunity as battery cell manufacturing is in nascent stage in India



Well Aligned Opportunity for

- Auto OEMs and EV manufacturers (in-house integration)
- Electronics/EMS players (assembly & systems integration)
- Battery startups / integrators focusing on BMS and design



Key Challenges

- Dependence on more economic imported pack from China
- High domestic competition due to low entry barriers



Business Models

- Contract manufacturing / OEM supply for EV players
- In-house pack assembly for EV or storage applications
- Partnerships with global cell suppliers & BMS technology providers

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Introduction and Business Case

Battery packs (especially Li-ion batteries) are the final package that are used in end applications, integrating cells with electronics, thermal management and safety systems. For India, local pack production is critical to reduce import dependence, customized for Indian conditions such as heat and duty cycles and drive down EV and storage costs.

With EV adoption rising and domestic cell plants still scaling, Li-ion battery pack assembly offers an immediate and scalable entry point into the battery value chain for Indian businesses and corporates.

Market Potential for Battery Pack Production in India

Year	Market Size (₹ Cr)	Annual Demand (GWh)	Drivers
2025	20,000-25,000	25-30	EV 2W/3W surge; early 4W and storage packs
2030	40,000-50,000	125-150	2W/3W dominance + 4W mass adoption; grid & C&I storage
2040	1,60,000-2,00,000	500-700	Deep electrification of transport + large-scale stationary storage

Market Segments and Applications

Segment	Applications	Business Model	Key Drivers
Mass-market EV battery packs	Passenger EVs, two-wheelers	High-volume OEM supply contracts	EV adoption & cost reduction
Premium / long-range EV packs	Performance & luxury EVs	Customization-led OEM partnerships	Demand for longer range & fast charging
LFP-based battery packs	Entry EVs, buses, ESS	Cost-optimized large-scale production	Safety, longevity & raw-material security
Nickel-rich battery packs	Long-range EVs	High-energy-density pack engineering	Range anxiety reduction
Structural / cell-to-pack designs	EV chassis-integrated packs	Deep OEM co-development	Weight reduction & vehicle integration

Grid-scale ESS battery packs	Utility & commercial storage	Project-based supply + long-term service	Renewable energy integration
Modular industrial battery packs	Forklifts, robotics, telecom	Configurable modular solutions	Electrification of industry
Regionalized battery packs	Local EV & ESS markets	Localized manufacturing & compliance	Supply-chain resilience & localization policies
Low-carbon / sustainable packs	EVs, ESS	Green premium supply contracts	OEM Scope-3 emission targets
Battery packs with lifecycle services	EVs, ESS	Product + service (BMS, warranty, recycling)	Total cost of ownership optimization

Typical Project Capacities & Investments Required in India

Facility Type	Throughput	Indicative Capex (₹ Cr)	Automation Level
Pilot / Proto Line	0.3-0.5 GWh/yr	60-100	Manual + semi-auto
Commercial Line - Tier-2	1-2 GWh/yr	150-250	Semi-auto
Multi-Line Plant - Tier-1	4-5 GWh/yr	350-600	High semi-auto
Large-scale Plant	8-10 GWh/yr	700-1,000	Highly automated
ESS-dedicated Line	1-2 GWh/yr	120-180	Semi-auto

Underlying Technologies & Processes

Element	Options	Key Traits
Form factor	Prismatic, cylindrical, pouch cell modules	Drives pack density, cooling design and manufacturability.
Module & pack assembly	Manual-semi-auto-fully automated	Automation improves yield, consistency and throughput.
Battery Management System (BMS)	In-house vs. licensed	Controls safety, charge/discharge, thermal monitoring; IP driver.
Thermal management	Air cooling, liquid cooling, PCM/gel	Critical for Indian climate; balances cost vs. performance.

Safety features	Fuses, disconnects, fire suppression	Prevents thermal runaway; mandatory for certification.
Testing & compliance	AIS-156, AIS-038, IEC standards	Certification ensures safety and OEM acceptance.

Key Challenges

Challenge Area	Key Issues	Business Impact	India Specific	Strategic Implications
Supply Chain Dependency & Cell Import Reliance	Heavy dependence on imported lithium-ion cells and key materials	Margin volatility and supply disruptions	China-dominated supply chains; currency and geopolitical risks	Develop local sourcing partnerships and diversify supply base
Rapid Technology Evolution & Standardization Risk	Changing battery chemistries (LFP, NMC, sodium-ion, solid-state)	Risk of technology obsolescence and stranded investments	EV ecosystem still evolving; varying OEM specifications	Modular designs and flexible manufacturing lines needed
Cost Pressure & Profitability Challenges	Competitive pricing driven by OEMs and international players	Thin margins for pack assemblers without differentiation	Strong competition from integrated global manufacturers	Move toward higher-value integration (BMS, thermal systems, software)
Demand Volatility & Offtaker Concentration	Dependence on EV OEMs and stationary storage projects	Revenue fluctuations linked to policy incentives and EV growth	Subsidy-driven market cycles; evolving EV adoption rates	Diversify across EV, stationary storage, telecom, and industrial segments
Capital Intensity & Safety Compliance Requirements	Investments required for automation, testing, certification, and safety standards	Higher upfront costs and operational complexity	Strict thermal safety norms; infrastructure and skilled workforce gaps	Invest early in testing labs, safety engineering, and quality control systems

Prominent Players in the Indian Market

Company / Entity	Project Details
Exicom Tele-Systems	Leading supplier of EV battery packs for 2W/3W and stationary storage; expanding into 4W packs.
Okaya Power Group	Manufacturing Li-ion packs for EVs and energy storage; strong distribution network.
Amara Raja / Exide	Diversifying from lead-acid; producing packs and BMS systems alongside cell projects.
Ola Electric	Produces in-house packs for its scooters; investing in pack R&D.
Ather Energy	Proprietary pack designs with thermal management tailored to Indian climate.
Sun Mobility	Pack + swapping ecosystem for 2W/3W fleets; modular battery pack systems.

Innovation Perspectives

Innovation	Business Opportunity	For Senior Management
Structural & cell-to-pack integration	Deep OEM co-design, platform-level supply	Step-change in cost, weight, and performance
Pack-level software & intelligence	Battery data platforms, SaaS revenues	Improves safety, life, and residual value
Chemistry-agnostic pack platforms	Multi-chemistry pack licensing	Future-proofs assets and customers
LFP scale & standardization	Ultra-high-volume standardized packs	Dominates mass EV and ESS markets
Fast-charge-optimized pack design	Fast-charging platform partnerships	Enables premium EV experiences
Second-life-ready pack architecture	EV-to-ESS repurposing platforms	Extends asset value
Low-carbon & traceable battery packs	Green premium pack contracts	Regulatory and OEM advantage
Pack-as-a-Service models	Leasing & subscription battery platforms	Lowers upfront cost for customers

Localized & modular gigafactories	Regional pack manufacturing franchises	Faster market entry
Integrated recycling feedback loops	Circular battery ecosystems	Cost & sustainability moat

Concentric & Satellite Opportunities

- **Thermal management and enclosure manufacturing:** Localised production of cooling plates, casings and fire-safe housings tailored to India’s climate.
- **BMS and electronics integration firms:** Indigenous design houses creating scalable, software-defined BMS for diverse chemistries (LFP, NMC, Na-ion).
- **Thermal Interface Materials(TIMs):** Production of thermal gap fillers, pads, adhesives and phase change materials used to increase thermal management efficiency.
- **Testing, certification and safety labs:** Regional facilities for vibration, abuse and thermal runaway testing to meet AIS and BIS standards.
- **Automation and assembly equipment suppliers:** Concentric ecosystem of robotics, welding and cell-stacking systems built for mid-scale Indian pack lines.
- **Second-life repurposing networks:** Satellite reuse of retired EV packs in stationary energy storage and telecom backup applications.
- **Battery recycling & circular materials tie-ins:** Integrated recovery of modules and metals feeding back into domestic cell manufacturing.

Key Takeaway for Senior Management

Takeaway	Details
Battery pack manufacturing is a systems engineering business, not an assembly business	<ul style="list-style-type: none"> • The real value lies in integration of cells, BMS, thermal design, safety architecture, and software intelligence • Examples: advanced BMS algorithms, liquid cooling systems, fail-safe circuitry, modular pack architecture • Innovation focus: intelligent pack design and software-driven performance optimization • Competitive advantage: high-performance, safety-certified packs command premium positioning
Software is becoming as important as hardware	<ul style="list-style-type: none"> • Pack intelligence integrates with vehicle/grid energy management systems • Examples: cloud-connected BMS, remote diagnostics, predictive performance updates • Competitive advantage: recurring service revenue and customer lock-in
Lifecycle performance	<ul style="list-style-type: none"> • Buyers increasingly evaluate total cost of ownership

<p>matters more than upfront cost</p>	<ul style="list-style-type: none"> ● Examples: degradation modeling, predictive health analytics, warranty optimization ● Competitive advantage: superior durability attracts fleet and grid customers, offering offtake at scale
<p>Automation and precision manufacturing create hidden margins</p>	<ul style="list-style-type: none"> ● Yield, consistency, and safety improve with advanced automation ● Examples: robotic welding, inline inspection, digital QA systems

Next Steps for Corporate Leaders

Battery pack production is scaling as EV, stationary storage, and industrial electrification demand accelerates across automotive OEMs, 2W/3W mobility, material handling, telecom, and C&I storage segments. Value is shifting from pure assembly toward BMS sophistication, module architecture, thermal management, cell selection, and lifecycle performance. As localization policies, safety norms, and recycling/EPR frameworks strengthen, battery packs are becoming a strategic control point within the broader electrification supply chain.

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.

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