

The Abundance Advantage

Leveraging Sodium to De-risk the American Battery Supply Chain
and Secure America's Energy Future

WHITE PAPER

Published by the Sodium Battery Community of NAATBatt International
September 30, 2026

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This White Paper was prepared and published by the Sodium Battery Community of NAATBatt International. NAATBatt International has not independently reviewed or verified the claims, data, or conclusions contained herein.

The Abundance Advantage: Leveraging Sodium to De-risk the American Battery Supply Chain and Secure America's Energy Future

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1. Market needs that Na ion can address

Na-ion batteries (Na-ion) offer a combination of technical properties that position them well across a range of stationary and mobile applications where lead-acid, lithium iron phosphate (LFP), lithium nickel manganese cobalt oxide (NMC), and lithium titanate (LTO) chemistries each face limitations. Unlike LFP and NMC cells, which require active thermal management to operate safely and efficiently across a broad climate envelope, Na-ion cells operate from -40 °C to 60 °C with minimal performance penalty — a range that encompasses virtually every deployment environment from arctic telecom infrastructure to desert utility substations. This precisely engineered thermal stability eliminates a significant source of system cost, complexity, and failure risk, and it contributes to lower total cost of ownership over the battery's service life. **Combined with cycle life that exceeds most lithium-ion (Li-ion) chemistries without costly thermal management, Na-ion systems reduce lifetime replacement costs and the operational burden of managing battery assets.**

Safety in transportation and field storage represents a second strong value proposition. Na-ion cells can be stored and shipped at or near 0% state of charge without damage, substantially reducing hazard classification and handling requirements relative to Li-ion cells, which must be shipped at partial charge. This translates directly into lower storage and transportation costs via simpler packaging requirements, reduced regulatory compliance overhead, and the ability to consolidate shipments that would otherwise require special handling. At the cell level, Na-ion failure modes are amenable to system-level management, enabling safer deployment across sites near population centers and reducing the fire-suppression infrastructure required at dense installations such as data centers. Table 1 summarizes how these attributes, including wide-temperature operation, de-energized storage, lower system cost, and improved safety, translate into concrete value propositions across the four application segments where Na-ion is most competitive.

¹ Mana Battery, Inc.

² Peak Energy

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Table 1. Summary of key market uses and Na-ion battery value propositions for those use cases. Unless otherwise noted, comparisons are with LFP lithium ion.

Application	Operation (-40°C to 60°C)	De-energized Storage	Low Cost	Safety
Energy Storage Systems	Climate-agnostic deployment; no active cooling required	Safer transportation to installation site	Lower \$/kWh over system lifetime	Enables higher cell density in a smaller footprint
Vehicles	Consistent range at low temp; low cooling requirement	Safer transportation from factory to dealer; safer maintenance	Lower total cost of ownership over vehicle life	Reduced consumer fire risk vs. NMC Li-ion
12V / Small Mobility	Superior cold-weather cranking vs. lead-acid	Simplified seasonal storage and safer transportation vs. NMC Li-ion	Lower total cost of ownership over vehicle life vs. lead-acid	Reduced consumer fire risk vs. NMC Li-ion
Telecom Switchgear	Eliminates site cooling; enables extreme climate operation	Long standby; simplified maintenance and remote site logistics vs lead-acid	Lower augmentation/ replacement cost vs lead-acid	Safer operation at unmanned remote sites
Underground Mining	No active heating or cooling required	Safer transportation and storage when not in use	Lower total cost of ownership over equipment life	Enables operation underground without diesel exhaust
UPS / Data Centers	-	Safer transportation to installation site	Competitive total cost of ownership	Reduced fire suppression requirements

The six use cases summarized in Table 1 span the near-term commercial opportunity for US Na-ion manufacturers. Three stand out as particularly attractive early market entries: stationary energy storage systems (ESS) for grid and commercial-and-industrial applications, lead-acid battery replacement across 12V automotive and small-mobility segments and telecom backup, and data center UPS systems. Vehicles are also a key longer term market. Together, these segments represent tens of billions of dollars in annual global expenditure, and each offers a technical and economic profile where Na-ion’s attributes translate into a durable advantage over the incumbent chemistry.

The markets needs that Na-ion can address are large and growing fast. Meeting that demand with domestically produced Na-ion batteries will require not a single pioneering company, but a coordinated industry with the manufacturing base, supply chain depth, and policy support to reach commercial scale. **This white paper outlines the case that the United States is well-positioned to build that industry.** Section 2 profiles a cohort of US companies already commercializing Na-ion chemistries across ESS, small mobility, backup power, vehicle, and defense applications. Section 3 maps the domestic supply chain resources available to support them, from abundant soda ash reserves and abundant resources suitable for hard carbon conversion, to emerging US suppliers

across cathode, anode, electrolyte, separator, and balance-of-system components. Section 4 examines why Na-ion's manufacturing profile lowers the capital intensity of domestic cell production relative to Li-ion, and Section 5 addresses end-of-life management and highlights a strategically important recycling pathway in which the large and growing installed base of domestic LFP batteries can serve as feedstock for US Na-ion cathode production as those cells reach end of service. Section 6 highlights the remaining gaps and outlines the coordinated industry, policy, and investment effort required to turn sodium's natural abundance into an American industrial advantage.

2. Market demand and US companies scaling Na ion chemistries

2.1. Peak Energy

Grid storage batteries are forecast to be among the fastest growing sectors in the global energy market. More than 100 GWh of battery storage was installed in 2025, and Bloomberg NEF predicts annual global storage installation to more than double that by the end of the decade. Currently, storage is dominated by lithium-iron phosphate (LFP) battery technology, the supply of which is dominated by China. Na-ion batteries, however, offer a better performing grid storage solution and promise the United States a domestic supply chain advantage that will enable globally competitive American production.

Chinese consolidation of LFP supply chains and non-market economic policies have enabled China to overproduce global demand for LFP cells, cell active materials, and processed minerals, ensuring China's permanent global price setting role for LFP. American efforts to expand domestic and friend-shored supply alternatives have yielded moderate domestic production that is only cost competitive in policy constrained markets (i.e. tariffs, price floors, and subsidized production). American-made LFP has demonstrated no pathway to globally cost competitive production and will remain limited in reach to domestic markets.

LFP-based systems comprise 90% of global BESS market share and most American BESS manufacturers likewise rely on LFP. Global reliance on LFP for energy storage coupled with the ongoing rise in storage deployment will ensure Chinese dominance of global energy markets that exceeds OPEC's influence in global oil markets. For America to counter Chinese control of this market, it must develop an alternative product that can compete on a global basis. Na-ion presents exactly that opportunity.

Na-ion batteries are proving a better solution to grid storage requirements and pose a unique opportunity for America to develop a globally competitive battery storage product, fracturing China's global dominance, strengthening American energy independence, while driving enormous investments in American energy manufacturing. Peak Energy, an American energy company, has developed a leading Na-ion energy storage system that reduces the cost of grid storage by as much as 50% and is directly competitive with Chinese-made LFP systems without further subsidy. Peak's differentiated product provides a technology moat between Chinese manufacturers who have not optimized for Na-ion's performance.

The United States also has a domestic natural resource advantage in Na-ion that powers its global competitiveness. Na-ion batteries require no critical minerals and the primary resources – soda ash, iron, and phosphorous – are uniquely abundant in North America. Further, promising research indicates significant beneficial use of existing domestic mining and manufacturing waste will offer further cost reduction.

Demand for American Na-ion batteries is rapidly growing as Peak Energy and other domestic firms develop the world's leading pipeline for Na-ion batteries. Peak's passively cooled ESS systems are enabled by the excellent thermal stability of NFPP/HC prismatic cells during both cycling and

storage over a wide temperature range (see Figure 1). By avoiding active cooling, Peak's ESS systems will use 98% less auxiliary power each year and provide \$50M+ savings over their planned 25-year useful life, relative to comparable LFP systems. Such clear savings are a major driver of Peak's 6+ GWh contracted volume to date (50+GWh in negotiations).

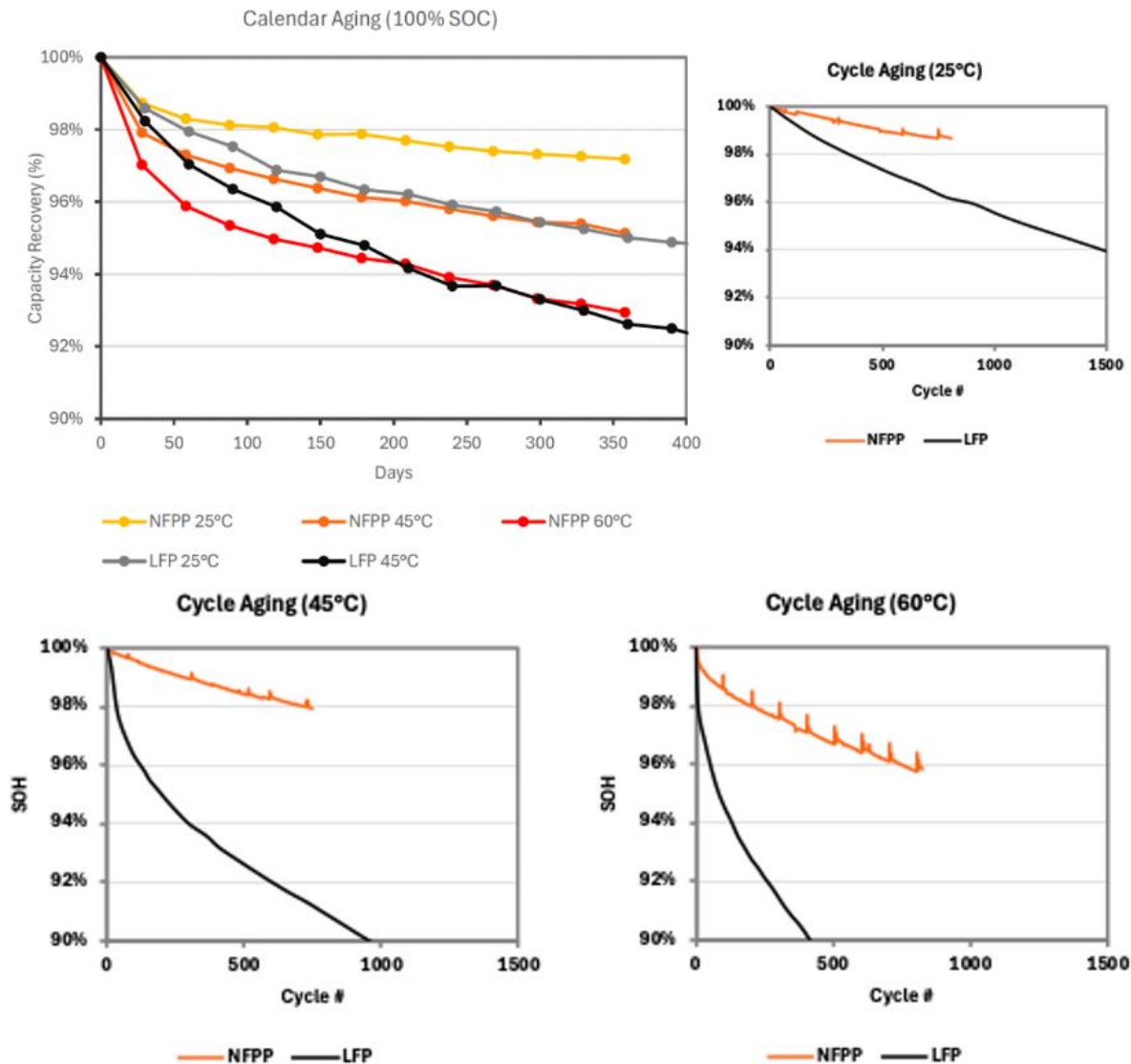


Figure 1. Calendar and cycle aging of Peak's 155 Ah NFPP/HC prismatic cells from 25 – 60 °C, compared with 280 Ah LFP Li-ion prismatic cell performance.

2.2. Unigrid

The Foundry Model: Repurposing Lithium-Ion Manufacturing for Na-ion

The rapid expansion of the Li-ion industry has led to a significant global footprint of manufacturing infrastructure. However, the high capital intensity and rigid requirements of conventional gigafactories have historically created a “Western Battery Gap”, where startups struggle to reach scale before exhausting their capital. Na-ion technology can avoid this by taking advantage of the foundry model, a method of scaling that leverages existing, underutilized Li-ion infrastructure rather than requiring the construction of entire facilities from the ground up.

Inherent Compatibility: The “Drop-In” Advantage

The primary value proposition for U.S. Na-ion manufacturing lies in its nearly 1:1 compatibility with existing Li-ion production lines. This compatibility allows the domestic industry to "upcycle" and fully utilize existing manufacturing assets that might otherwise become stranded as market preferences shift. This is possible based on the following:

- **Process Alignment:** The fundamental stages of battery production, slurry mixing, electrode coating, calendaring, and cell assembly, are identical for Li-ion and Na-ion.
- **Aluminum Current Collectors:** Unlike Li-ion, which must use expensive copper for the anode current collector, Na-ion can utilize aluminum for both the cathode and the anode. This simplifies the supply chain and allows for simpler welding processes on the same assembly equipment.
- **Less Sensitive to Moisture:** Certain Na-ion chemistries are less sensitive to moisture during the manufacturing process. This allows for less stringent dry room conditions, potentially reducing facility OpEx to approximately 27% of the costs required for traditional Li-ion environments.
- **De-energized Handling:** Na-ion cells can be shipped and stored at 0% state of charge (SoC). This eliminates many of the fire safety considerations and hazardous material handling requirements that drive up the logistics costs of Li-ion manufacturing.

Leveraging the Failures of the Past - Correcting the Gigascale-or-Bust Narrative

The Foundry Model challenges the assumption that “gigascale or bust” is the only path to economic viability. By distributing production across multiple, specialized coating lines (e.g., four 250-300 mm lines instead of one 1.5 m-wide line), manufacturers can achieve greater operational flexibility and lower initial CapEx. This also helps to accelerate commercial adoption across multiple chemistries and technologies without waiting for the market to narrow down.

History shows that battery companies often fail not because of their chemistry, but because of the “valley of death” between R&D and mass production. By adopting a foundry approach, the U.S. Na-ion industry can bypass the multi-year lead times and multi-billion dollar debt cycles associated with new construction. This model reframes the established Li-ion supply chain from a competitor into a foundation, using existing domestic capabilities in separators, electrolyte blending, and module assembly, for a more secure energy future.

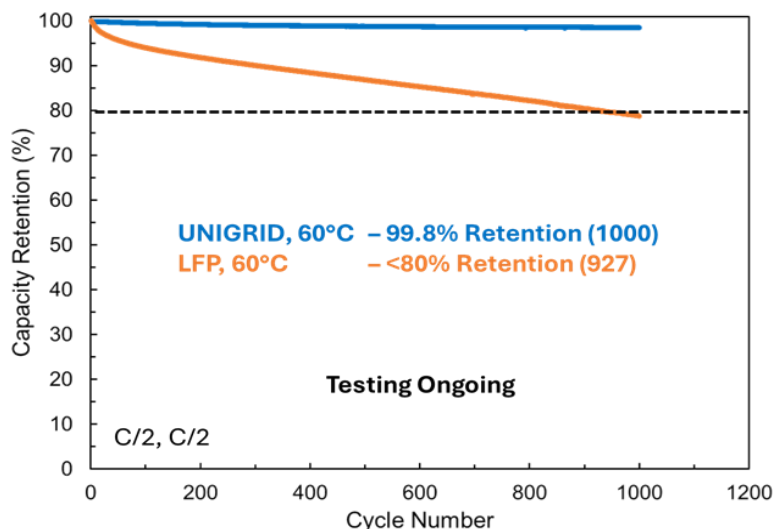


Figure 2. Cycle aging of UNIGRID’s 4 Ah NaCrO₂ 3270 cylindrical cells at 60 °C, compared with 6 Ah LFP Li-ion 3270 cell performance.

From the Volta Foundation’s Battery Report, the U.S. announced 1.3 TWh of battery production capacity, much of this will be underutilized. Na-ion manufacturing should capitalize on this existing underutilized resource.

NaCrO₂: Resilient, Versatile, and Safe Na-ion

UNIGRID, utilizing the foundry model, has scaled to >200 MWh and can further scale to >1 GWh by 2027 to continue to fulfill the ever-growing market demand for Na-ion, projected 10 GWh as of today. Its NaCrO₂ chemistry utilizes abundant chromium, does not undergo thermal runaway until >500°C, has resilient cycle life and calendar life even versus LFP (see Figure 2), can operate over a wide temperature range, thus reducing the need for costly thermal management subsystems. NaCrO₂ is versatile and able to serve ESS, data center, 12 V starter/small mobility batteries, markets where UNIGRID's customers are integrating their batteries into today.

2.3. Alsym

Energy storage solutions require secondary battery technologies that fundamentally align with the demands of the application to maximize customer value. Na-ion batteries excel across multiple dimensions through a superior blend of stability and performance versatility, delivering the design capacity across wide-ranging temperatures and rates over a service life of 15 – 20 years while maximizing the energy available for work relative to the energy stored. The performance metrics of recovered capacity and energy efficiency demonstrate how the fundamental properties of the electrode active materials and electrolytes comprising Na-ion batteries are the chemistry of choice for energy storage applications.^{7,8}

The suitability of Na-ion batteries for the design of energy storage systems is reflected in recovered capacity and energy efficiency, complementary figures of merit that together characterize a system's ability to preserve and efficiently supply energy for work. Recovered capacity describes how much of the batteries' initial capacity remains as confirmed by fully charging and discharging the battery after a period of storage. Energy efficiency compares how much energy is available to do work relative to the energy supplied to the battery during charging. In both cases, values closer to 100% are indicative of a system with minimal chemical and electrochemical instabilities that manifest as wasted energy and increased costs.

Figure 3 demonstrates Na-ion batteries' robust chemical stability by comparing recovered capacity values over a range of temperatures as a function of storage time, with values between 93% and 86% after nearly 175 days at 25 and 60 °C, respectively. These high values of recovered capacity, despite sustained exposure to the very demanding condition of 60 °C at full state of charge, where the battery is pushed past the limits of stability for alternative chemistries, is a testament to the technology's ability accommodate transient high stress events. This stability is conferred by the core materials' properties, as well as their compatibility with one another. In less stable systems, irreversible losses that undermine the recovered capacity can arise from the dissolution and rebuilding of the interphases between the electrolyte and electrodes, as well as from damage to the

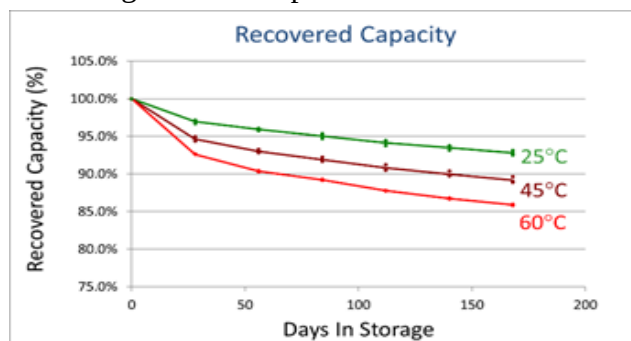


Figure 3 Recovered capacity for a 0.8Ah Na-ion 18650 at 100% state of charge as a function of days in storage at three different temperatures.

cathode or to solvent molecules comprising the electrolyte. The deployment of hard carbon anodes enables the use of electrolyte formulations specific to Na-ion technologies that have superior chemical and electrochemical stability across both high- and low-temperature storage conditions.

By pairing advanced salt and solvent combinations within optimized electrolyte formulations, it is possible to reduce the tendency for oxidative decomposition and the generation of acid byproducts that damage the

⁷ Journal of Energy Storage 74 (2023) 109386

⁸ Large-battery.com/blog/coulombic-and-energy efficiency explained/

electrolyte and consume sodium inventory. Consequently, for Na-ion batteries the system can maintain a high level of recovered capacity to support work the customer depends on, without having to insulate it from challenging environmental conditions or provide engineering supports at increased cost. In addition to Na-ion batteries' high degree of chemical stability, particularly over long periods at high temperatures, the benefits of this stability also manifest in the form of high levels of energy efficiency, improving the value to the customer over the technology's service life.

The energy a cell generates is a product of the charge capacity and the voltage of the cell. When comparing two batteries with the same charge capacity, the one with a higher operating voltage will possess greater energy and capacity to do work. As mentioned earlier, a battery's energy efficiency is the ratio of the energy produced during discharge over the energy supplied during the charging phase. High levels of energy efficiency imply low levels of heat dissipation, or wasted energy, which may arise if the Na-ion's ability to migrate between electrodes is frustrated by insulating or restrictive pathways.⁹ Figure 4 shows that the energy efficiency for a Na-ion battery remains over 95% for 2,000 cycles, demonstrating that virtually all the energy used to charge the battery is returned for productive work during the subsequent discharge cycles. By comparison, lead-acid batteries operate near 80% efficiency with flow batteries in the range of 65 – 85%.

Here, as for recovered capacity, this performance results from intrinsic advantages of Na-ion batteries. Not only are stable and highly conducting interfaces formed as a consequence of optimal chemistry, but so too are they maintained over many cycles, indicative of significant mechano-electrochemical stability. On a local level, the cathode and anode active materials deployed for Na-ion batteries experience very low levels of volume change during cycling. This mechanical stability ensures that the interfaces between the electrolyte and the electrodes remain intact. Ongoing side reactions are thereby avoided, preventing the formation of thicker, more resistive interfaces that would otherwise inhibit charge transport and cause heat generation and energy loss.

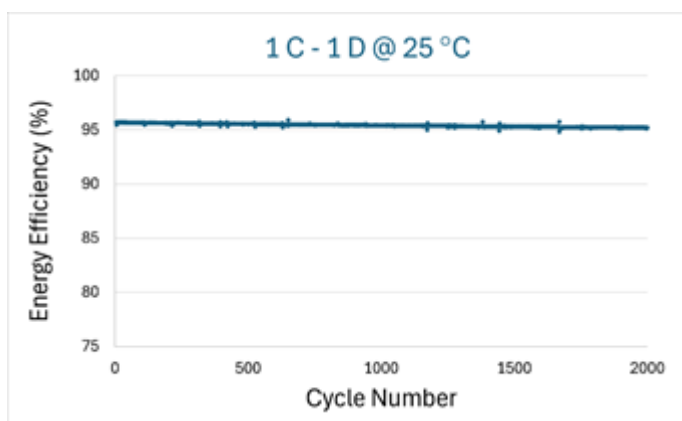


Figure 4. Energy efficiency vs. cycle number for a 20 mAh Na-ion pouch cell comprising a NFPP cathode and hard carbon- based anode.

On a macro-level, the dimensional stability imparted to the electrodes by the synergistic active and electrolyte materials properties extends to the electrodes' electronic and ionic conduction pathways. By limiting mechanically induced distortions to these networks, coherent interfaces provide facile transport of charge carriers over the service life of the battery. In practice, these networks avoid polarization effects that depress the working voltage, thereby reducing the work that can be done with a given amount of stored charge. Preserving these highly conducting networks allows customers to access the intrinsic long-term performance of the Na-ion battery's electroactive materials, maximizing value over the system's lifetime.

Advanced materials specific to Na-ion batteries coupled with their intrinsic stability and chemo-mechano-electrochemical compatibility are the ideal technology for diverse energy storage systems due to their ability to sustain high levels of performance in a manner optimized for value. Na-ion batteries meet critical performance requirements across wide temperatures and rates, enabled by

⁹ [Ecoflow.com/us/blog/battery-internal-resistance-power](https://www.ecoflow.com/us/blog/battery-internal-resistance-power)

stable and highly conducting networks inherent to the core chemistry and the benefits conferred to the cell level. As a result, durability and reliability are accomplished by design rather than by a multitude of engineering trade-offs. Na-ion batteries' fundamental performance and value proposition provide natural and strong alignment with existing and future demands of the energy storage market.

2.4. Mana Battery

Mana Battery, Inc. was founded in 2023 by a team of battery industry veterans from Tesla, Solid Power, and other significant Western battery companies. Mana is commercializing a Na-ion battery cell technology platform that enables the highest energy-density Na-ion cells, alongside electrolyte molecules and formulations that are tailor-made for Na-ion chemistry. Lower cost battery cells made in the West and free from the impacts of geopolitical tensions are sorely needed to increase supply chain security and to reduce the cost of battery cells

enabling energy storage systems (ESS) for a resilient electricity grid, uninterruptible power supply (UPS) for datacenter and industrial applications, defense batteries, and mobility batteries. Mana has two main product lines, which can be produced domestically with a fully non-FEOC supply chain: 1) a proprietary high-energy "anode-free" Na-ion battery cell design that is enabled by Mana's cell design elements and electrolytes, and 2) safe, proprietary liquid electrolytes for Na-ion batteries that use conventional hard carbon anodes. The company develops and produces both technologies jointly with its partners, with initial manufacturing efforts taking place in the United States.

The primary customers for Mana's electrolyte will be non-Chinese battery cell manufacturers. Mana has demonstrated strong market pull for its electrolyte in battery cells for 4-8 hour duration grid energy storage systems, with conditional Memoranda of Understanding (MOUs) signed with 5 customers in the US, Europe, and India. These relationships represent combined off-take of >20,000 metric tons per year by 2029, valued at >\$100M/year and increasing rapidly beyond 2030, and positioning the US as a global exporter of leading battery technology. Mana is producing multi-kilogram batches of its electrolyte, scaling to 100-kilogram batches in 2026 and metric ton-scale batches in 2027. To-date, Mana has demonstrated improved lifetime across a range of temperatures and improved safety in state-of-the-art Na-ion cells (with a hard carbon anode) using Mana

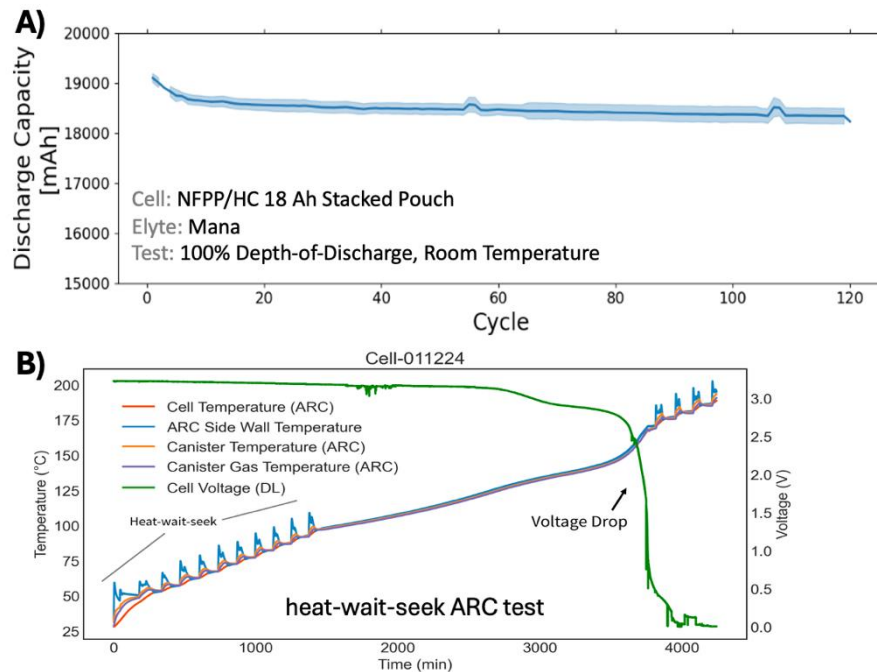


Figure 5. A) Cycling performance of 18 Ah NFPP/HC cells containing Mana electrolyte matches Mana's 1 Ah cell demonstrations, which project to >10,000 cycles to 90% capacity degradation. C) Representative ARC testing data in 18 Ah NFPP/HC cells with Mana electrolyte, showing no flame, no thermal runaway, and 10x lower self-heating rate compared to the same cells with Chinese electrolyte.

electrolyte technology. For example, in 18 Ah battery cell accelerating rate calorimetry (ARC) tests, completed in partnership with a ESS manufacturer, Mana's electrolyte enables Na-ion cells that do not undergo thermal runaway and have a 10x lower self-heating rate when compared to the same cells using a state-of-the-art Chinese electrolyte (Figure 5). Mana's electrolyte technology enables highly safe ESS with low operations and maintenance cost through its wide temperature window and cell-level safety, leading to competitive domestic ESS technology and application of ESS in urban areas.

The primary customers for Mana's anode-free cell include battery manufacturing and device OEM's (including defense contractors, energy storage system manufacturers, and automakers). Mana is negotiating joint development programs with multiple non-FEOC partners, including Tier 1

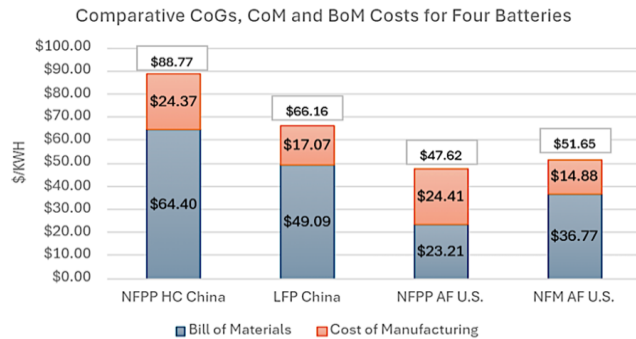


Figure 6. Mana's battery cell cost model predicts a domestically manufactured <\$50/kWh anode-free sodium-ion battery cell cost at scale. This model was validated against a Tier 1 OEM model.

manufacturing of the cell and materials (vs. \$66/kWh for made-in-China LFP), which has been validated against external models, including a US-based Tier 1 ESS and automotive manufacturer. Mana has shown that the proposed anode-free cell designs can achieve a <\$25/kWh BOM cost at scale (Figure 6). All material processing and cell assembly for these calculations is assumed to take place in the US, including cathode synthesis.

Mana has shipped anode-free Na-ion cell prototypes to the US Army, defense contractors, Tier 1 battery cell manufacturers, and Tier 1 product OEMs (UPS/ESS, EV), successfully demonstrating compelling performance for small pouch cells that deliver >2,200 cycles in a Department of Energy-

battery manufacturers and product companies, for scale-up into the anode-free cell's markets in defense applications (6T batteries, aviation auxiliary power), UPS/standby batteries (for datacenter, railway, and industrial applications), and electric vehicles. Critically, Mana's manufacturing plan includes production of its anode-free cell technology through manufacturing partnerships, working with experienced battery manufacturers to minimize risk and accelerate the path to scale.

By removing lithium, copper, graphite, and cobalt (and nickel, depending on the cathode), Mana's anode-free cell technology enables a projected \$48/kWh cell-level cost with US

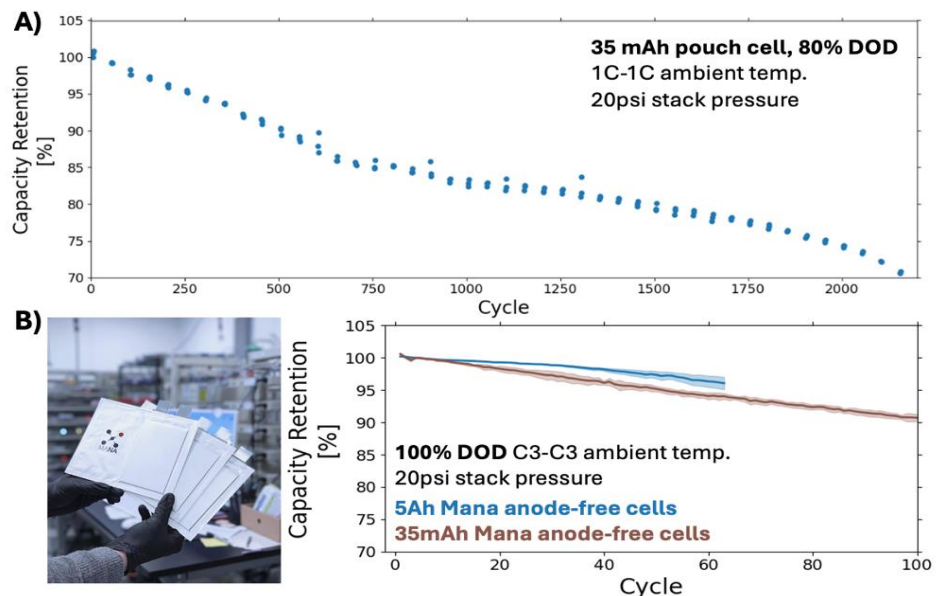


Figure 7. A) Cycling performance of small prototype anode-free sodium-ion cells in a DOE-developed cycling protocol, achieving >2,200 cycle lifetime. B) Images and performance of 5 Ah anode-free sodium-ion cell prototypes, compared to the same small prototypes in (A).

developed cycling protocol (Figure 7), >85% energy retention when continuously operating at -40°C, >80% capacity retention at 4C continuous discharge, and fast-charge at room temperature from 0-70% state-of-charge (SoC) in 6 minutes. Unoptimized 5 Ah prototype anode-free cells assembled on a partner's prototype Li-ion manufacturing line delivered >170 Wh/kg and exhibited no thermal runaway to 300°C (overheat test), enabled by Mana's safe liquid electrolyte technology. Mana's internal cell modeling indicates that the proposed cell design can achieve up to 212 Wh/kg and 479 Wh/L in 40+ Ah cells, **beating the global average energy density of LFP Li-ion**. Mana has also produced 5+ Ah anode-free Na-ion pouch cells with contract manufacturing partners. These cells were assembled in March 2026 and initiated testing in April 2026, with initial data shown in Figure 7.

3. Na ion supply chain resources available in the US

3.1. Soda ash reserves, coal suitable for conversion to HC

The two highest-volume feedstocks in a Na-ion cell — sodium for the cathode and carbon for the anode — are both materials in which the United States already holds a structural resource advantage. Soda ash (sodium carbonate, Na_2CO_3) is the universal sodium precursor for the leading Na-ion cathode chemistries in commercial development, including Prussian white analogs, polyanionic phosphates such as NFPP, and layered oxides such as NaCrO_2 and NFM. The world's largest known natural reserves of trona, the mineral feedstock for soda ash, lie in the Green River Basin of southwestern Wyoming, where major producers including Sisecam Wyoming, Genesis Alkali, and Tata Chemicals' Soda Ash Partners collectively generate approximately 12 million metric tons of soda ash per year, roughly a fifth of global supply, and orders of magnitude larger than the volumes a fully scaled domestic Na-ion industry would consume. Critically, US soda ash is recovered from natural trona rather than synthesized via the Solvay process that dominates Chinese supply, conferring a durable cost advantage.

The anode picture is similarly favorable. Hard carbon, the dominant Na-ion anode material, can be produced from a range of domestically available precursors, including biomass such as wood and nutshell, synthetic polymers, and coal and coal-derived pitch. Coal- and pitch-based hard carbons offer attractive precursor economics, high carbon yield, and predictable ash and impurity profiles, and have attracted growing commercial interest as a complementary feedstock to bio-based routes. The United States holds the coal grades best suited to this pathway in abundance, with more than 7 billion tons of demonstrated anthracite reserves concentrated in the Pennsylvania anthracite fields, alongside vast bituminous and sub-bituminous resources across Appalachia, the Illinois Basin, and the Powder River Basin. Anthracite in particular, with its high fixed-carbon content, low volatile matter, and naturally low ash, is a strong precursor for high-capacity hard carbon. Together, the breadth of US sodium and carbon feedstocks places the two largest mass flows in a Na-ion cell on domestic soil and provides a raw-material foundation that no other major battery-producing nation can match.

3.2. Material suppliers

3.2.1. Cathode

The cathode is the single largest cost contributor in a Na-ion cell and the primary determinant of cell-level performance: it sets the practical ceiling on energy density, working voltage, cycle and calendar life, rate capability, and thermal stability, and the rest of the cell — electrolyte formulation, anode pairing, and pack architecture — is engineered around it. Three families of Na-ion cathode chemistries are advancing toward commercial scale today, each with a distinct application fit. Prussian white and Prussian blue analogs (PBAs) offer the lowest material cost and rely exclusively on earth-abundant precursors. Polyanionic compounds, including sodium iron phosphate pyrophosphate (NFPP), $\text{Na}_3\text{V}_2(\text{PO}_4)_3$, and related structures, deliver excellent cycle life, calendar

life, and intrinsic safety, and are well suited to long-duration stationary storage. Layered oxides, including NaCrO₂, NFM, and copper-substituted variants, deliver the highest gravimetric energy density and are best matched to mobility, defense, and other weight-sensitive applications. The long-term competitive position of US Na-ion cell makers will depend on access to high-performance, domestically produced cathode active material across more than one of these chemistry families.

At present, cathode is the most acute gap in the US Na-ion supply chain. Unlike hard carbon, electrolyte, and balance-of-system components — for which credible US suppliers are profiled in the subsections below — no US company is publicly known to be producing Na-ion cathode active material at commercial scale. The recent wind-down of Natron Energy ended the most visible publicly disclosed US cathode effort, and global supply of Na-ion cathode active material is now overwhelmingly concentrated in Chinese producers tightly aligned with Chinese cell makers. US Na-ion cell developers, including the companies profiled in Section 2, are consequently forced either to synthesize cathode in-house at sub-scale or to import active material, with both options carrying cost, capital, and supply-security penalties that compound as production volumes rise. Closing this gap is therefore among the highest-leverage near-term priorities for the US Na-ion industry. The precursors required for all three leading cathode families, soda ash, iron, manganese, and phosphate, are abundantly available domestically, as described in Section 3.1; existing US LFP cathode synthesis lines can be reconfigured to produce NFPP and related polyanionic Na-ion cathodes with relatively modest retooling; and US-developed direct-recycling routes from end-of-life LFP to NFPP cathode (Section 5) offer a longer-term, low-cost feedstock pathway that is uniquely available to US producers. Establishing one or more US Na-ion cathode producers would unlock the cost trajectory and scaling pace of the cell makers profiled in Section 2, anchor the recycling pathway described in Section 5, and capture the highest-value, highest-IP step in the Na-ion supply chain on domestic soil.

3.2.2. Hard Carbon

Ingevity is a publicly traded specialty materials company headquartered in North Charleston, South Carolina. The company employs approximately 1,500 people across 10 manufacturing facilities and 30 locations worldwide. Ingevity's purpose is to purify, protect, and enhance the world around us through products and technologies designed to reduce environmental impact and support human and planetary health. The company has focused on renewably based solutions for more than 100 years, and in 2023, 79.4% of the raw materials used in its products were renewable.

Performance Materials, Ingevity's largest business segment by revenue, manufactures engineered carbon materials in Covington, Virginia, and Wickliffe, Kentucky, using domestically sourced waste sawdust feedstock. The company has supplied carbon materials, namely activated carbon (AC) structures, to the automotive industry since the 1970s, primarily for evaporative emissions control. Globally, its AC products capture and store fuel vapors that would otherwise be released as pollution, preventing the release of more than 8 million gallons of gasoline vapor per day and enabling those vapors to be routed to the engine. Ingevity has also developed extensive expertise in engineering carbon materials from a wide range of precursors, including wood, nutshell, and coal, using both chemical and physical activation methods to tailor porosity, hardness, particle size and shape, and impurities content for specific applications. Through decades of supply experience with domestic and international OEMs, Ingevity has developed substantial technical expertise and a strong performance record in multiple applications.

Today, the company is leveraging that foundation to introduce an improved hard carbon product, NuCharge™ G3 platform, with enhanced electrochemical performance for next-generation energy storage applications. By utilizing existing U.S.-based manufacturing assets, Ingevity is positioned to

scale production efficiently while contributing to the development of a domestic battery materials supply chain.

NuCharge® G3 hard carbon shows significantly higher electrochemical performance than the leading benchmark from Asia. The comparative benchmark hard carbon is widely used by major Na-ion cell manufacturers, and typically demonstrates a reversible capacity of approximately 300 mAh/g in standard carbonate-based electrolyte. Ingevity's NuCharge® G3 (A) hard carbon can deliver a reversible capacity of ~340 mAh/g, and NuCharge® G3 (B) hard carbon can deliver a reversible capacity greater than 380 mAh/g in carbonate-based electrolyte, corresponding to more than a 13-25% capacity improvement (Figure 8a). The capacity improvement from NuCharge® G3 (B) enables cell manufacturers to save approximately 20wt% of hard carbon usage to deliver the same cell capacity either in commercial prismatic or cylindrical format cell. Furthermore, the enhanced capacity of NuCharge® G3 (B) can lead to a 9–15% increase in cell-level volumetric energy density, depending on cathode chemistry and cell design. Additionally, Ingevity's NuCharge® G3 (B) hard carbon demonstrated an even higher reversible capacity of over 410 mAh/g with a 93% first-cycle coulombic efficiency in ether-based electrolytes (Figure 8a). The performance demonstrates that the hard carbon AAM is compatible with different electrolyte systems.

Across C-rates from 0.05C to 4C, Ingevity's NuCharge® G3 (A) hard carbon consistently delivers ~20% higher capacity than benchmarks (Figure 8b), along with excellent cycling performance either at a moderate C-rate of 0.5C or a high C-rate of 2C (Figure 9) with enhanced materials-level energy densities (>20-25% increase). NuCharge® G3 (B) is currently being tested for cycling and rate performance graphs in carbonate and ether electrolyte chemistries. With the enhanced electrochemical performance, Ingevity is helping U.S. cell manufacturers increase Na-ion cell energy density and pave a pathway to compete with LFP systems. Overall, Ingevity will help U.S. Na-ion cell manufacturers secure a domestic supply of cost-effective, high-performance hard carbon anode.

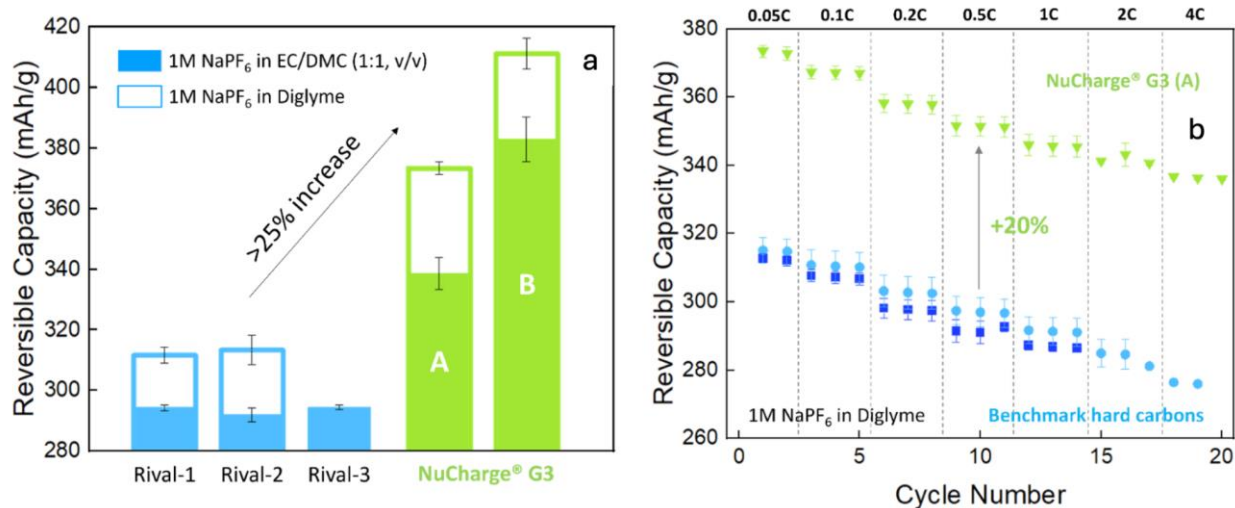


Figure 8^a: 1st cycle reversible capacity (desodiation capacity) of three benchmark hard carbons and Ingevity's NuCharge® G3 hard carbon in carbonate-based (1M NaPF₆ in EC/DMC) and ether-based (1M NaPF₆ in diglyme) electrolyte. Figure 8^b: Rate performance of two benchmark hard carbons and Ingevity's NuCharge® G3 (A) hard carbon in ether-based (1M NaPF₆ in diglyme) electrolyte in half coin cells (note: NuCharge® G3 (B) is currently under testing, and the improvement trend is expected to be consistent with its first-cycle performance)

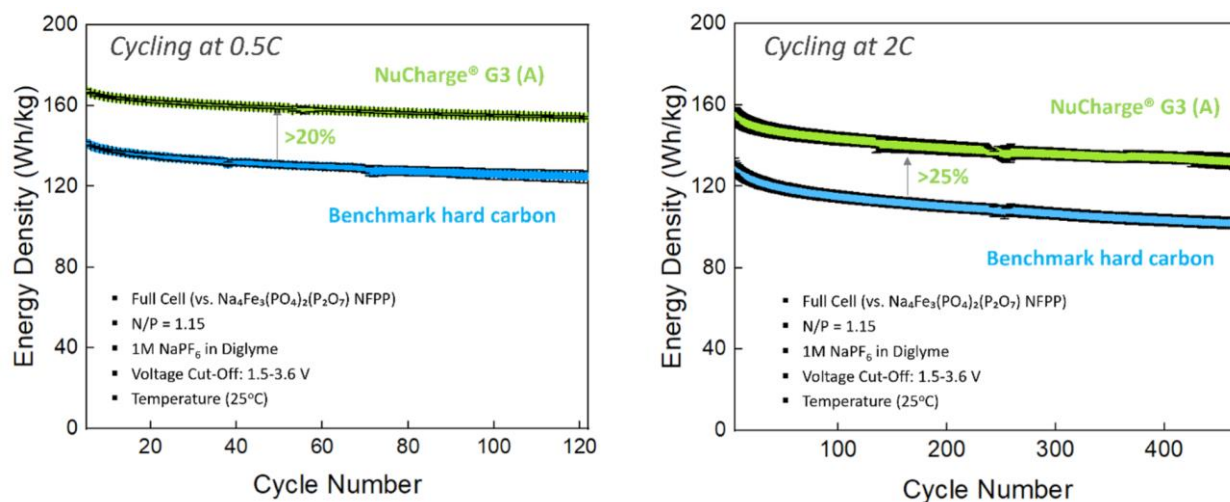


Figure 9: Cycling stability of benchmark hard carbon and Ingevity’s NuCharge® G3 (A) hard carbon in ether-based (1 M NaPF_6 in diglyme) electrolyte in full coin cells with NFPP cathode. The energy density was calculated based on the cathode and anode weight. The NFPP cathode material and cell design were not optimized, so the energy density may be lower than other reported values; however, the purpose here is to demonstrate the full-cell performance improvement when NuCharge® G3 hard carbon is used. (note: NuCharge® G3 (B) is currently under testing, and the improvement trend is expected to be consistent with its first-cycle performance)

Ingevity’s NuCharge® G3 platform combines carbon expertise, renewable feedstocks, and U.S. manufacturing to deliver superior Na-ion battery performance. It enhances capacity, rate, and energy density positioning hard carbon as a key enabler of Na-ion and a viable alternative to lithium.

3.2.3. Separator

The separator is the thin microporous membrane that electrically isolates the cathode and anode while permitting Na-ions to migrate between them through the electrolyte. Its mechanical integrity, thermal stability, wettability, and pore structure are central to cell safety, cycle life, and rate capability. Critically, the separator is one of the few components of a Na-ion cell that requires essentially no chemistry-specific reformulation. The polyolefin-based microporous films developed for Li-ion, including dry-process polypropylene, wet-process polyethylene, single- and multilayer constructions, and ceramic-coated variants, function equivalently in Na-ion cells. This makes separator one of the most mature segments of the US Na-ion supply chain. The United States hosts two of the world’s leading battery separator manufacturers. Celgard, headquartered in Charlotte, North Carolina, has produced dry-process polypropylene and trilayer separators for more than four decades, with US manufacturing assets that already serve major global Li-ion customers and a product portfolio with advanced dry as well as wet-process separators that is directly applicable to Na-ion cells. Entek, headquartered in Lebanon, Oregon, manufactures wet-process polyethylene separators and is substantially expanding its US footprint through a new federally supported manufacturing facility in Indiana. Together, Celgard and Entek give US Na-ion cell makers immediate, scalable access to domestic separator supply across both dominant manufacturing technologies, with no chemistry adaptation required and a clear roadmap for capacity growth as Na-ion production scales.

3.2.4. Electrolyte

The electrolyte is one of the most commercially significant components in a Na-ion battery (SIB). It serves as the medium through which ions travel between the battery’s two electrodes, and it directly

determines how long the battery lasts, how safely it operates, and how quickly it can charge and discharge. Getting the electrolyte right is, in many ways, the central engineering and business challenge of the Na-ion industry.

A Na-ion electrolyte has three components: a sodium salt, an organic solvent, and performance-enhancing additives. The dominant salt today is sodium hexafluorophosphate (NaPF_6). Its rise is as much a supply chain story as a chemistry one — it's closely related to the leading salt used in lithium-ion batteries, meaning existing manufacturing infrastructure can be readily repurposed, lowering production costs and shortening time to market.

Other salts offer performance advantages but come with tradeoffs. Sodium perchlorate performs well in the lab but poses explosion risks that make it commercially unviable. A newer class of salts — NaFSI and NaTFSI — offer strong conductivity but can corrode battery components at higher voltages. Manufacturers are managing this through blended formulations, typically mixing in a small amount of NaPF_6 to provide a protective effect.

On the solvent side, carbonate-based blends dominate commercial products due to their stability, manageable cost, and relatively low toxicity. Ether-based solvents are gaining traction in research settings for their superior performance characteristics, particularly at low temperatures — a meaningful differentiator for cold-climate energy storage markets. Additives, particularly one called fluoroethylene carbonate (FEC), are used to condition the electrode surface during the battery's first charge cycle, forming a protective layer that is critical to long-term cycle life.

The Na-ion electrolyte market is currently an extension of the lithium-ion electrolyte industry. Chinese chemical companies, most notably Capchem and Tinci, dominate production, leveraging their existing lithium-ion manufacturing base. However, because Na-ion electrolytes represent a small fraction of their revenue, these players have little incentive to invest in sodium-specific R&D or push the technology forward. The result is a market where production capacity exists but innovation is stagnant.

This dynamic creates a clear opening for non-Chinese entrants, both on commercial and geopolitical grounds. A small number of specialty companies are moving into the space. Orbia (formerly Silatronix, Wisconsin) and NEI Corporation (New Jersey) are working with battery manufacturers to develop next-generation electrolyte formulations. Mana Battery is pursuing a differentiated approach with a family of novel borate-based electrolyte designed to work with both current hard carbon anodes and Mana's "anode-free" cell architecture. Based on early commercial interest in the electrolyte for both cell designs, Mana is scaling aggressively with a roadmap targeting giga-scale electrolyte production in the US.

The strategic imperative is clear: the gap between laboratory breakthroughs and domestic commercial supply chains needs to be bridged through sustained industrial policy and patient capital. The United States is well-positioned to compete at the frontier. A strong academic research base, including institutions such as MIT, Stanford, University of Colorado, University of Maryland, and UT Austin, is producing advances in the underlying chemistry. Federal funding through the Department of Energy's Vehicle Technologies Office and ARPA-E is supporting sodium-specific programs. Further, the U.S. has the chemical manufacturing infrastructure, intellectual property frameworks, and regulatory environment needed to move discoveries from the lab to commercial production. For investors and policymakers alike, high-performance sodium electrolytes represent both a near-term market opportunity and a longer-term energy security asset.

3.2.5. Modules/Packs/System components

Cells become useful products only once they are integrated into modules, packs, and complete systems with the battery management, electrical, thermal, and safety infrastructure needed to

operate them in the field. This balance-of-system (BoS) layer accounts for a substantial share of delivered system cost and is where most of the integration risk in a new chemistry surfaces. For Na-ion, the BoS layer is in many respects simpler than for Li-ion: the absence of cell-level thermal runaway reduces fire-suppression infrastructure; tolerance of 0–100% depth-of-discharge cycling eliminates derating of the usable energy window; the wide -40°C to 60°C operating range reduces or eliminates active thermal management; and the ability to ship and store cells at 0% state of charge simplifies factory-to-site logistics. Realizing these benefits in practice, however, requires module, pack, and BMS designs that are tuned to the voltage profile, impedance characteristics, and state-of-charge behavior of Na-ion cells, rather than lifted unchanged from Li-ion practice.

The United States has several established suppliers positioned to provide this Na-ion-tuned BoS layer. Nuvation Energy, headquartered in Sunnyvale, California, has more than fifteen years of field-proven experience designing battery management systems for grid-scale and industrial energy storage, with deployments across hundreds of installations worldwide. Its UL 1973 certified BMS product line is explicitly chemistry-agnostic, supporting Na-ion alongside lithium-ion, zinc, nickel-iron, and supercapacitor stacks, and its current-generation G5 platform is targeted at 1500 V stationary energy storage architectures — the architecture toward which most utility-scale Na-ion deployments are converging. Re:Build Manufacturing, through its Re:Build Battery Solutions division near Pittsburgh, Pennsylvania, offers a full-stack US battery integration capability spanning module and pack engineering, custom and ready-to-deploy BMS hardware and software, and the high-volume manufacturing automation required to produce these systems at scale; its 175,000 square-foot Pennsylvania facility, with a planned expansion to 750,000 square feet, gives US Na-ion cell makers a domestic partner capable of taking a cell to a deployable product. Together, Nuvation Energy and Re:Build Manufacturing allow US Na-ion cell makers to source the BMS, module, pack, and system-integration layers of the BoS stack from domestic suppliers, removing one of the most common chokepoints in commercializing a new battery chemistry.

4. Cell manufacturing capability in the US

The battery industry has a long history of research in promising chemistries that never get to quality, volume manufacturing. This section highlights key differences in Na-ion manufacturing which can offer meaningful cost and process advantages.

Importantly, giga scale production is not a prerequisite for cost effective Na-ion manufacturing. For example, the efficiency gap between running four sets of coating lines and a single set is modest and advances in electrode processing technology make even smaller scales increasingly viable. Furthermore, the lead acid industry generally considers practical shipping distances to top out at roughly 750 miles, beyond which logistics costs erode the economic benefits of centralized scale. Na-ion manufacturing is well suited to a distributed, regional model.

Cost reductions can be realized across several areas including dry rooms, building fire protection, electrode processing, and pack BMS requirements. As noted previously, Na-ion is not a monolithic category and multiple chemistries exist. This analysis is intended to illustrate the potential gains available when manufacturing processes are designed around Na-ion characteristics rather than adapted from Li-ion production templates.

4.1. Dry Room Requirements

Dry rooms are expensive. Most Li-ion facilities operate at dewpoints of -40°C ; some solid state batteries are pushing to -60°C . But Na-ion chemistries tolerate - and in some cases actually require - water, making dry room dewpoints of -10°C realistic. The relationship between dewpoint and energy is highly nonlinear and going from -10°C to -40°C doesn't simply mean "more drying", it requires a more aggressive desiccant regeneration cycle, additional refrigeration stages and often multiple desiccant wheels in series.

The economics for less stringent dry room conditions are compelling. When costs including construction (modular versus built in), dehumidification equipment, floor coatings and interlocks are taken into consideration, a -10°C dry room is roughly 60% of the CapEx and 30% of the OpEx of a -40 °C dew point dry room. Over a 1M ft² facility where dry rooms can occupy 25% of the floor space and cost \$750/ft², this translates into a \$75M CapEx reduction and roughly \$5M in annual energy savings.

4.2. Fire Protection

The requirements for fire protection are complex, substantial and not to be taken lightly. Standard sprinkler systems (\$2-3/ft²) are insufficient for Li-ion facilities where a thermal runaway event produces a high intensity fire. But many Na-ion, and their manufacturing processes, are inherently less hazardous and offer the potential for reductions in fire protection expenditures.

Li-ion facilities typically require clean agent, inert gas, or aerosol systems at \$8–12/ft², fire rated separation walls and construction at \$50–100/ft² and epoxy intumescent coatings on structural steel totaling \$6–8M for a 1M ft² factory with 100,000 ft² of steel surface area. Total fire protection budgets for giga scale Li-ion plants commonly reach \$25–30M.

4.3. Dry Electrode coating

Despite skepticism among many, dry electrode coating at manufacturing scale has arrived and in fact, has already been in use for supercapacitors and primary batteries for many years. Multiple companies now sell systems and numerous battery manufacturers are developing them internally for rechargeables.

Wet slurry lines have become gargantuan leading to large CapEx, vast floor space, high ceilings and significant solvent recovery equipment. Tomorrow's Na-ion factories need to be leaner. Dry lines may run more slowly at 40 m/min with a single 300 mm coat width (versus 80 m/min and four 300 mm lanes), but the economics are compelling with 50% lower CapEx and 80% lower OpEx (excluding labor) for equivalent output. That more than offsets the added labor and logistics of running eight dry systems instead of one giga wet slurry line. With calendaring already integrated into the dry process and single lane coating eliminating slitting, the overall operational footprint and complexity shrink further still.

4.4. Pack Design and System Integration

With no thermal runaway, lower internal resistance and tolerance to full 100% cycling, Na-ion cells afford simplified monitoring and passive thermal management lowering costs and increasing overall pack energy density.

Li-ion battery packs typically require active liquid thermal management systems (pump, reservoir, heat exchanger, coolant lines, and associated controls) to support fast charging and manage degradation to improve lifetime economics. A Li-ion EV pack thermal management system adds approximately \$400 and 30 kg. A Na-ion pack BMS, using passive cooling with a fan, simplified cooling plates and reduced thermal interface material, is estimated at \$50 and 10 kg. For BESSs, where 10-20% of the total cost is fire protection and thermal management, these savings become very significant.

With the potential for long lifetime at full 0-100% DoD cycling, Na-ion battery packs afford increased effective energy density versus Li-ion packs which use about 80% during standard use and 90-95% when pushed for extended range. This doesn't completely offset lower density at the cell level, but it does close the gap significantly.

5. End of life/Recycling

As Na-ion batteries scale toward commercial deployment, responsible management of end-of-life cells becomes an increasingly important priority from both environmental and regulatory perspectives. Spent Na-ion cells contain approximately 29 wt% valuable metals, 26 wt% carbon materials, 12 wt% flammable liquids, and 2.4 wt% fluorine substances.¹⁰ If improperly landfilled or incinerated, these materials pose fire hazards, toxic gas emissions, and potential soil and groundwater contamination. As a result, developing robust and cost-effective recycling pathways is essential to ensure long-term sustainability and remain in step with evolving battery stewardship regulations.

The central challenge for Na-ion recycling is economic. Li-ion battery recycling can be profitable when spent cells contain high-value metals such as lithium, cobalt, and nickel that command strong recovery revenues. Na-ion cells deliberately replace these scarce elements with earth-abundant, low-cost alternatives (sodium, iron, and manganese) which are the source of their manufacturing cost advantage but substantially reduce the return from end-of-life material recovery. In mature industrial recycling routes, the material regeneration recycling method is projected to yield only \$2.36 per kg per cell in revenue against \$2.10 per kg in processing costs, representing a profit margin of just \$0.26 per kg per cell. Elemental extraction routes fare no better: theoretical revenues of \$2.68/kg collapse to \$1.03/kg in practice, often insufficient to cover process costs of \$2.40–\$3.40 per cell.⁴ This economic reality places a premium on recycling processes that minimize chemical inputs, energy consumption, and capital cost while maximizing material recovery rates. Academic examples of potential routes include water-based Na-ion cathode regeneration¹¹ and HC regeneration,¹² as well as conversion of spent LFP cathode to NFPP cathode.¹³

While the process examples included here are in the academic development stage, they do provide some intriguing directions for profitability recycling spent Na-ion cells. The excellent cell level safety demonstrated by US-based Na-ion companies such as UNIGRID and Mana raise the possibility of lower cost spent Na-ion battery transportation and handling, relative to the cost of similar spent Li ion battery logistics. Na-ion safety validation and more thorough economic analysis of direct recycling approaches for Na-ion cells are areas where work at the national laboratories can build confidence that US companies can profitably recycle Na-ion cells.

6. Conclusion

The market opportunity that Na-ion is positioned to address is large, growing, and strategically important. Stationary energy storage, including grid-scale ESS, commercial-and-industrial systems, and data center UPS, is forecast to be among the fastest-growing global energy segments through the next decade, and the lead-acid replacement segments where Na-ion offers a credible technical advantage, including 12 V automotive, small mobility, and telecom backup, add tens of billions of dollars more in annual demand. Vehicles further provide a longer term market opportunity. In each of these segments, Na-ion's combination of wide-temperature operation, de-energized storage and transport, intrinsic safety, and competitive total cost of ownership offer a durable advantage over the incumbent chemistry, and a meaningful share of this demand can credibly be served by a US-anchored industry.

¹⁰ Zhao, et. al., "Recycling of Na-ion batteries," *Nature Reviews Materials*, **8** (2023) 623-634, <https://doi.org/10.1038/s41578-023-00574-w>

¹¹ Hao, et. al., "Water-induced integrated regeneration of cathode materials from spent Na-ion batteries," *ACS Nano*, **19** (2025) 4496-4504, <https://doi.org/10.1021/acsnano.4c13941>

¹² Li, et. al., "Degradation mechanism and direct regeneration of hard carbonanodes from spent 75 Ah Na-ion batteries for large-scale energy storage," *Energy Storage Materials*, **84** (2026) 104824.

¹³ Xu, et. al., "Integrated process of CO₂ sequestration and recycling spent LiFePO₄ batteries," *Energy Storage Materials*, **60** (2023) 102819.

The companies and supply-chain capabilities profiled in this paper demonstrate that the foundation for that industry already exists in the United States. American firms are advancing differentiated Na-ion chemistries across every major commercial family with production scaling from megawatt-hours today toward gigawatt-hour annual output before the end of the decade. The country has the world's largest known natural reserves of soda ash, abundant domestically available precursors suitable for hard-carbon conversion, leading domestic suppliers of hard carbon, separator, electrolyte, battery management systems, module and pack integration, and a Li-ion manufacturing base that can be repurposed to Na-ion at substantially lower capital intensity than greenfield construction. Government support for this transition will enable US-base Na-ion cell manufacturing to occur at the pace needed to supply market needs and capture market share. Another acute remaining gap, as discussed in Section 3, is in midstream materials processing, most visibly production of Na-ion cathode active material and electrolyte at commercial scale. Closing the cell manufacturing and midstream gaps are the highest-leverage near-term actions available to the US Na-ion industry and its public-sector partners.

The United States possesses in abundance all needed natural resources to manufacture Na-ion batteries, but midstream processing of active cathode, anode active material, and electrolyte has lagged behind due to limited domestic demand and higher upstart cost. **Federal investment in midstream materials processing and cell manufacturing capacity will enable American leadership in this fast-growing sector and place the United States in a leading competitive position** as China simultaneously scales up Na-ion production. The time for action is immediate, as Chinese players are rapidly deploying scale and pivoting production of energy storage products built around Na-ion. America's window to compete is open, and it is time to seize the natural advantage.

The Abundance Advantage

Leveraging Sodium to De-risk the American Battery Supply Chain and Secure America's Energy Future

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Brings more than 20 years of experience in carbon material development and commercialization across a range of downstream applications and markets. He currently leads commercialization of Ingevity Corporation's Energy Storage Platform as Business Development Manager, where his portfolio spans hard carbon anode materials for sodium-ion batteries, multiwall carbon nanotube (MWCNT) conductive additives, and silicon-carbon composite anode materials. Prior to his commercial role, BP held technical and innovation leadership positions at Ingevity and MeadWestvaco spanning activated carbon, adsorbed natural gas storage, and engineered carbon materials. BP holds a Ph.D. in chemistry and an M.B.A. from the University of Michigan's Ross School of Business.

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President of R&D at Alsym Energy. He has over 15 years' experience in the field of energy storage, involving new materials discovery as well as manufacturing process and device development. Following a PhD in Physical Chemistry from the University of Muenster, Germany, David's career began at Ilika Technologies, UK, where high-throughput materials discovery was leveraged to enable thin film solid state battery development. Later he contributed to the design and initiation of a bulk solid state battery development program. Originally from Connecticut he returned to the US, working at A123 Systems' R & D facility in Massachusetts, supporting a number of new battery development programs while transitioning from senior technical to director-level roles stemming from his interest in aligning materials' fundamentals with application requirements.

Edward McGlone:

At the epicenter of energy, transportation, and innovation, Edward McGlone has transformed organizations and built impactful coalitions to challenge the status quo. Pairing political acumen, policy expertise, and a canny knack for strategy, Edward has opened new markets for companies, passed landmark legislation, and built policy-oriented strategies that grow revenue and improve political standing. Edward is currently Vice President for Government Affairs at Peak Energy and Vice Chair of the American Battery Leadership Coalition, an emerging organization working to ensure that sodium-ion batteries become a core pillar of America's energy, storage, manufacturing, and national-security strategy.

Bill Orabone:

Has forty years of experience in design, engineering, production, sales, and the business of batteries spanning from nickel metal hydride to lithium ion and lithium polymer to sodium ion. He has founded and sold two US battery manufacturing companies, designed and launched over 15 battery factories across the U.S., Asia and Europe and led a \$100M conversion a U.S. lithium ion factory to sodium ion production.

Heather A.S. Platt:

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