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ENERGIZING INDIA'S FUTURE: THE RISE OF SODIUM-ION BATTERIES

On December 02, 2024, the Ministry of New and Renewable Energy, Government of India (**"MNRE"**) published a pivotal report *'Assessment of the Global Landscape for Sodium-Ion Batteries and Their Potential in India'* prepared under the Accelerating Smart Power and Renewable Energy (**"ASPIRE"**) programme—a bilateral initiative with the UK's Foreign, Commonwealth and Development Office (**"FCDO"**). This comprehensive study with analysis from KPMG dives deep into how sodium-ion batteries (**"SIBs"**) could reshape India's energy storage ecosystem.

Why Sodium-Ion Batteries Are a Big Deal

India's energy landscape is at a turning point. With a bold target of achieving 500 gigawatts **("GW")** of non-fossil fuel capacity by 2030 and a long-term vision of net zero emissions by 2070, renewable energy sources like solar and wind are scaling up rapidly. As of September 2024, India boasts over 150 GW of renewable capacity, but these sources are inherently intermittent—solar panels don't generate at night, and wind turbines depend on breezy days. This variability poses a challenge to grid stability, making energy storage a linchpin in our transition to a cleaner future.

For years, lithium-ion batteries (**"LIBs"**) have been the go-to solution, powering everything from electric vehicles (**"EVs"**) to grid-scale storage systems. However, LIBs come with baggage: their reliance on scarce minerals like lithium and cobalt drives up costs, strains global supply chains, and raises environmental and ethical concerns, particularly around cobalt mining in places like the Democratic Republic of Congo. Enter SIBs - a homegrown contender that leverages India's abundant sodium resources (think salt from our vast reserves) to offer a cheaper, safer, and more sustainable alternative.

Key Takeaways from the Report

The 78-page report is packed with data, analysis, and forward-looking recommendations. Here's a detailed rundown of its most compelling findings:

1) A Global Battery Boom

The world is in the midst of a battery revolution, driven by the global push for net zero emissions. The International Energy Agency (**"IEA"**) projects that renewable energy capacity hit 4,141 GW by 2023, a 15% jump from 2022—the fastest growth in two decades. This surge, coupled with the rise of EVs, is set to triple battery demand by 2030. In India, the Central Electricity Authority (**"CEA"**) estimates a need for 41.7 GW/208 gigawatt-hours **("GWh")** of battery storage by 2030 to support our 500 GW renewable goal. SIBs, with their unique advantages, could play a starring role in meeting this demand.

2) SIBs vs. LIBs: A Head-to-Head Comparison

How do SIBs stack up against the reigning champion, LIBs? Here's the breakdown:

Cost: LIBs hit $128/kWh in 2022, but SIBs are projected to drop to $40/kWh by 2030—a 15-20% cost edge over LIBs—thanks to cheaper, abundant raw materials like sodium.

Resource Availability: India lacks lithium and cobalt reserves, relying heavily on imports. In contrast, we're the third-largest producer of sodium chloride globally, churning out 26.5 million tonnes in 2021 alone. Add in our iron, manganese, and phosphate reserves, and SIBs look like a natural fit.

Safety & Sustainability: SIBs use fewer critical minerals, sidestepping cobalt's human rights issues, and offer a 100% depth of discharge (**"DoD"**)—meaning they can be transported fully discharged, boosting safety.

Performance: While LIBs lead in energy density (80-300 Wh/kg vs. SIBs' 100-170 Wh/kg), SIBs shine in grid-scale applications with a 2–6-hour discharge duration, a 3,500-6,000-cycle life, and comparable longevity (10-15 years).

Verdict? SIBs may not power long-haul EVs yet, but they're tailor-made for grid stability tasks like energy arbitrage and renewable firming.

3) India's Golden Opportunity

India's unique position makes SIBs more than just an alternative—they're a strategic asset. With 220 MWh of grid-scale BESS installed and tenders for 16 GWh underway, the stage is set for growth. The report predicts SIBs could capture 4% of India's energy storage market by 2030, up from zero today, driven by:

Policy Push: Initiatives like Energy Storage Obligations, the Production Linked Incentive scheme for Advanced Chemistry Cells, and Viability Gap Funding for BESS projects signal strong government backing.

Self-Sufficiency: SIBs' reliance on locally available materials could cut import dependence, bolstering energy security and economic resilience.

4) The Global SIB Scene

Globally, SIBs are gaining traction. China leads with its manufacturing muscle, but the UK, US, Japan, and France are hotbeds of innovation. The UK, in particular, stands out with players like AMTE Power and LiNa Energy, backed by £2 billion in R&D funding through 2030. In India, homegrown companies like Indi Energy, KPIT Technologies, and Cygni Energy are making waves, signaling a vibrant domestic ecosystem.

Challenges on the Horizon

SIBs aren't without hurdles. The technology is nascent, with lower energy density than LIBs, limiting its use in compact, high-power applications like sports cars or heavy-duty trucks. Manufacturing capacity lags behind LIBs, and supply chains for components like hard carbon need development. Plus, India's workforce needs training to handle this emerging technology. The report identifies six key areas to address:

- **Technology**: Boost domestic R&D and manufacturing.
- **Policy**: Craft SIB-specific regulations.
- **Demand**: Stimulate market uptake.
- **Supply Chain**: Build local sourcing networks.
- **Skills**: Train a specialized workforce.
- **GESI:** Ensure gender equality and social inclusion in the SIB ecosystem.

Recommendations: Powering Up SIBs in India

To turn potential into action, the Report lays out a roadmap:

⇒ **SIB-Specific VGF**: Redirect some of the INR 9,400 crore VGF budget for BESS to SIB projects, lowering costs and attracting investment.

⇒ **State-Level Support**: Encourage states to set BESS targets and offer incentives for SIB manufacturing and grid integration.

⇒ **Demand Drivers**: Launch SIB-specific tenders to assure manufacturers of market demand.

⇒ **Manufacturing Boost**: Allocate PLI capacity (e.g., the remaining 10 GWh tranche) to SIB facilities, leveraging their similarity to LIB production lines.

⇒ **Skill Building**: Partner with institutions like the UK's Faraday Institution to train technicians and engineers.

⇒ **R&D Partnerships**: Foster international collaborations to enhance SIB performance, especially in cathode stability.

⇒ **Standards**: Develop quality benchmarks with industry input to build market trust.

⇒ **Pilots**: Fund SIB grid storage demos to showcase viability and build confidence.

Forging a Sustainable Future: India-UK Collaboration and the Promise of SIBs

The UK's expertise offers a powerful blueprint for India's sodium-ion battery (SIB) ambitions, creating a winning partnership to drive the global energy transition. With initiatives like the UK Battery Industrialization Centre and £11 million invested in next-generation battery technologies (including SIBs), the UK stands as a global leader, opening doors for collaboration. Potential synergies include joint research with institutions like Innovate UK, business links pairing Indian startups with UK firms for technology transfer, and policy exchange leveraging the UK Battery Strategy to refine India's approach. "SIBs will enable smooth renewable integration into the grid, helping us meet our 2030 targets and net zero by 2070," says Ajay Yadav, Joint Secretary, MNRE. With India's abundant resources, cost advantages, and supportive policy framework, this collaboration could position India to lead the SIB revolution—ushering in not just an energy transformation, but a future rooted in self-reliance, sustainability, and a cleaner tomorrow for all.

KEY AMENDMENT TO ALMM ORDER: IMPLEMENTATION OF MANDATE FOR SOLAR PV CELLS

The Ministry of New and Renewable Energy (**"MNRE"**) has issued Office Memorandum No. 283/59/2024-GRID SOLAR, dated December 9, 2024 **("Amendment"**), amending the Approved List of Models and Manufacturers (**"ALMM"**) framework under the 'Approved Models and Manufacturers of Solar Photovoltaic Modules (Requirements for Compulsory Registration) Order, 2019' (**"ALMM Order"**). The Amendment introduces mandatory compliance for solar photovoltaic (**"PV"**) cells under ALMM List-II, effective June 1, 2026, while refining obligations for solar PV modules under ALMM List-I.

Highlights of the Amendment

1. Introduction of ALMM List-II for Solar PV Cells

- Effective June 1, 2026, solar PV cells must be sourced from manufacturers and models listed in ALMM List-II, reflecting anticipated increases in domestic cell production capacity.
- This supplements the existing ALMM List-I requirement for solar PV modules, established under the ALMM Order.

2. Exemptions for Projects Bid Before December 9, 2024

- Projects with bid submission deadlines on or before December 9, 2024, including those under Section 63 of the Electricity Act, 2003, must use ALMM List-I modules but are exempt from List-II cell requirements, irrespective of commissioning dates, even beyond June 1, 2026.
- This offers flexibility for ongoing projects while transitioning to stricter local content rules.

3. Mandatory Compliance for New Bids

- Projects with bid deadlines after December 9, 2024, must incorporate clauses in tender documents mandating the use of both ALMM List-I modules and List-II cells, regardless of commissioning timelines.
- For tenders issued prior to December 9, 2024, but with bid deadlines thereafter, bidding agencies must amend documents to reflect these requirements.

4. Post-June 2026 Requirements

- From June 1, 2026, only modules utilizing List-II cells will remain on ALMM List-I. Non-compliant manufacturers risk delisting.
- A transitional ALMM List-I(a) will be maintained post-May 31, 2026, for modules exempt from List-II cell requirements, applicable to specific projects.

5. Net-Metering and Open Access Projects

- Unless exempted by prior MNRE orders (e.g., O.M. No. 283/54/2018-GRID SOLAR-Part(5), dated October 7, 2022), these projects must use ALMM List-I modules. Exemption from List-II cells applies if commissioned before June 1, 2026; full compliance is required thereafter.

6. Deemed Compliance and Guidelines

- Thin-film modules from integrated manufacturing units listed in ALMM List-I are deemed compliant with List-II cell requirements.
- Procedural guidelines for List-II enlistment will be issued separately.

Implications for Stakeholders

The Amendment to the ALMM Order, effective as outlined, introduces a structured transition toward enhanced domestic sourcing requirements while balancing immediate industry needs. For stakeholders—including project developers, module manufacturers, and cell manufacturers—this policy shift presents both opportunities and compliance obligations. Projects bid prior to December 9, 2024, benefit from exemptions, allowing continued flexibility in cell sourcing. However, bids post-dating this threshold must adhere to stricter standards, necessitating updates to procurement strategies and tender documentation. From June 1, 2026, the mandatory integration of List-II cells into List-I modules underscores the need for robust supply chain alignment. Stakeholders are advised to review contractual obligations, secure ALMM-compliant suppliers, and monitor forthcoming guidelines to ensure adherence to this evolving regulatory framework, which supports India's renewable energy objectives under a legally enforceable mandate.

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Warm Regards,

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