



Project Title: Plasma Low-cost Ultra Sustainable Cathode Active Material (PLUS CAM)

FOA Area of Interest 12

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Glossary

Acronym	Definition
AA	After Award
ANL	Argonne National Laboratory
AM	Additive Manufacturing
AOI	Area of Interest
APQP	Advanced Product Quality Planning
AS	Aerospace
BCE	Battery Center of Excellence (6K R&D facility in North Andover, MA)
BoM	Bill of Materials
CAM	Cathode Active Material
Co (or C)	Cobalt
CO ₂	Carbon Dioxide
CoGS	Cost of Goods Sold
COR	Contracting Officer's Representative
DEI	Diversity, Equity, and Inclusion
DEIA	Diversity, Equity, Inclusion, and Accessibility
DLA	Defense Logistics Agency
DOD	Department of Defense
DOE	Department of Energy
DV	Design Validation
ESG	Environmental, Social and Governance
EV	Electric Vehicle
Fe	Iron
FMEA	Failure Mode and Effects Analysis
Gen	Generation
GHG	Greenhouse Gas
GWh	Gigawatt/Hour
ISO	International Organization for Standardization
IT	Information Technology
JDA	Joint Development Agreement
JV	Joint Venture
LCA	Lifecycle Analysis
LFP	Lithium Iron Phosphate

Acronym	Definition
LMFP	Lithium Manganese Ferro Phosphate
LMO	Lithium Manganese Oxide
LNMO	Lithium Nickel Manganese Oxide
MJ	Mega joules
NC	North Carolina
Ni (or N)	Nickel
NMC	Nickel, Manganese, Cobalt
NV	Nevada
OEM	Original Equipment Manufacturers
ONE	Our Next Energy
PD	Production Design
PI	Principal Investigator
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
PMO	Project Management Office
PMP	Project Management Plan
QC	Quality Control
QMS	Quality Management System
R&D	Research and Development
RCA	Root Cause Analysis
SBIR	Small Business Innovation Research Program
SMART	Specific, Measurable, Achievable, Relevant, and Timely
SOP	Start of Production
SVP	Senior Vice President
Ti	Titanium
tpa	tonnes per annum
TS	Technical Standard
VP	Vice President
WBS	Work Breakdown Structure

1. Project Overview

High volume plasma production of cathode ready to replace dirty co-precipitation
Enabling domestic production of cathode AND on-shoring of feedstock supply chain

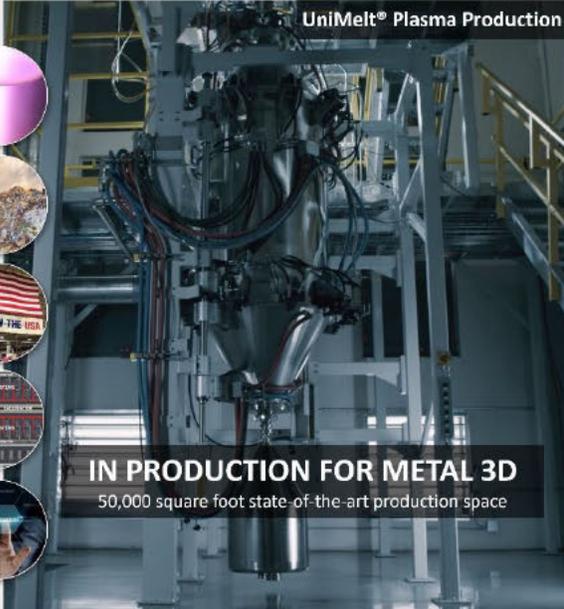
DRAMATIC COST REDUCTIONS
95% FASTER = 50% to 60% reduction in processing cost

NEAR ZERO ENVIRONMENTAL IMPACT
Zero solid/liquid waste, 90% less water, 70% less GHG

COMPETING WITH CHINA HEAD-TO-HEAD
On-shore production at a lower cost than China

CATHODE READY FOR SCALE UP
Premium single crystal cathode meeting spec now

FUTURE PROOF TECHNOLOGY
Chemistry agnostic: deploy future-proof flex-chem plants



UniMelt® Plasma Production

IN PRODUCTION FOR METAL 3D
50,000 square foot state-of-the-art production space

Figure 1-1 – UniMelt plasma production technology is fully scaled, in production, lower cost production than coprecipitation AND dramatically lower impact to the environment, two requirements for repatriation to the US.

a) Background

6K was founded by Dr. Kamal Hadadi who spent 12 years at MIT's Plasma Science and Fusion Center. 6K (previously Amastan) has spent more than 13 years and over \$120 million dollars designing, building, and commercially deploying the UniMelt® microwave plasma technology.

It is the world's only plasma production system capable of high-volume production of low cost, sustainably produced engineered materials, including EV-quality materials. The platform leverages a highly uniform thermal 6,000-degree Kelvin profile in a high throughput production zone (3 inches by up to 8 feet) and a highly reactive plasma environment that forces reaction completion in fractions of the time of conventional processes. Smaller footprint, lower capital expense (CapEx), lower conversion costs, and major reductions of GHG are all core attributes.

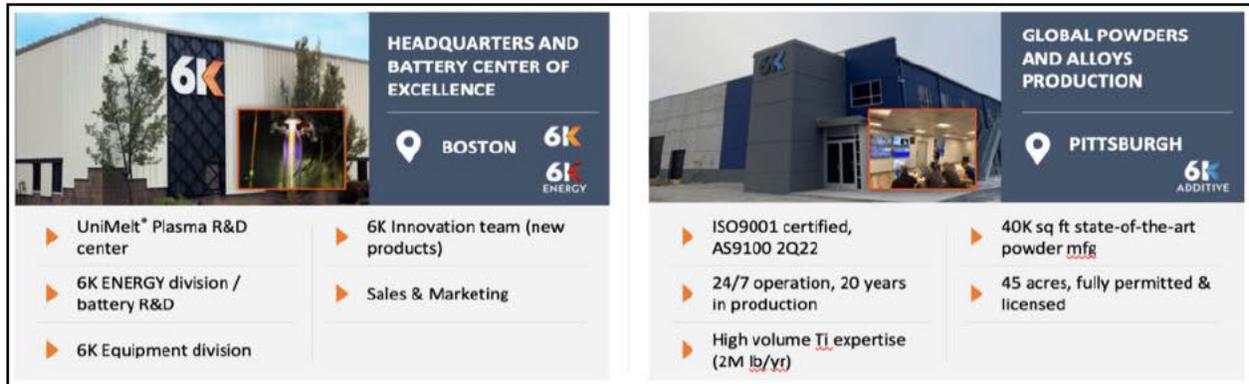


Figure 1-2 – 6K received its first private investment in 2014, has grown to 150 people, and commercialized the world’s only UniMelt Plasma Production for **highly engineered materials**.

Key milestones that support this goal:

- **High Volume UniMelt production systems have been put in service** with high throughput production zone, high throughput UniMelt, and the associated process technologies, proving the contract manufactured and OEM UniMelt systems can be scaled to meet tens of GWh, with components sourced 100% domestically.
- **Over 10 classes of engineered materials** were produced between 2015 and 2017, including: semiconductor materials, battery cathode, metal 3D powders, phosphors for lighting, solid-state laser materials, transparent ceramics, advanced thermal barrier coatings, and more.
- **6K Additive was launched in 2018** and is the world’s only producer of premium metal powders for Additive Manufacturing made from sustainably sourced feedstocks. They have paved the way to produce battery cathode materials by demonstrating a fully industrialized implementation of UniMelt plasma, running 24 hours a day with high uptime and approximately 90% yield in a 50,000 square foot, ISO9001-certified facility.
- **6K Energy was launched in 2019** and comprises executives and battery technologists from A123, Tesla, 24M, LG, Farasis, Clarios, CAM-X, and other global leaders. Its mission is simple: repatriate lithium-ion battery materials production through advanced plasma production and innovative feedstock sourcing.
- **Government funding has been critical** to the development of 6K’s cathode products, starting in 2018 with a Phase I and Phase II contract administered by the DOE VTO office which demonstrated the ability for plasma-produced NMC622 to match performance specs of commercial-quality materials. A DLA Phase I contract demonstrated the ease of extensibility to higher nickel (90% and beyond).
- **6K can reliably produce premium single crystal cathode materials** which meet or exceed partner expectations for CAM performance. 6K’s materials are currently being testing by dozens of Original Equipment Manufacturers (OEM's) and lithium-ion battery cell producers to ensure 6K produced materials are meeting requirements.

- **6K has built numerous partnerships** in its mission to create a fully US domestic supply chain, including publicly announced Heritage/Retriev for recycling of end-of-life cathode, Albemarle for developing low-cost processes for domestic lithium, and Our Next Energy (ONE) where 6K will supply of cathode for the Aries and Gemini platforms.
- **6K Energy’s \$30M Battery Center of Excellence** (opening in July 2002) is a critical component of accelerating and de-risking this proposed cathode production plant implementation. As an advanced battery product development center, it will have ten pilot scale UniMelt cells, and the ability to validate and verify processes prior to being transferred to the scaled production plant (the subject of this proposal).
- **6K will close approximately \$200M in private funding** (July 2022) to accelerate the deployment of battery materials on domestic soil, and which will provide the necessary cost share for a successful DOE program. 6K’s team and investors are fully committed to the mission to bring cathode production to the United States.

b) Project Goal

6K proposes a 3,000 tpa (3,000 metric ton) demonstration plant as the proof point for scaling its UniMelt production platform for Cathode Active Material (CAM) production in the United States. Plasma production technology leapfrogs legacy coprecipitation technology with proven 6,000-degree Kelvin microwave plasma, an ultra-fast, ultra-clean process demonstrating zero solid and liquid waste, using 90% less water, 70% less energy, while generating 70% less Greenhouse Gas (GHG) for NMC811 with process costs substantially lower than coprecipitation in China.

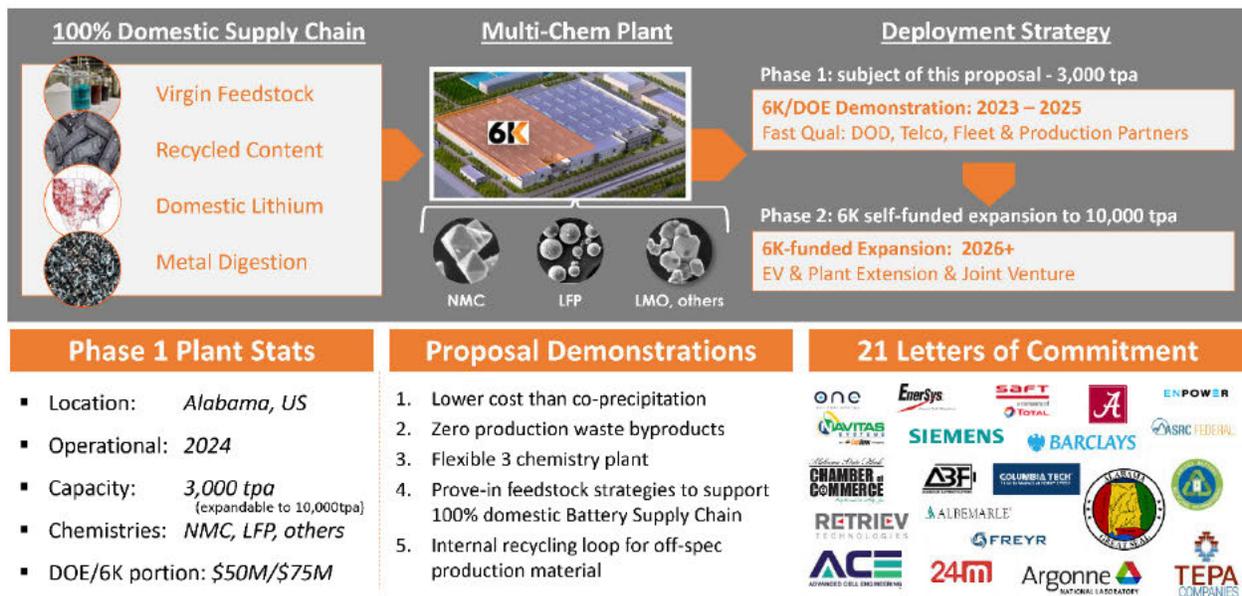


Figure 1-3 – 6K Proposal at a Glance. 6K Primary Project Goal is to demonstrate an economically advantaged and sustainable cathode production capability on US soil based on 6K’s UniMelt plasma production platform.

Note: 6K’s portion in Phase 1, \$75M, includes working capital not part of grant submission.

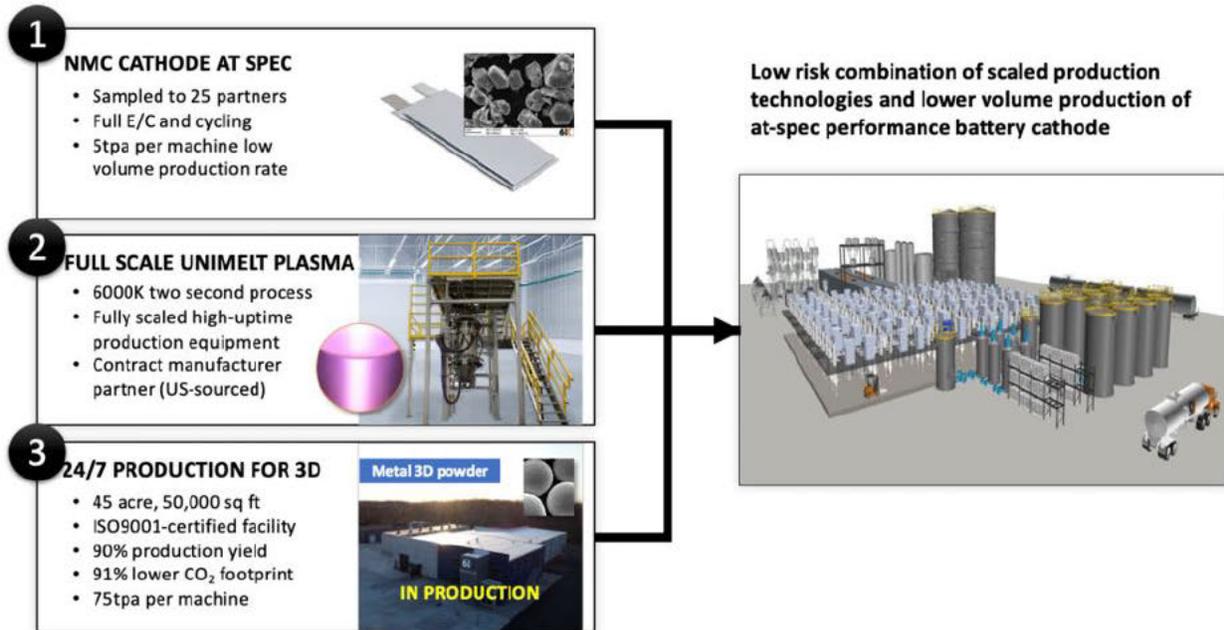


Figure 1-4 – Targeted Improvements. 6K’s PLUS CAM™ plant is a low-risk combination and scaling of three-core proven successes to date that enable the first 3,000 tpa plasma-based cathode production plant.

Targeted Improvements – combination and scaling of known technology baseline

The targeted improvements are specifically the scaled production of at-spec cathode materials using UniMelt production that has been scaled in another volume market. These three foundational areas ensure that the objectives of proposed project can be met with high confidence.

- 1. UniMelt cathode meets customer specifications at pilot production rate (10 tpa):** 6K has demonstrated its NMC cathode viability by meeting all critical specifications for its NMC811 single crystal cathode product, which is being tested by over 20 partners for capacity, power, cycle life, etc., with full cell full depth of discharge cycling trending to more than 1,200 cycles, proving the material can meet customer expectations.
- 2. Fully Industrialized UniMelt Plasma Systems:** 6K has developed and successfully deployed the world’s only microwave-based plasma production UniMelt plasma production system at scale.
- 3. UniMelt Plasma in high volume ISO9001 production plant:** UniMelt has already been deployed in the 6K Additive division for the high-volume production of premium metal 3D powders in a remote, 24 hour 3-shift operation facility, already demonstrating 90% yields, 50-75 tpa with high uptime. The 6K Ni powder has a 91% lower carbon footprint than best competition, high customer acceptance, and is deploying into commercial space, medical, automotive, and industrial applications.

Critical Success Factors for the targeted improvements

To achieve the Project Goal through the advancement of the targeted improvements, the following critical success factors must be achieved:

1. Scaling the Gen 1 UniMelt throughput for cathode production from 10 tpa to 50 tpa for launch, extending to 100 tpa. Note that the 6K Additive production systems are 50-75 tpa today in 3-shift operation running at >80% yield.
2. Implementation of the UniMelt and associated infrastructure and processes to achieve a high uptime (>80%), high plant yield (>80%) output for 3,000 tpa total capacity.
3. Workforce: Hire and train a diverse workforce at wages higher than current local rates
4. Demonstration of the production of multiple chemistries in a single plant with a single UniMelt platform for improved plant utilization efficiency.
5. Implement a viable domestic supply chain for raw material inputs leveraging partners:
 - Digestion of critical metals (Ni, Fe) from domestic sources to produce feedstocks for direct incorporation into 6K's process flow.
 - Demonstration of domestic source of lithium salts with 6K partner Albemarle.
 - Demonstration of cathode produced from recycled nitrate salts from EOL batteries at 75% recycled content in cooperation with 6K partner Retrieval.

c) DOE Impact

1. Proven Plasma Innovation Advantage: DOE funding enables 6K to implement the UniMelt technology in full-scale CAM production, demonstrating that microwave plasma process is superior to coprecipitation, and the basis for future expansion.

2. US Leadership and National Security: project will prove the technology's ability to create a highly competitive domestic cathode plant, which is critical to long term economic competition and battery material independence with China and repatriation of the supply chain. Meeting the goals will enable 6K to supply all DOD programs with 100% domestic content by 2026.

3. Commercial Impacts of Program: 6K's participation in this program accelerates product qualification by commercial and DOD partners, bringing forward the time it takes to launch a revenue generating plant with up to 150 new jobs targeted to disadvantaged communities.

Why is DOE funding critical for 6K's demo plant?

Funding bridges to production scale: 6K has received private funding of almost \$290M by investors. Capital for full-scale demonstration plants is more challenging. DOE support bridges the gap. Once the plant is operational and milestones met, 6K will be able to raise private debt and equity capital to expand and build the next 10-20 GWh and beyond.

Unique and powerful eco-system enablement that increases success: through this DOE grant, it enables and solidifies critical upstream and downstream partnerships that would take longer or be more difficult to lock in. Funding reduces barriers to materials qualification at downstream partners, accelerates introduction into battery supply chain.

d) Equity Plan

Diversity, equity, inclusion, and accessibility (DEIA) principles are incorporated into all aspects of the project in all phases (before, during, and after) as noted throughout the 6K Equity plan. This begins with 6K's site selection criteria that establishes the priority of siting the project

within at least one Disadvantaged Community (DAC) that can benefit from the project. Benefit streams are further described in the Justice40 Initiative section of the Equity Plan. SMART Goals have been established for each budget period and are summarized in a matrix on page 13 of the 6K Equity Plan. The Equity plan identifies specific DEIA and Justice40 Initiative actions and policies for each phase of the project. In all phases, 6K will include the voices of underserved communities and households in the decision-making process. Over time, the project will create up to 150 well-paying jobs. Through education, recruitment, training, and retention initiatives, it is anticipated that at least 40% of the employees will come from DACs and that the workforce will reflect the diversity of the community.

2. Technical Description, Innovation, and Impact

a) Relevance and Outcomes

UniMelt Microwave Plasma Process Technology

6K has developed a flexible, low cost, and highly scalable continuous materials production platform based on its patented UniMelt microwave plasma technology. The use of a microwave plasma provides for a very controlled, uniform, highly reactive, and high temperature reaction zone that enables the synthesis of materials at rates far greater than with conventional methods, and with much greater chemistry and size flexibility. This platform has been deployed to mass production for advanced powders for Additive Manufacturing and is now being applied to the domestic production of battery materials.

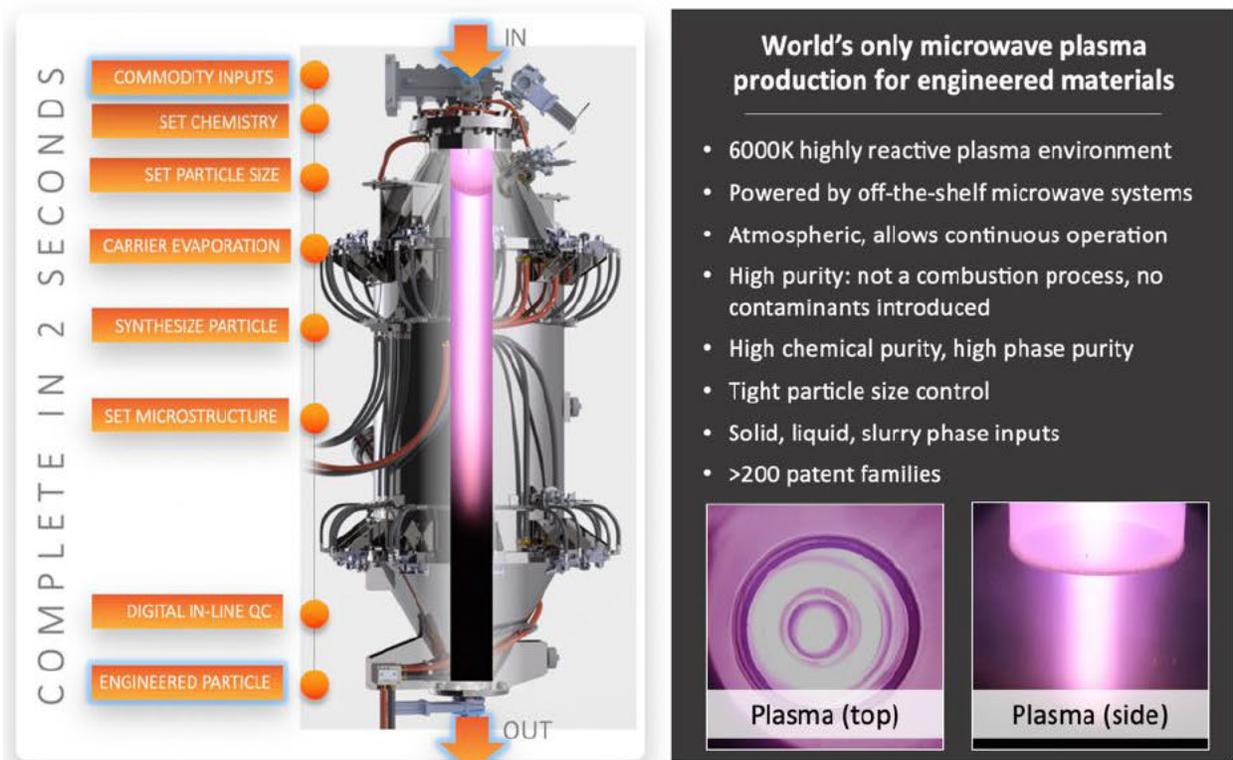


Figure 2-1 – 6K’s UniMelt microwave plasma production system for engineering materials is unique in the materials production industry.

UniMelt a stable and uniform microwave plasma is formed using a gas appropriate to the product chemistry (e.g., oxygen, nitrogen, argon, hydrogen, etc.). A combination of power input and multiple controlled gas feeds are used to tailor the energy content, reaction zone size, and thermal profile to the material being produced. Feedstock containing all necessary elements for the product is fed into the plasma, where any carrier liquids (if present) are quickly evaporated, and the intimately mixed precursor reacts to form the target compound, driven by the high temperature and the reactivity of the ionized species in the plasma. As material leaves the reaction zone and passes farther down the reactor, the microstructure is further developed, controlled by the length and temperature profile of this region. Finally, material is collected either in a cyclone or a baghouse depending on the target material size.

The process takes less than 2 seconds, has a small footprint, and results in exceptionally low conversion costs. Feedstocks are typically aqueous solutions of simple salts, providing tremendous flexibility in formulation chemistry, dopants, etc., however solid feedstocks and slurries have also been successfully utilized. Control of input material size, reaction atmosphere, plasma power, material residence times, and precursor chemistry enable control over particle size, morphology, and microstructure. The flexibility of the technology is demonstrated in Figure 2-2, which contains a sampling of various engineered materials, in addition to battery materials, and particle sizes that have been produced to date, with key examples spanning multiple applications.

Producing cathode battery materials with UniMelt

To produce NMC811 via 6K's UniMelt process, a salt solution containing Ni, Mn, Co, and Li is atomized and delivered to the plasma. The droplets rapidly form a uniform intimate mixture that is converted to the lithium transition metal oxide structure. A final thermal post-process (three hours or less at temperature) completes the crystal development, producing large, uniform single crystal NMC. The final product is a granular powder, and a standard



Figure 2-2 – Sampling of materials produced using 6K UniMelt plasma production system, demonstrating the versatility of chemistry, size, and morphology (microstructure) control.

deagglomeration¹ step is sufficient to produce the free single crystals. The extensibility of this single crystal process has been demonstrated in a DLA Phase 1 program, where single crystal stoichiometry² up to 91% Ni were successfully produced. These two single crystals are shown in Figure 2-3 below.

Objectives Pursued During the 6K PLUS CAM Project

The Primary Goal is to establish and demonstrate a viable cathode production capability on US soil based on 6K's innovative UniMelt Microwave plasma production platform. This will be enabled by 6K's significantly lower manufacturing costs and improved sustainability relative to established cathode production methods like coprecipitation.

In addition to cathode production capability, the Secondary Goal is establishment of a **viable supply of domestic raw materials** for the cathode production process, enabling true energy independence. To that end, a secondary objective of this proposal is to demonstrate viable sources of critical feedstocks via a combination of domestic salt production from existing metal feedstock sources, recycling of EOL batteries as feedstocks, as well as internal process fallout that goes back into the 6K process. 6K partner **Retriev**, and development of existing raw material supply via 6K partnerships with leaders in the space such as **Albemarle**.

When successful, this demonstration project will form the basis for a domestic cathode production capability that frees the US from its current dependence on foreign sources for these materials so critical to the US's energy strategy. 6K is proposing a \$125M³ total project for scaling existing proven processes for a 3,000 tpa flexible chemistry plant.

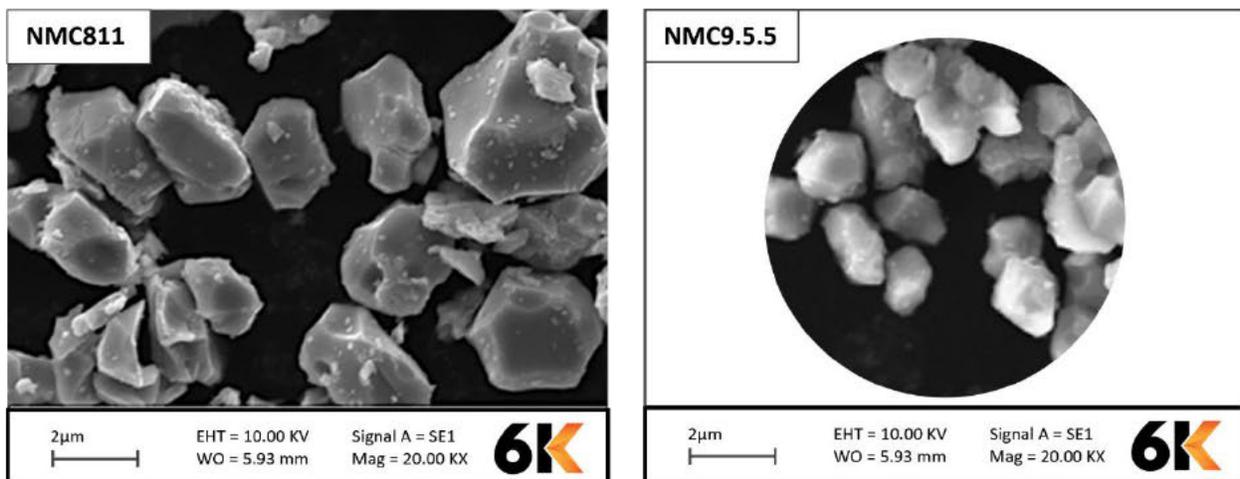


Figure 2-4 – Sampling of uniform single crystal NMC811 (left) and single crystal deagglomeration producing 91% Ni NMC9.5.5 material (right)

¹ Deagglomeration is a size reduction process in which loosely adhered clumps (agglomerates) of powders or crystals are broken apart without further disintegration of the powder or crystal particles themselves.

² Stoichiometry is the relationship between the quantities of reactants and products before, during, and following chemical reactions

³ Includes working capital not included in the grant proposal

The demonstration plant will prove all facets of full-scale UniMelt-based cathode production, including workflows and materials handling, workforce training, feedstock flows, 3-shift operations and more. Following the successful deployment of the plant and meeting critical KPI metrics of yield and uptime, **6K will further self-fund an additional \$50M to expand the plant to a total of 10,000 tpa.** This plant will be profitable and commercially advantaged versus coprecipitation, including versus imported foreign cathode product.

Objectives aligned with the Primary Goal:

1. Demonstrate the efficiency and sustainability of the UniMelt microwave plasma process over conventional coprecipitation processes.
2. Demonstrate the UniMelt system's versatility to create multiple chemistries from a common equipment infrastructure.
3. Demonstrate environmental responsibility of the UniMelt system through reduction of energy and water usage and zero hazardous waste production.
4. Demonstrate support to DACs through the geographical placement of the production facilities and job training.
5. Demonstrate the UniMelt system's ability to achieve initial commercial scale production with a 3,000 tpa output.

Objectives aligned with the Secondary Goal:

1. Demonstrate internal recycling of cathode scrap through digestion and return to process stream.
2. Demonstrate recycled salt solutions from end-of-life batteries in conjunction with 6K partner Retrieiv.
3. Demonstrate Li salt sourcing in conjunction with 6K's partner Albemarle.
4. Demonstrate metal salt production through the digestion of Ni, Co, and scrap steel for iron, building upon previous experience and utilizing existing partnerships.

Relevance of Project to FOA Goals and Objectives

The objective of the *Domestic Battery Cell and Component Manufacturing Demonstration Topic* (Area of Interest 12 (AOI 12)) is to **"accelerate commercialization of innovative manufacturing processes for battery cells, materials, or components that have never been utilized at scale for the electric vehicle (EV) and electric grid market through large-scale pilot demonstration projects."**

- 6K's proposed demonstration plant based on its proprietary UniMelt Microwave Plasma platform directly supports this objective with a volume production demonstration of 6K's innovative materials manufacturing approach that will cost-effectively deliver large-scale critical battery materials at scale for the EV and electric grid markets.

In support of the AOI 12 objective to "...focus on improving cost or performance of commercialized battery chemistries or enabling next-generation battery chemistries":

- 6K will demonstrate how the technology reduces costs through lower capital investment in infrastructure, significant reduction in operating costs, and the elimination of waste disposal costs.

- We will also demonstrate how the same UniMelt production technology can be used to produce multiple battery chemistries, thereby futureproofing the production infrastructure established in part by this grant.

6K's Plasma Technology also directly supports the DOE goal of "ensuring justice and equity, creating jobs, boosting domestic manufacturing, reducing GHG emissions, and advancing a pathway to private sector."

- 6K will demonstrate how the technology reduces energy consumption by 70%, water consumption by 90%, carbon monoxide emissions by 70%, and produces zero liquid/solid waste.
- Our technology advances private sector manufacturing through the creating of domestic manufacturing facilities that will generate a viable, long-term battery chemistry production industry within the United States that delivers products at a more favorable cost than offshore suppliers.

Meeting DOE Technical Targets and Policy Priorities

6K's proposed demonstration directly aligns with DOE technical targets and policy priorities.

- Our UniMelt process is a disruptive technology that will establish a domestic cathode volume production capability at lower production cost than imports from overseas and will do so more sustainably than conventional coprecipitation-based methods.
- The UniMelt technology brings manufacturing diversity to the DOE project portfolio, mitigating risk with its already proven next generation materials production platform.
- Our project builds coordination and partnerships with other battery technologies and suppliers upstream and downstream in the supply chain, increasing chances of a long-term economically successful US battery industry.
- 6K's proposed project will increase high-quality employment and manufacturing opportunities in the United States, and incorporate diversity, equity, inclusion, and accessibility elements with an Equity Plan that focuses on small/minority business, Tribal Nations, and underserved communities. The proposed project targets up to 150 high-quality, high-paying jobs with strong career paths in the battery supply chain to underserved communities. This will expand substantially as 6K expands to 10,000 tpa in its self-funded Phase 2 and builds additional plants in the US.
- The UniMelt process significantly reduces environmental impacts to DACs, allowing environmentally responsible chemical production onshore, fulfilling 6K's commitment to achieve 100% North American sourcing of battery material, eliminating dependency upon foreign entities of concern.

Expected Outcomes

6K expects to successfully demonstrate the UniMelt process in full commercial-scale production, delivering high-quality chemistries at a more favorable cost than offshore suppliers.

Our expected outcomes from this demonstration are:

1. Fully Operational Plant: Construction, implementation, and operation of a domestic revenue-generating cathode plant using UniMelt Plasma production technology
2. Validation of the commercial-scale process:
 - a. Initial production of a of 3,000 tpa CAM plant.
 - b. Space and manufacturing infrastructure to support future expansion to up to 10,000 tpa within the demonstration plant, based on 6K customer demand.
3. Unique Flex-Chemistry: Demonstration of the production of multiple chemistries in a single plant, specifically NMC, LFP, and other chemistries such as LMO, LMFP, etc.
4. Validation of cost-efficiencies achieved with the 6K process.
 - a. 30% lower conversion cost for NMC811 with 6K's Generation 1 (Gen 1) 100 tpa per system process versus traditional coprecipitation methods
 - b. 50% lower conversion cost for NMC811 with 6K's Generation 2 (Gen 2) 400 tpa per system process versus traditional coprecipitation methods.
 - c. Demonstration of an internal recycling loop for cathode production that effectively reduces BoM yield losses to nearly 0%.
5. Sustainability: Demonstration of substantial ESG improvements over conventional coprecipitation of NMC cathode, to be demonstrated at scale and validated by lifecycle analyses (LCA) analyses conducted by team member ANL:
 - a. Major reduction in water consumption, estimated to be up to 90% versus standard coprecipitation plus calcination.
 - b. Improved CO2 footprint, estimated to be a 60-70% reduction versus standard coprecipitation plus calcination.
 - c. Total elimination of liquid waste, a huge issue for coprecipitation, limiting site options for conventional cathode plants which largely dispose of this waste in rivers and oceans.
6. Workforce development: The project will create up to 150 well-paying jobs. Through education, recruitment, training, and retention initiatives, it is anticipated that at least 40% of the employees will come from DACs and that the workforce will reflect the diversity of the community.
7. Domestic Supply Chain: viable domestic supply chain for raw material inputs.
 - a. Digestion of critical metals (Ni, Fe) from domestic sources to produce feedstocks for direct incorporation into 6K's process flow.
 - b. Demonstration of domestic source of lithium salts with 6K partner Albemarle.
 - c. Demonstration of cathode produced from recycled nitrate salts from EOL batteries at 75% recycled content in cooperation with 6K partner Retrieval.

b) Feasibility

Previous Work and Results: Summary

The microwave plasma-based domestic cathode production capability proposed in this document builds upon five years of development activity bringing CAM to scale-up readiness, which in turn draws on over 10 years of experience developing the fundamental microwave plasma technology and bringing it to market at scale producing powders for the Additive Manufacturing market.

6K is now preparing to scale its cathode synthesis capability into production based on these key demonstrations and customer validation points:

#1. Premium NMC811 cathode product meeting customer specification

1. 6K's single crystal NMC811 cathode has been sampled in multi-kilogram quantities to over 20 customers spanning the battery supply chain, from raw material suppliers to OEM's, who have judged the 6K cathode "as good or better than" powder made conventionally.
2. 6K's single crystal NMC811 process consistently produces a uniform, high phase purity powder with low cation mixing that exhibits full expected capacity, rate capability and first cycle efficiency and demonstrated process consistency.
3. Cycle life has been tested extensively by 6K customers, with confirmation that 6K's cathode performs on par with material made by the conventional approach.
4. Extensibility to numerous chemistries (like NMC9.5.5, LMO, LFP, LTO, etc.) gives 6K the flexibility to adapt to market trends toward higher energy stoichiometries⁴, cobalt-free cathode, and true flexible-chemistry production plants – saving hundreds of millions of dollars in CapEx.

#2. Full scale UniMelt production in its 6K Additive division

1. Implementation into a true 24 hour, three-shift operation industrialized setting, incorporating all production and life safety requirements
2. Achieved full customer acceptance, with ISO9001 certification, and adding AS9100 (aerospace) and ISO13485 (medical) later in 2022
3. Proven out UniMelt plasma platform and all associated support infrastructure for high uptime (achieving 80%) and high yield (approaching 90%)
4. Achieved true production outputs of 50-75 tpa (50 tpa is target for **cathode** launch)
5. 6K Additive has effectively built and trained a workforce to run and support production using UniMelt plasma production systems. This was done in a disadvantaged community

⁴ Stoichiometry refers to the relationship between the quantities of reactants and products before, during, and following chemical reactions

NMC811 single crystal cathode product

6K has completed product development of its first cathode product, single crystal NMC811, and validated performance testing with over 20 global partners. Partner feedback consistently states that 6K product made with plasma meets or exceeds that from coprecipitation, today's existing approach.

6K has also developed processes to produce this product on full scale UniMelt equipment at a rate of approximately 10 tpa. The project will scale to 50 tpa ultimately to 100 tpa on Gen 1 and 400 tpa on Gen 2.

The first two graphs below demonstrate 6K's ability to achieve a run rate with high repeatability while delivering materials to industry partners hitting the target capacity. Figure 2-5 shows the consistency of two critical internal key parameters, the first being 6K partners confirming 6K's ability to achieve the target capacity, and the second showing 6K consistency testing of the product for discharge capacity and Li/Metal ratio over a seven-month period of performance.

Customer cycling data proves the material is able to achieve automotive requirements with latitude to tailor material to meet specific specifications based on strategies like doping and size control managed via Joint Development Agreement with a partner. The cell used to capture the data shown in Figure 2-5 was a multi-layer production intent cell and trending to over 1,200 cycles while retaining 80% of its initial capacity.

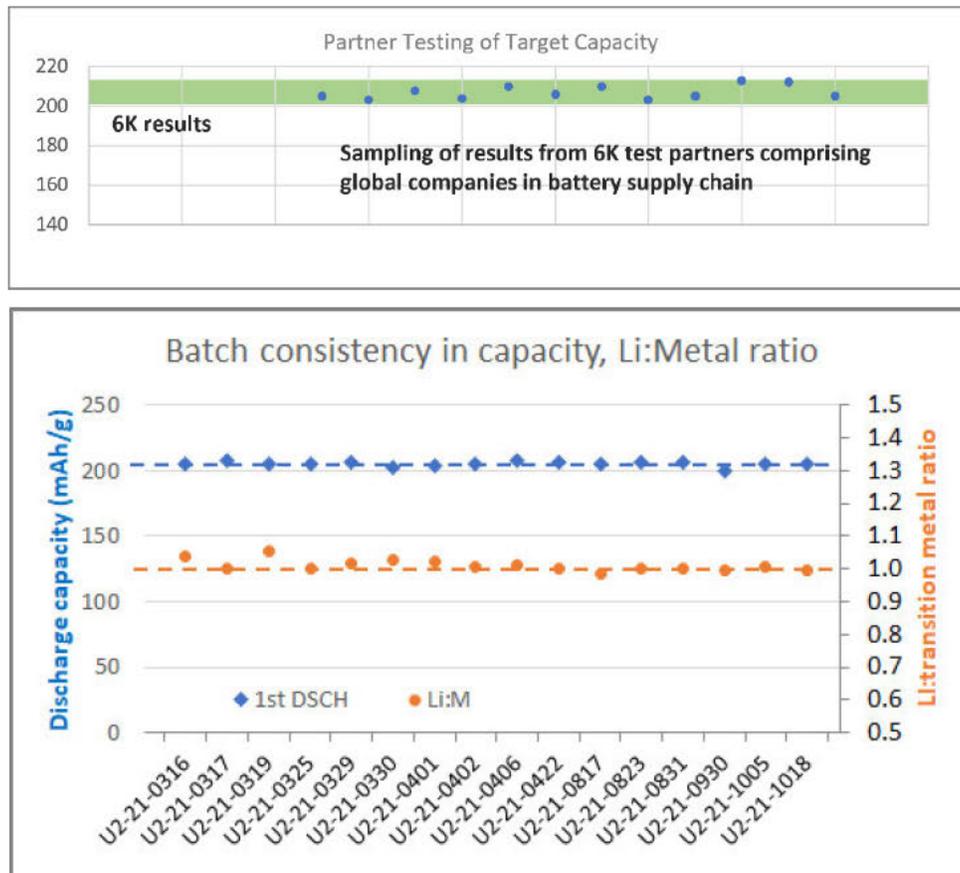


Figure 2-5 – Product consistency and target capacity validated by 6K quality control and verified by partner testing

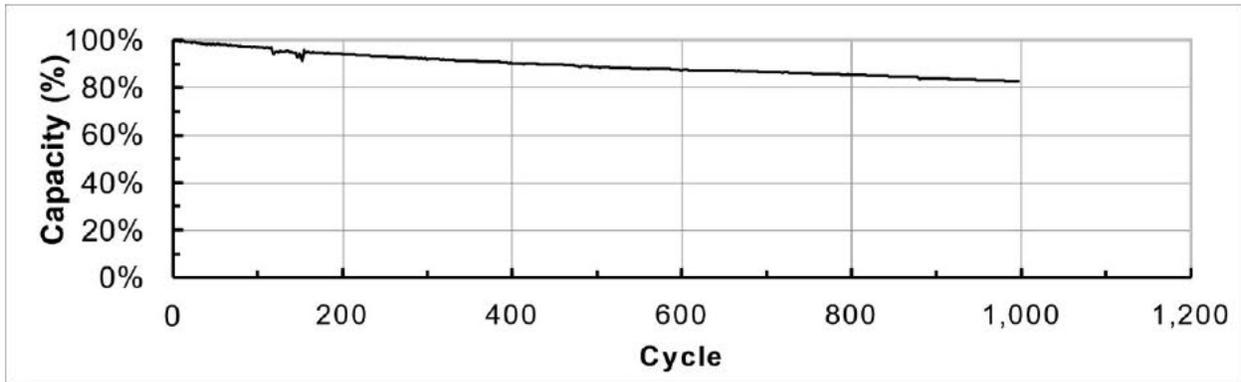


Figure 2-6 – Global cell maker **cycle data** in lithium-ion pouch cells with 6K's (undoped) NMC811 single crystal cathode, performance projected to >1200 cycles @80% retention (on par with their incumbent)

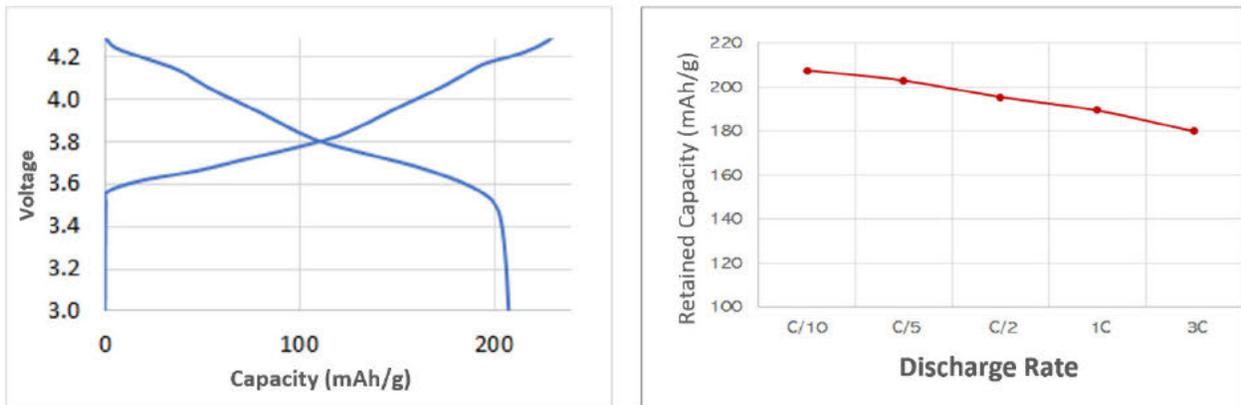


Figure 2-7 – Other examples of critical parameters tracked are voltage charge and discharge and rate performance.

Multi-Chemistry capability provides a future-proof US-based industry



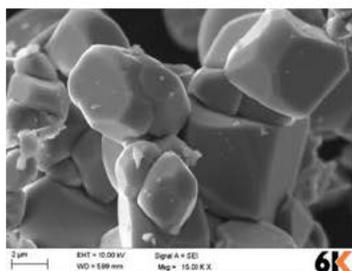
Figure 2-8 – 6K's UniMelt Production is chemistry agnostic and has produced over 15 different battery classes and chemistries, supporting 6K's plan to introduce a multi-chemistry plant, illustrating the ability to flexibly allocate production CapEx to serve market needs as they change.

6K's cathode production technology has unparalleled chemistry flexibility, allowing for multiple chemistries to be produced in the same plant, giving 6K the ability to reallocate production as the market and chemistries evolve over time. This makes 6K's technology nimbler and eliminates concerns over creating stranded capacity.

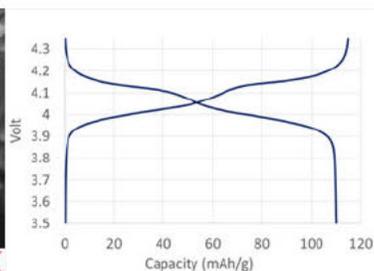
The flexibility stems from the unique way in which material is synthesized in 6K's plasma reactor. Intimately mixed feedstocks are fed into the reactor, with the size of the feedstock, whether solid or liquid, chosen based on the desired final product characteristics. Reactions happen extremely fast (fractions of a second), driven both by the 6,000 Kelvin plasma and by the highly reactive ionized plasma species. Feedstock types (aqueous, solid, and even slurries) and plasma gas(es) are selected to provide the best combination of cost and product characteristics.

Taking advantage of this capability, 6K will produce single crystal NMC, LMO and LFP concurrently within the proposed cathode demonstration plant.

- **LMO cathode:** 6K commenced development activities on LMO in Q4 2021, and **within three quarters** has demonstrated full capacity and efficiency, phase purity, and the ability to dope for high temperature stability, as shown in **Figure 2-9** below.
- **LFP cathode:** 6K is now in active development of its LFP cathode product, and is making similarly rapid progress, currently achieving 85% of target capacity in a desirable spherical morphology. Sampling of 6K LFP is expected to begin in Q4 of 2022.



a.) 6K LMO cathode



b.) 6K LMO voltage profiles



c.) Effect of doping on 45C cycling

Figure 2-9 – LMO cathode produced using 6K's process a.) SEM of single crystal form of LMO, b.) Voltage profile and capacity of LMO produced by 6K, and c.) Effect of doping on elevated temperature cycling performance in accelerated testing demonstrating the successful incorporation of dopants in LMO.

UniMelt Plasma Full Scale Production for premium sustainable 3D metal powders



Figure 2-10 – 6K Additive has proven all aspects of high volume, high uptime production using the UniMelt plasma innovation, including workforce development, 24 hour 3-shift operation, redundancy, and ISO certification.

A critical proof point for this proposal is the existing implementation of UniMelt plasma to deliver a premium product as part of 6K Additive operating division. This accelerates and de-risks the work plan for this proposal by leveraging solved scaling issues.

- Proven the ability to develop, train, and operate a 24/7 workforce for UniMelt plasma
- Worked through infrastructure and supporting equipment requirements for continuous high volume production meeting ISO certification
- Proven UniMelt equipment can operate with high uptime and high yield for premium products to demanding markets (aerospace, defense, auto, etc.)
- Proven a supply chain and developed contracting manufacturing capabilities to domestically source, build, and commission high volume equipment

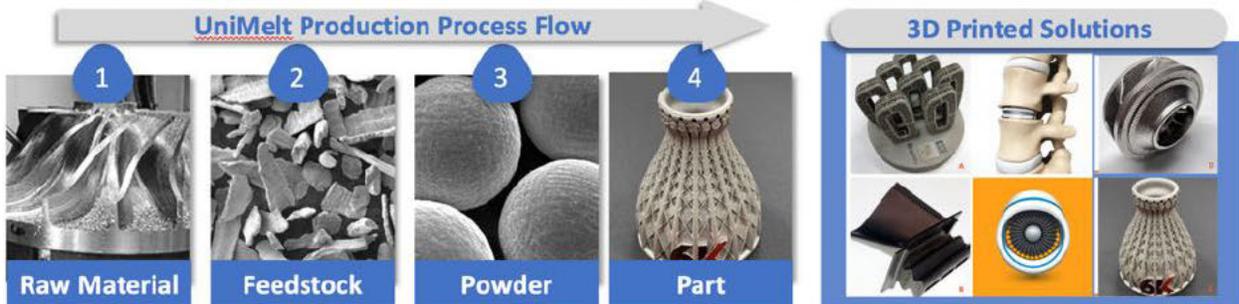


Figure 2-11 – 6K Additive has launched a ground-breaking product enabled by UniMelt plasma, the world’s only sustainably-sourced 3D metal powders. Third Party Life Cycle Assessment proves a 91% lower carbon footprint.

Workforce development

6K will employ its existing staffing model to ensure that DEIA principles are incorporated into all aspects of the project in all phases (before, during, and after) as noted throughout the 6K Equity plan. 6K has built a 45,000 square foot facility in Burgettstown, a borough in Washington County, Pennsylvania, which produces Additive Manufacturing powders for 6K's Additive division. Over a one-year period 6K recruited, hired, and trained a highly diverse team of 40 personnel with varying skillsets and experience levels. This facility has been operational for three years with excellent employee retention and job satisfaction. 6K uses its employee retention program to provide ongoing career growth through technical training and internal advancement programs. The result has been the stable development of a quality workforce with exceptionally low turnover.

6K's site selection criteria for the new production facility prioritizes DAC locations that can benefit from the specific DEIA and Justice40 Initiative actions and policies identified in the 6K Equity Plan for each phase of the project. 6K is currently developing local community partnerships to provide capacity-building and workforce development training, connecting disadvantaged community members to the project through jobs and community benefits.

- 6K has already begun to engage with local community organizations to identify and reach out to local disadvantaged business enterprises (DBEs) that could serve as consultants/contractors/subcontractors.
- With input from the local community, 6K is establishing percentage goals for DBE contractor participation.
- 6K is initiating discussions with local community and technical colleges and universities for curriculum development and career planning for potential job candidates.
- Through education, recruitment, training, and retention initiatives, it is anticipated that at least 40% of the employees will come from DACs and that the workforce will reflect the diversity of the community.

6K will consult with community-based organizations and the community to develop a Community Benefits Agreement and Good Neighbor Agreement with measurable outcomes. 6K will collaborate with local community groups to inform DACs of opportunities for jobs and training and establish hiring goals for underserved populations so that the workforce represents the local community. In conjunction with state and local partners, 6K will seek to provide workforce education, training, apprenticeships, certification, and licensing.

c) Innovation and Impacts

In this section, 6K will compare and quantify the primary advantages of its **UniMelt plasma** innovation versus the **chemical coprecipitation** process used almost exclusively in the industry today. Main components:

1. Number of steps, complexity, and speed of the processes
2. The reduction of process cost by 50%-60%
3. The reduction of impact to environmental factors by 70%-100%

4. The ability to develop 100% domestically sourced feedstocks from a combination of battery recycling, internal recycling loops, domestic lithium, and digestion of metals

Current State of the Art: chemical coprecipitation

The current state of the art for the production of cathode battery materials relies on the traditional coprecipitation plus calcination process.

In this process, a solution of Ni, Co, and Mn sulfates is slowly titrated with base in a large, stirred tank reactor over the course of many hours to coprecipitate a suspension of the mixed metal hydroxide precursor material. Lithium cannot be added at this step because of the vastly difference aqueous chemistry between lithium and transition metal salts.

Upon completion of the precursor particle growth period, the mixed metal hydroxide particles must then be separated from the reaction byproducts by filtration and washed extensively to eliminate residual sulfate and sodium ions, consuming substantial amounts of water and generating massive quantities of waste. Given the limited market and the quantities of sulfate waste, it is **not cost effective to “recycle” the sulfate, and as such it is primarily disposed of by pumping into rivers and oceans.** The salinity this contributes limits the quantities that can be dumped into rivers, and thus greatly constrains site selection for conventional plants.

Once washed, the precursor particles must be dried (consuming energy), sieved, and then dry blended with the lithium source (lithium hydroxide for NMC811.) The blended precursor is then processed in large calcination furnaces (typically roller hearth kilns) in multiple thermal steps that can last 10-16+ hours in total, representing considerable energy consumption. If the material is to be converted into the desirable single crystal morphology, additional processing and firing steps are then required. The net effect is a process that takes multiple days, is energy and water intensive, generates massive quantities of liquid waste, and that today is largely dominated by Chinese suppliers. The need for a domestic production capability to be environmentally responsible, and cost-competitive with Chinese production makes long term viability of the traditional approach in the US challenging.

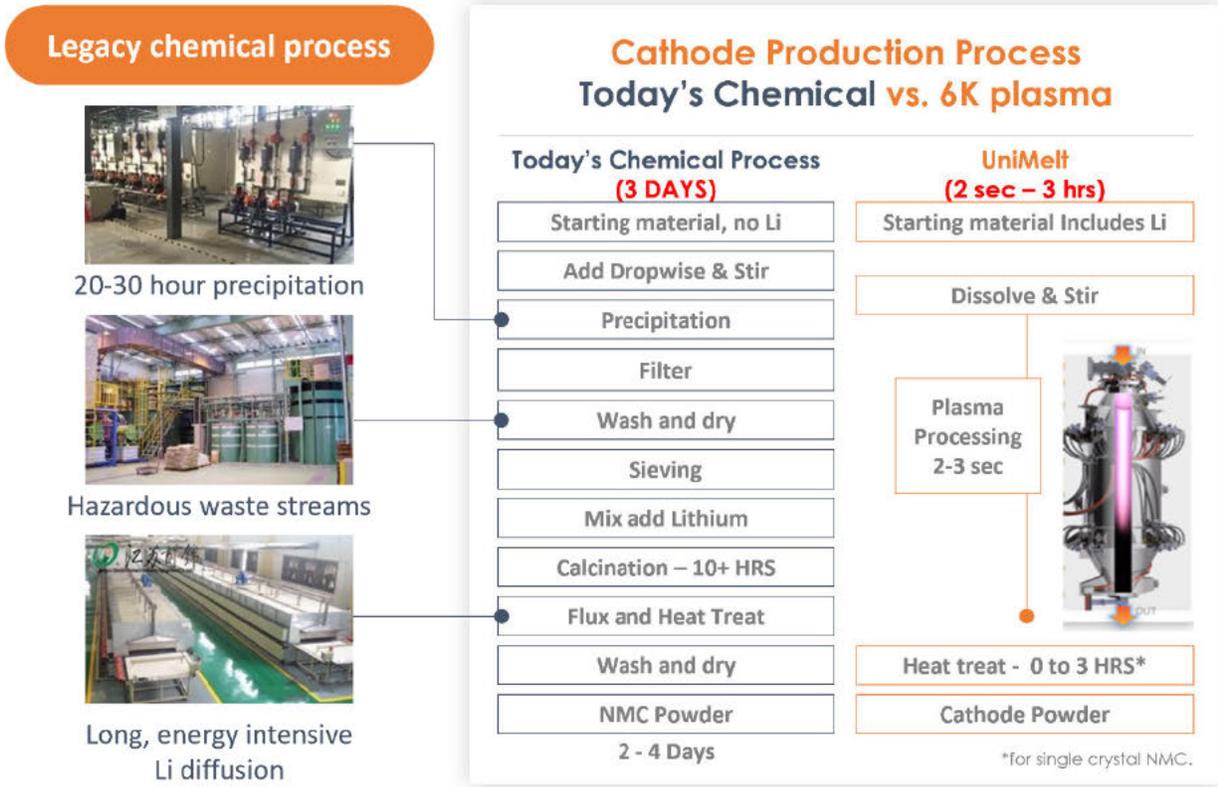


Figure 2-12– Visual representation of legacy coprecipitation versus UniMelt makes it clear how energy, water, waste, and cost are greatly reduced with a transformational solution.

Impact on Advancing the State-of-the-Art: UniMelt plasma for battery cathode

As described above, the UniMelt production process represents a massive simplification relative to the conventional process that is unfettered by the limitations of traditional synthetic routes, reducing what is normally a multiday process down to a few hours. This simplicity and resulting chemistry flexibility allow for the elimination of numerous process steps, reduction of water and energy usage, and complete elimination of liquid waste, at a production cost that is multiple dollars per kilogram lower than the conventional route, without sacrificing product quality, as demonstrated in the feasibility section above. Moreover, the process is not limited to a single chemistry, enabling one 6K plant to make multiple cathode types, and more importantly, providing the flexibility to adapt to future changes in the market and battery chemistries, enabling a level of futureproofing that is unique in the industry. The benefits over the current state of the art for production of NMC are summarized in **Table 2-1** below.

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Item	6k UniMelt Plasma	Coprecipitation	Comments
Cost			
Process Cost (US)	(b) (4)	\$3/kg-\$6/kg higher	References: ANL Report, conversations with cathode makers, plus, premium for single crystal adds~10%-15%
Environmental, Social and Governance			
Water Use	90% Less	135 liters/1kg NMC	Argonne National Labs
Energy Use	Up to 70% Less	99 MJ/1kg NMC	Argonne National Labs
Solid Process Waste	Zero	Minimal	
Liquid Process Waste	Zero	Major sulfate and alkaline waste post coprecipitation	Significant disposal issues with sulfate waste
NOx Process Waste	Scrubbed for zero net output ^A	n/a	NOx process waste is recycled
Steam Loss	Today: Vented ^B Future: Recovered ^C	Vented	Included in the above water use ^C
Yield			
Zero Loss Production	Efficient: Direct re-digestion of off-spec powder for use as feedstock	Inefficient: More steps to recover	All 6K in-process fallout is returned into the process
Plant Advantages			
Footprint	(b) (4) square foot per 10,000 tpa	150k-160k square foot per 10,000 tpa	References: on-line sources on Eco-Pro cathode plant
CapEx Redeployment			
NMC622 to NMC811	Easy / Fast	Difficult / Expensive: Different process, feedstock	This is a seamless transfer for 6K, a clean out and change in the feedstock chemistry ratios
NMC to LFP	Quick Redeploy	Not possible, Complete retrofit required	Changes in the front-end feed systems. Majority unchanged
Notes:			
A – All NOx to be scrubbed to produce nitric acid for feedstock production			
B – Clean steam is vented			
C – Future recovery and recycling of steam in a heat exchanger will further lower water and energy consumption			

Table 2-1 Advantages of 6K NMC811 cathode production versus the current state of the art of coprecipitation plus calcination (10 GWh plant equivalent)

Dramatic Cost Savings

Of equal importance to the technical performance is economic viability, and 6K's UniMelt Production Technology provides significant cost savings relative to conventional cathode production methods. An extensive and detailed bottoms-up manufacturing cost model has been developed and vetted by multiple customers and investors, and it demonstrates that when applied to the production of high Ni NMC cathode, the UniMelt process enables more than 50% conversion cost reduction relative to the standard coprecipitation and calcination approach used today. For example, for the production of the desirable single crystal form of NMC811, the total conversion cost (cost of goods sold, not including bill of material) is (b) (4) for a plant utilizing the Gen 1 reactor, decreasing to (b) (4) for the higher throughput Gen 2 reactor currently in development. These conversion costs enable a long-term viable cathode

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production capability on US soil. The source of the cost reductions can be understood by comparing the process flow versus standard coprecipitation, shown in Figure 2-12. The 6K process has far fewer steps, eliminating potential sources of yield loss and allowing a smaller plant size, requiring less capital, using a fraction of the water (~10%) and energy (~30%) by eliminating the majority of the thermal processing required and eliminating all solid and liquid waste generation, all of which results in significant cost savings.

Massive sustainability impacts

Any long-term viable domestic cathode production capability must also deliver significant improvements in sustainability relative to the incumbent coprecipitation process. By eliminating the precursor coprecipitation process and its huge water consumption, significantly reducing the thermal processing required, and totally eliminating waste generation, 6K's cathode production has massive environmental benefits.

For example, using ANL's model of water and energy consumption and waste generation for production of high nickel NMC, a conventional plant producing would consume 135 liters of water, generate 135 liters of liquid waste, and consume 99 MJ of energy for every kilogram of cathode produced.

In contrast, a 6K plant of the same size will reduce water consumption by 90%, reduce energy consumption by up to 70%, and completely eliminate the production of waste. These advantages not only represent cost savings, but also facilitate permitting, give greater flexibility in site selection, and eliminate negative effects on the host community.

Innovations in establishing a domestic supply chain of raw materials

Launching cathode production is step one of 6K's domestic cathode strategy, however domestic raw material supply must also be established to create a truly stable and independent battery supply chain. Production of NMC cathode material relies on salts produced almost exclusively

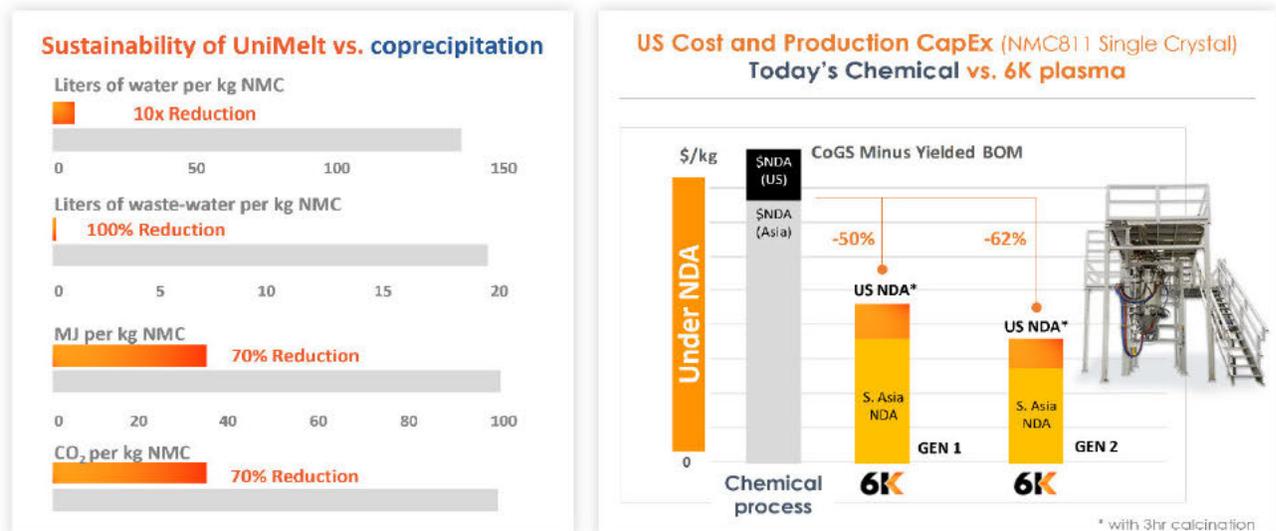


Figure 2-13 – Advantages of UniMelt technology versus today's coprecipitation, 1) 70%-100% reduction on key environmental impacts, and 2) 50%-60% reduction in the process cost of NMC811 cathode. These two advantages will enable the near term AND continued repatriation of battery cathode production to US soil.

in China, from raw materials sourced in China, Africa, South America, etc. Similar challenges exist for the raw materials required to produce LFP and LMO. This global supply chain channeled through the US’s chief economic rival is both costly and high risk. To lessen the risk to its US-based cathode production capability, 6K will source and demonstrate generation of the critical raw materials required for the production of its cathode products.

Key components of the 6K strategy:

- a. Domestic lithium sources collaborating with partner Albemarle
- b. Demonstrate production of LFP feedstocks from scrap iron
- c. Demonstrate the production of Ni and Co nitrate salts by digestion of metals
- d. Blending in sources of recycled domestic content collaborating with partner Retrieval
- e. Developing an internal cathode recycling loop to approach 100% feedstock yields

Developing domestic Lithium sources

As part of its ongoing relationship with Albemarle, 6K will establish a supply agreement for Li salt from Albemarle’s existing mines in Silver Peak, NV (brine), Salar de Atacama, Chile (brine) and/or Kings Mountain, NC (spodumene⁵). Final conversion of the salt to the nitrate form will initially be demonstrated at 6K in budget period 1. 6K has a separate multi-year, multi-million-dollar partnership effort to support the development, and supply to this proposal.

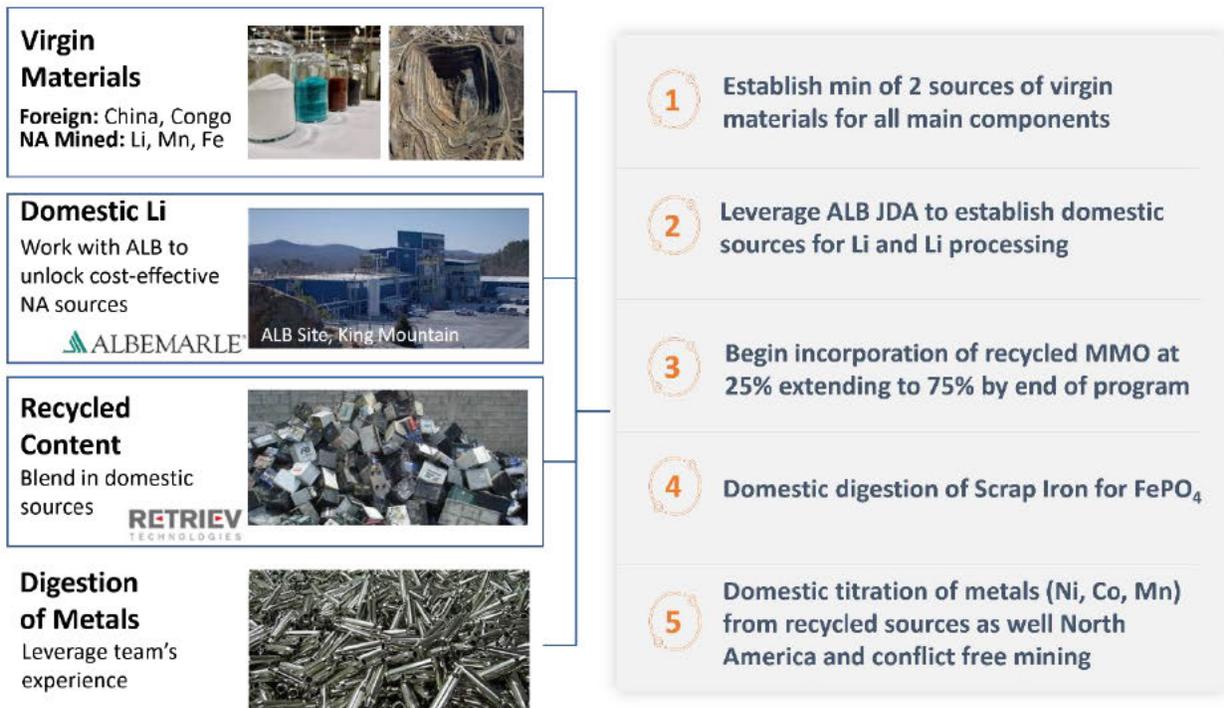


Figure 2-14 – 6K is creating an ecosystem of partners to enable the long-term goal of 100% domestic feedstock.

⁵ Spodumene is a pyroxene mineral consisting of lithium aluminum inosilicate, LiAl(SiO₃)₂, and is a source of lithium.

Creating domestic LFP feedstocks from scrap iron

Building upon past experience of the team members, 6K will demonstrate the production of iron salt from scrap for LFP production. The US exports over 1M tons per month of scrap iron and steel (<https://www.usgs.gov/centers/national-minerals-information-center/iron-and-steel-scrap-statistics-and-information>), so supply exists to cover the needs of the domestic energy storage market, both automotive and stationary, and the conversion of scrap to iron salts is a well-established process that has been previously rolled out to production by 6K team members. In budget period 2, 6K will establish a prototype capability to produce iron salts and use these materials to produce LFP via the UniMelt process at the kg scale. Electrochemical testing in cells will be conducted and completed in budget period 3. As with NMC, 6K will evaluate potential partners for iron salt production in budget period 3, concluding with a go/no-go decision on partnering.

Creating domestic feedstocks from recycled content

To further secure domestic supplies of critical feedstocks, 6K will work in conjunction with its recycling partner Retriev to develop a recycled supply of Ni, Co, Mn, and Li salts sufficient to supply up to an equivalent of 3GWh of NMC capacity by 2026. By closely coordinating 6K's and Retriev's activities, the overall cost, water, waste and energy requirements of the closed loop cathode recycling and production process can be minimized. For example, enabled by 6K's use of nitrate salts as direct feedstocks into its cathode production process, Retriev can eliminate the crystallization and separation of discrete salts from the process flow, instead finishing the recycling process at the mixed salt solution stage. To quantify the ESG benefits of this approach, 6K will engage with ANL to conduct LCA analysis for the closed loop process from end-of-life battery recycling to new cathode production.

Proof of concept for this approach has already been completed, where mixed nitrate salt solutions were used by 6K to produce single crystal NMC811 cathode with 100% of the Co content provided by the recycled salt solution (17% total recycled content). During the course



Figure 2-15 – 6K will collaborate with partner Retriev to develop feedstocks from end-of-life batteries, blending in 25% mixed metal oxides to start, and increasing to more than 75% during this program.

of the program, 6K will demonstrate performance parity with virgin salts at 25% recycled content (budget period 1), 50% recycled content (budget period 2), and more than 75% content (budget period 3.)

Internal cathode production recycling loop for 100% yield of feedstocks

6K’s direct cathode conversion process enables a greatly simplified recycling route for cathode production scrap resulting from off-spec material, equipment hold-up/cleanout, etc. Scrap cathode powder from the manufacturing process can be recycled by directly digesting the cathode back to the stock solution used as feedstock for the production process. In the case of NMC, scrap cathode powder can be dissolved in a solution comprised primarily of nitric acid, producing a nitrate salt solution that can be fed directly back into the 6K production stream in any quantity desired, including the Li content. As a result of this simplified process route for recycling scrap cathode, 6K has the potential to operate with nearly 100% yield of input raw materials.

Overall Impact on Industry and Environment by Advancing State-of-the-Art

6K’s impact can be summarized in the two figures below.

Given the challenges to scale coprecipitation plants, it was hard to find direct comparisons for a 10,000 tpa plant; however, a Korean vendor published target numbers to highlight their “next generation” plant, which failed in comparison to a 6K UniMelt plant producing NMC811.

First, the ability for 6K to locate the plant offers a higher degree of optionality given the lack of needing to manage any solid or liquid hazardous waste. Furthering 6K’s optionality is the amount of land and the size of the building required, both approximately 50% of the size needed for the advanced coprecipitation plant.

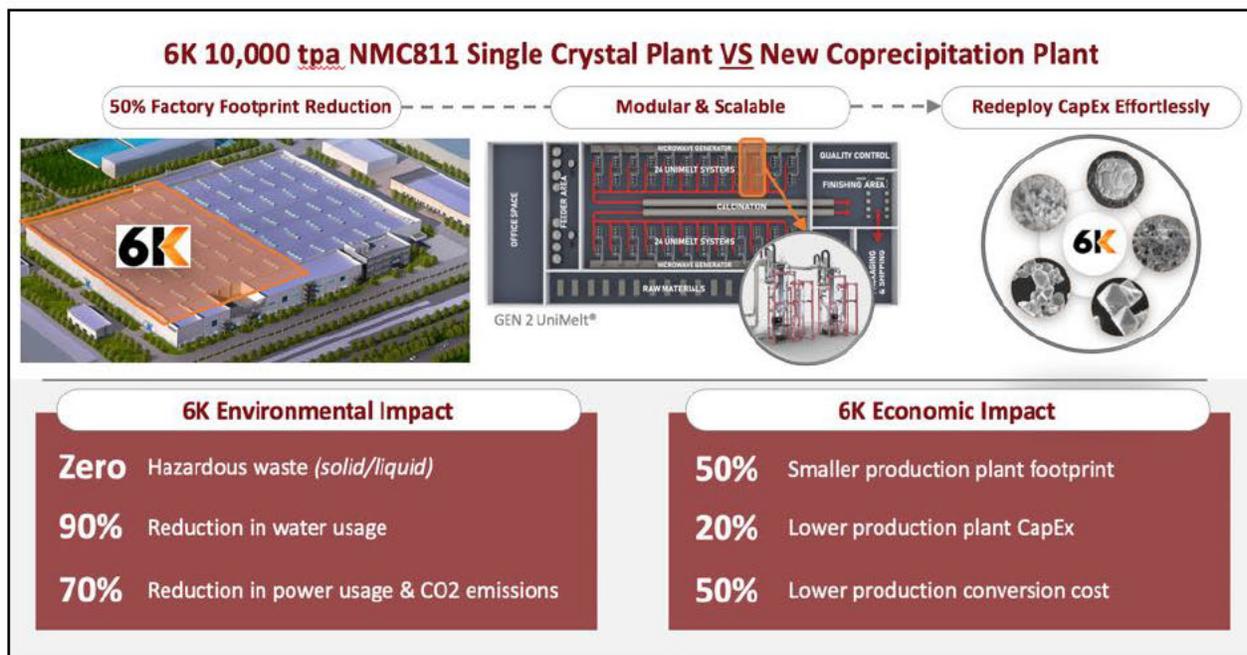


Figure 2-16 – 6K’s impact on the industry for replacement of traditional coprecipitation processes for cathode is profound, and cuts across process cost, footprint, plant CapEx, and numerous environmental impacts.



Figure 2-17 – With 6K's UniMelt technology, you do not have to choose between powering your life and saving the planet, while employing US workers in a burgeoning market.

The modularity of the equipment allows for start-up ahead of full capacity installation as well as the flexibility to completely change chemistry solutions after a program ends and a new solution is required. The overall cost of the CapEx would be more than 30% lower if fully built out with the 6K next generation (Gen 2) solution, while still delivering more than 20% savings with Gen 1.

The US cannot afford to deploy traditional coprecipitation. Over a five-year period, 6K saves \$10B, 30M tons CO₂, and 135,000 Olympic pools of waste – just for 400 GWh announced capacity by 2025 alone.

The benefits of the disruptive 6K UniMelt Plasma processing technology are shocking when applied to the stated capacity of Li-ion production in the United States in 2025, 400GWh.

Cost has always been, and will remain for the foreseeable future, the number one factor in selecting suppliers for high volume automotive products. This requirement is multiplied for CAM as it is the most expensive component on the vehicle. If all the stated capacity reaped the cost benefit of 6K vs coprecipitation, \$10B of cost would be eliminated.

The cost is realized by reducing the need to dispose of the equivalent of 135,000 Olympic swimming pools of hazardous waste, and completely eliminating the need to use 120,000 Olympic pools of water to produce the material, all while reducing energy consumption by up to 70% offsetting a massive amount of trees needed to offset the impact of 30M tons of CO₂.

3. Work Plan and Market Transformation Plan

a) Project Objectives

The Primary Goal is to establish and demonstrate a viable cathode production capability on US soil based on 6K's innovative UniMelt Microwave plasma production platform. This will be

enabled by 6K's significantly lower manufacturing costs and improved sustainability relative to established cathode production methods like coprecipitation.

In addition to cathode production capability, the Secondary Goal is establishment of a **viable supply of domestic raw materials** for the cathode production process, enabling true energy independence. To that end, a secondary objective of this proposal is to demonstrate viable sources of critical feedstocks via a combination of domestic salt production from existing metal feedstock sources, recycling of EOL batteries as feedstocks to the 6K process with 6K partner **Retriev**, and development of existing raw material supply via 6K partnerships with leaders in the space such as **Albemarle**.

Expected Outcomes

6K expects to successfully demonstrate the UniMelt process in full commercial-scale production, delivering high-quality chemistries at a more favorable cost than offshore suppliers.

Our expected outcomes from this demonstration are:

1. **Fully Operational Plant**: Construction, implementation, and operation of a domestic revenue-generating cathode plant using UniMelt Plasma production technology
2. **Validation of the Commercial-Scale Process**:
 - a. Initial production of a of 3,000 tpa CAM plant
 - b. Space and manufacturing infrastructure to support future expansion to up to 10,000 tpa within the demonstration plant, based on 6K customer demand
3. **Unique Flex-Chemistry**: Demonstration of the production of multiple chemistries in a single plant, specifically NMC, LFP, and other chemistries such as LMO, LMFP, etc.
4. **Validation of Cost-Efficiencies**: Achieved with the 6K process
 - a. 30% lower conversion cost for NMC811 with 6K's Generation 1 (Gen 1) 100 tpa per system process versus traditional coprecipitation methods
 - b. 50% lower conversion cost for NMC811 with 6K's Generation 2 (Gen 2) 400 tpa per system process versus traditional coprecipitation methods
 - c. Demonstration of an internal recycling loop for cathode production that effectively reduces BoM yield losses to nearly 0%
5. **Sustainability**: Demonstration of substantial ESG improvements over conventional coprecipitation of NMC cathode, to be demonstrated at scale and validated by lifecycle analyses (LCA) analyses conducted by team member ANL:
 - a. Major reduction in water consumption, estimated to be up to 90% versus standard coprecipitation plus calcination
 - b. Improved CO2 footprint, estimated to be a 60-70% reduction versus standard coprecipitation plus calcination

- c. Total elimination of liquid waste, a huge issue for coprecipitation, limiting site options for conventional cathode plants which dispose of this waste largely in rivers and oceans
6. **Workforce Development**: Phase 1 of the project will create up to 150 well-paying jobs. Through education, recruitment, training, and retention initiatives, 6k anticipates that at least 40% of the employees will come from DACs and that the workforce will reflect the diversity of the community
7. **Domestic Supply Chain**: Viable domestic supply chain for raw material inputs
 - a. Digestion of critical metals (Ni, Fe) from domestic sources to produce feedstocks for direct incorporation into 6K's process flow
 - b. Demonstration of domestic source of lithium salts with 6K partner Albemarle
 - c. Demonstration of cathode produced from recycled nitrate salts from EOL batteries at 75% recycled content in cooperation with 6K partner Retrieval

b) Technical Scope Summary

The project will be conducted in three budget periods (shown for simplicity as starting in 2023 and finishing in 2025). A summary of the overall approach, and the associated Expected End Results is provided below.

Budget Period 1: Starting the plant construction and workforce development, scaling up production capability, and starting the demonstration of metal salts production domestically

6K will kick off the plant construction process. It will also start a sound foundation for the plant's workforce training with a strong D&I framework. From the technology side, 6K will order its Gen 1 UniMelt. In parallel, the metal salt production digestion of Ni and Co effort will be underway along with its internal recycling of cathode scrap and end-of-life (EOL) batteries effort.

Expected End Results Budget Period 1 (2023):

- Site secured, architectural drawings completed, permits completed, and construction underway.
- UniMelt systems (Gen 1) will be placed on order.
- Operator training program will be developed with support local HBCU.
- Internal Ni and Co domestic raw materials production process is validated.
- Internal recycling loop demonstration initial results.

Budget Period 2: Plant in operation, equipment qualification, metal salts, recycled cathode.

The plant construction will finish with key operators on board. The customer qualification process will start on Gen 1 equipment. Gen 2 equipment will be ordered for the next demonstration of expansion. Ni and Co metal salt production will be scaled up with a partner. 6K will start the effort on Fe metal salt. The internal recycling of scrap cathode will demonstrate 25% of the process fallout is returned to the production process.

Expected End Results Budget Period 2 (2024):

- Plant construction will be completed, equipment installed.
- UniMelt equipment will be commissioned and validated.
- Workforce training program completed, and key operators will be hired and trained.
- Ni and Co domestic raw materials scaling with partner.
- Internal Fe raw material domestic feedstock developed and validated.
- Recycled content demonstration showing equivalent specification to virgin feedstocks.

Budget Period 3: Three-shift operations, SOP and expansion, metal salts, recycled cathode.

Three shifts operation will be in place for the plant. 6K will implement a plan to ensure a strong workforce pipeline. Gen 1 UniMelt will enter SOP. Gen 2 will be validated and qualified. Fe domestic salt production scale up begins with a partner. 6K continues to demonstrate the recycled cathode content from 50%, to 75%, of recycled cathode by the end of this period.

Expected End Results Budget Period 3 (2025):

- UniMelt and cathode material successfully qualified for production.
- Ramp up period approaching yield and throughput targets.
- D&I training will be administered quarterly for new employees.
- Capable of three-shift plant operation in place.
- Workforce pipeline development, including apprenticeship program launched and formal training curriculums for local community and technical colleges.
- Demonstrating greater than 75% recycled content product.

c) Work Breakdown Structure and Task Description

6K will manage the PLUS CAM Project using the Project Management Institute, Inc.'s (PMI) Project Management Body of Knowledge (PMBOK) methodology. This methodology uses a Work Breakdown Structure (WBS) to subdivide the project into manageable, defined tasks, allowing each task to be resourced, tracked, and reported over the life of the project.

6K's WBS describes the PLUS CAM Project work activities in three budget phases:

- Budget Period 1 (2023): Starting the plant construction and workforce development, scaling up production capability, and starting the demonstration of metal salts production domestically.
- Budget Period 2 (2024): Plant in operation, equipment qualification, and metal salts development, and scaling up with partners, first recycled cathode content demonstration.
- Budget Period 3 (2025): Plant SOP with three-shift operations and ready for expansion per market demand, developing and rolling out the training for the future pipeline workforce, continuation of metal salts scaling up with partners, demonstrating the next levels of recycled cathode content.

Description of Specific Activities

The PLUS CAM project WBS is divided into four major work streams:

- Plant Development: plant construction and setup will be completed by the end of 2024
- Equipment Deployment: Gen 1 UniMelt will be transferred from BCE to the plant and SOP beginning in 2025. Gen 2 UniMelt will be transferred from BCE to the plant and SOP beginning early 2026.
- Workforce Development: By the end of 2025, the plant will be capable of being fully staffed for 24/7 operations. In parallel, 6K will launch apprenticeship programs and formal training on battery materials production with local community and technical colleges, and high schools.
- Domestic salt production demonstration of Ni, Co, Fe, and recycled cathode content: 6K will develop the process and will seek appropriate domestic partners to scale up the key metal salts – Ni, Co, and Fe. By 2027, 6K will establish a 100% domestic salt supply chain. Alongside the salt work streams, 6K will demonstrate increasing recycled content in cathode materials from production scrap and EOL batteries throughout the project.

Summary of Work Breakdown Structure

6K's WBS is graphically summarized in **Figure 3-1, PLUS CAM Project Work Breakdown Summary Overview**, below. This graphic shows the planned work activities over the three-year Grant period (2023 – 2025), and the work activities that continue after the Grant period of performance (2026).

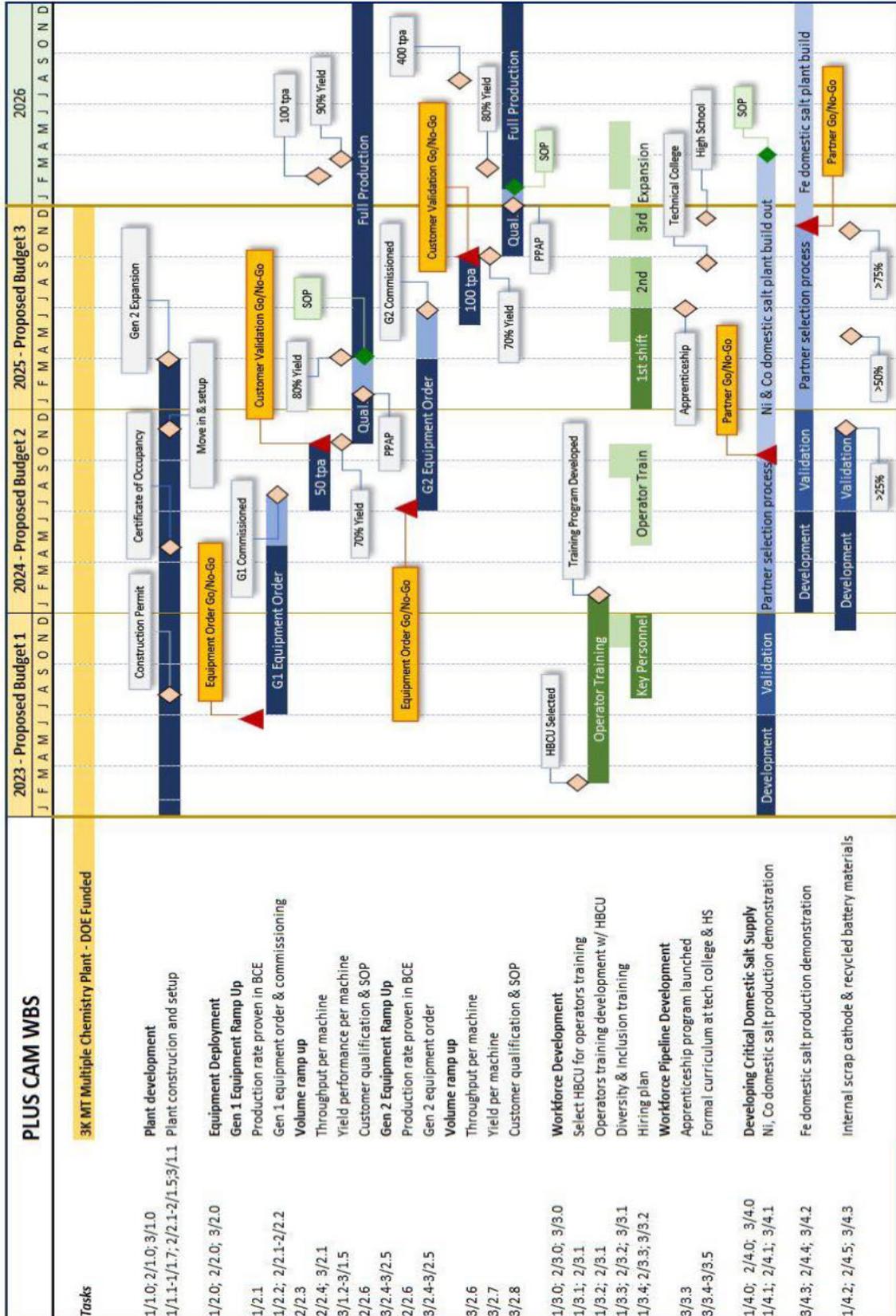


Figure 3-1 – PLUS CAM Project Work Breakdown Structure

d) Milestone Summary

The milestones are summarized in **Table 3-1, PLUS CAM Project Milestone List**, below. All the milestones are SMART with specific criteria and deliverables where appropriate with an approval process to move to the next task(s). For instance, “Land Acquisition Complete” milestone will produce a land title and an agreement from local municipalities to allow the construction company to start the work. The WBS will formally document each milestone’s checklist and signoff signatures.

WBS	Description	SMART	2023				2024				2025				2026			
			1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q
1/1.0; 2/1.0	Plant Development																	
1/1.1-1/1.7; 2/1.1-2/1.4	Plant construction and setup	Yes	x	x	x			x	x	x								
2/1.5; 3/1.1	Gen 2 expansion											x						
1/2.0; 2/2.0; 3/2.0	Equipment Deployment																	
	Gen 1 Equipment Ramp-up																	
1/2.1	Production rate proven in BCE	Yes	x															
1/2.2; 2/2.1-2/2.2	Gen 1 equipment order and commissioning	Yes						x	x									
	Volume Ramp-up																	
2/2.3	Throughput per machine - 50 tpa and 100 tpa	Yes								x						x		
2/2.4; 3/2.1	Yield performance per machine - achieving 70% and 80% yield	Yes								x	x							
3/2.2-3/2.5	Gen 1 Customer qualification and SOP	Yes										x	x					
	Gen 2 Equipment Ramp-up																	
2/2.6	Production rate proven in BCE	Yes						x										
3/2.4-3/2.5	Gen 2 equipment order and commissioning	Yes										x	x					
	Volume Ramp-up																	
3/2.6	Throughput per machine - achieve 100 tpa and 400 tpa	Yes											x					x
3/2.7	Yield performance per machine - 70% and 80% yield	Yes											x			x		
3/2.8	Gen 2 Customer qualification and SOP	Yes												x	x			
1/3.0; 2/3.0; 3/3.0	Workforce Development																	
1/3.0; 2/3.0; 3/3.0	HBCU selected for operators training	Yes	x															
1/3.1; 2/3.1	Operators training development with HBCU	Yes						x										
1/3.2; 2/3.1	Diversity and inclusion training for the workforce	Yes				x			x				x	x	x	x	x	x

1/3.3; 2/3.2; 3/3.1	Key Personnel and Hiring Plan	Yes		x			x	x	x	x	x		
Workforce Pipeline Development													
3/3.3	Apprenticeship program launched	Yes							x				
3/3.4-3/3.5	Formal curriculum launched at tech college and high schools	Yes								x	x		
1/4.0; 2/4.0; 3/4.0 Developing Critical Domestic Salt Supply													
1/4.1; 2/4.1; 3/4.1	Ni, Co Domestic Salt Production Demonstration	Yes	x	x			x						x
3/4.3; 2/4.4; 3/4.2	Fe Domestic Salt Production Demonstration						x	x				x	
1/4.2; 2/4.5; 3/4.3	Internal Cathode Recycling Demonstration	Yes					x	x		x	x		

Milestones notation: Y/T.S; Where Y = Budget Year (1-3) / T = Task (1-4) . S = Subtask (1-n).

Table 3-1 – PLUS CAM Project Milestone List,

No Go Decision Points

Go/No Go Decision Points are considered a phase gate for the PLUS CAM Project. These go/no go decision points are incorporated into the WBS and appear in the Project Schedule and may be listed in the Risk Register. Similarly, to milestones, go/no go decisions are SMART with criteria specific to its decisions and formal signoff process. For example, “Gen 1 Equipment Order Go/No Go” decision points requires Gen 1 UniMelt to reach a desired throughput rate at 6K’s BCE with documentation of consecutive runs hitting throughput rate. The document will be signed off by a process engineering leader and a manufacturing engineering leader and ultimately signoff from the PI.

The PLUS CAM Project Go/No Go Decision Points are summarized in Table 3-2 - PLUS CAM Go/No Go Decision Points, below.

WBS	Description	2023				2024				2025			
		1	2	3	4	1	2	3	4	1	2	3	4
1/2.1	Gen 1 equipment order go/no-go		x										
2/2.4	Gen 1 customer qualification go/no-go										x		
2/2.6	Gen 2 equipment order go/no-go						x						
3/2.6	Gen 2 customer qualification go/no-go												x
2/4.1	Ni & Co domestic salt production partner go/no-go							x					
3/4.2	Fe domestic salt production partner go/no-go												x

Milestones notation: Y/T.S; Where Y = Budget Year (1-3) / T = Task (1-4) . S = Subtask (1-n).

Table 3-2 – PLUS CAM Go/No Go Decision Points

e) End Project Goal

The true goal of this activity is to lay the groundwork for a transformational technology to support the long-term goal of a sustainable li-ion battery materials ecosystem in the United States which is not reliant on foreign adversaries. 6K will demonstrate a means to this by accomplishing the specific end project goals in the table below.

Project Goal	Criteria	Comment
Gen 1 UniMelts deployed at 100 tpa	System fed continuously at rate for 24hrs	Deployed in production end 2025
Gen 2 UniMelts deployed at 400 tpa	System fed continuously at rate for 24hrs	Proven at BCE in 2025, released to plant in 2026
Plant Run-at-Rate achieves 3,000 tpa, 2 chemistries	2nd chemistry running on systems at rate	Plant at full rate in 2026
Conversion cost benefit vs coprecipitation	Achieve cost targets within 10%	Measurement taken +3 months from SOP
Demonstrate ESG benefit vs coprecipitation	Energy, Water, Waste benefits	LCA with third-party to validate
Hire workforce from DACs	40% of total plant HC	Core element of workforce development plan
Domestic Supplier for Li feedstock	Supply agreement for Li completed	Long-term goal to produce in USA
25% recycled NMC811 CAM	Equal performance to virgin salts, commercially available	100% for low-volume applications
Capability to perform domestic metal salts production	Demonstrate process to convert Ni, Co, and Fe	Limited Co 2nd life sources available, process virgin
Demonstrate recycling loop to reuse in-line material fallout	Recaptured material has equal performance	Focus on reactor and baghouse

Table 3-3 Project Goal criterion demonstrates how End Project Goals are achieved.

At the conclusion of each objective, an assessment will be collaboratively conducted with the DOE to determine if the goal (outcome) was achieved, and the DOE's acceptance or exception is noted. If the goal is not achieved, the exceptions are noted and follow-up actions, if any, are presented and agreed upon.

f) Project Schedule

As described earlier, 6K will follow the PMBOK project management methodology and utilize Microsoft Project and SharePoint as main tools to manage the overall project. Other tools will be utilized as needed depending on the teams' collaboration preferences. **Figure 3-1, PLUS CAM Project Work Breakdown Summary Overview**, above, shows the WBS as a Gantt chart, reflecting the preliminary PLUS CAM Project Schedule. **Table 3-1, PLUS CAM Project Milestone List** shows all the milestones in the three-year budget period. **Table 3-2, PLUS CAM Go/No Go Decision Points**, lists out the go/no go decisions points for the project.

g) Buy American Requirements for Infrastructure Projects

6K's infrastructure requirements include the construction of a production facility, components of the UniMelt systems, and miscellaneous supporting infrastructure. All iron, steel, manufactured goods and/or construction materials used for 6K's infrastructure requirements are procured domestically through American businesses. All public infrastructure (i.e., access

(roads, rail) and utilities (electricity, gas, water, and sewage)) will be procured through the local municipalities or industrial providers.

h) Project Management

i. Project Management Organization and Management

6K's PLUS CAM Project is organized into multiple task project teams, each with a dedicated project manager who is focused on the specific objectives, goals, and deliverables of the specific project team as defined by the PI. The individual sub-project team managers report to one of two senior-level project managers: a technical project manager, and a production project manager. These two senior program managers report to 6K's PLUS CAM Project PI, who coordinates and monitors all work activities across the individual project teams. The PI is the single point of accountability for 6K's PLUS CAM Project and is responsible for the project oversight, control, and integration of team activities, and has full authority for managerial, technical, and operational decision making for the entire PLUS CAM Project. The PI leads the PLUS CAM Project Steering Committee, facilitates the weekly/monthly project status meetings, and is responsible for all project deliverables. The 6K PLUS CAM Project program organizational structure and interface to the DOE is depicted in Figure 3-2, *PLUS CAM Project Program Structure*, below.

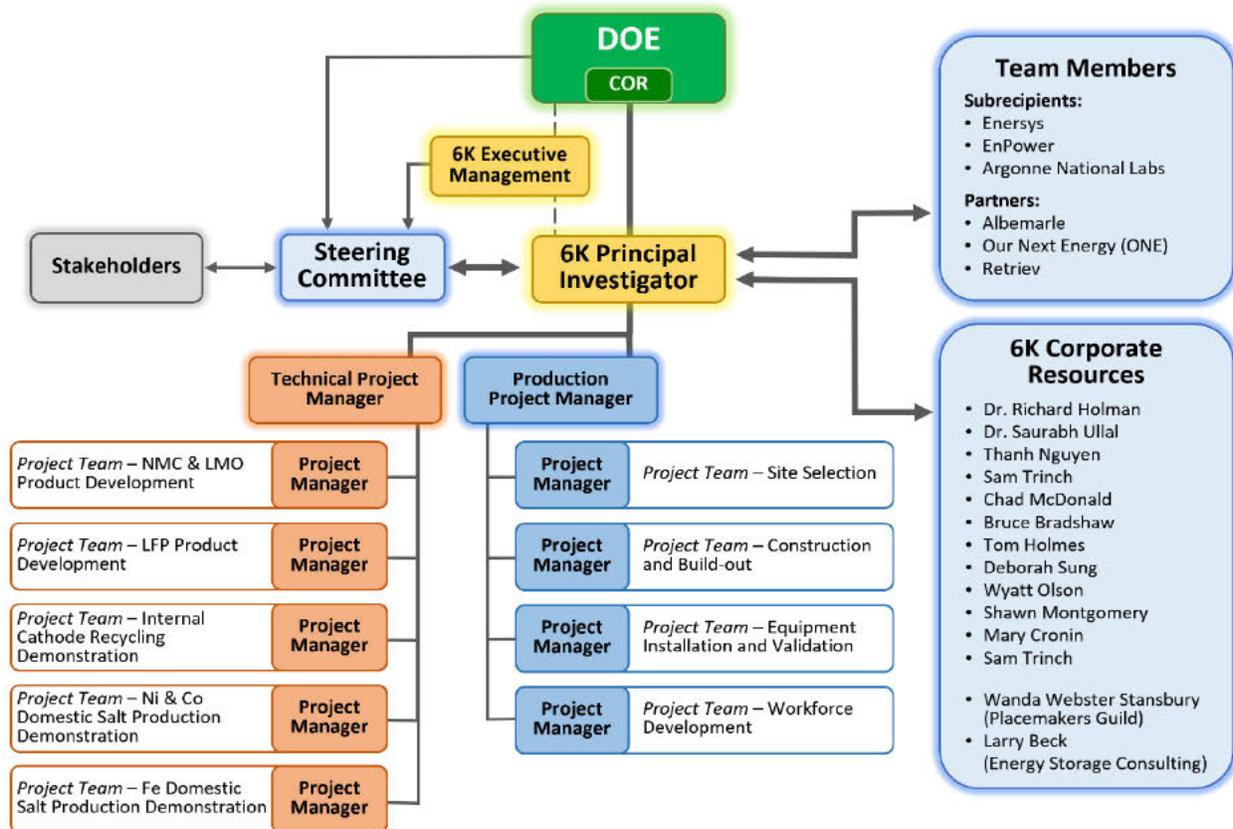


Figure 3-2 – Project Management Office is structured to maximize team resources and leverage team expertise

Dr. Richard Holman, Principal Investigator:

6K's PLUS CAM Project PI is Dr. Richard Holman. Dr. Holman has an extensive background in materials science, electrochemical technologies, and production of material products. Dr. Holman received his Ph.D. in materials science from the Massachusetts Institute of Technology in 2001. He spent over 10 years at A123Systems where he joined at its inception and ultimately served as Director of Core Cell Engineering, followed by six years at 24M technologies where he served as VP of Product Development working on next-generation lithium-ion technology. Dr. Holman has over 17 years of experience in the battery industry taking products from concept to production in the electric vehicle (EV), power grid, and power tool markets.

Dr. Holman reports directly to Sam Trinch, President, 6K Energy, and has full authority to represent 6K's management in all aspects of 6K's PLUS CAM Project. Reporting to Dr. Holman are two 6K project managers; a technical project manager, and a production project manager. Dr. Holman also leads the PLUS CAM Project Steering Committee.

PLUS CAM Project Steering Committee:

The PLUS CAM Project Steering Committee is an advisory group that provides oversight and offers directional decisions on various aspects of the project. This committee sets the strategic direction for the project tasks, provides project goals and scope, determines how success of the project task is measured, monitors the performance of the overall project, prioritizes project activities, and assists the PI by eliminating barriers, issue resolution and problem solving. The Steering Committee membership consists of executives and subject matter experts from 6K, DOE, stakeholders, teammates, and industry participants as needed. 6K participation in the Steering Committee includes the Chief Executive Officer, Chief Financial Officer, Chief Operations Officer, President of 6K Energy, Senior Vice President (SVP) of Business Development and Strategy, SVP of Deployment, and Vice President (VP) of Government Affairs. Broad Government participation is encouraged and guided by the COR.

ii. Team Member Roles

6K has cultivated key down-stream partners, EnerSys and EnPower, who will benefit from this grant by helping offset their costs to evaluate and test 6K materials ahead of formal qualification for SOP. Each of these partners are global leaders in their specific fields of energy storage and are staffed with experienced teams in both R&D and mass production. In-kind contributions will be made available from each partner in order to conduct the work needed to evaluate 6K materials. Specifically, EnerSys and EnPower will be conducting material characterization in a coin cell, half-cell, and full cell for electrochemical testing, and preliminary full cell abuse testing. The deliverable from this activity will be a report summarizing the results and making a Go/No-Go decision to proceed towards the full qualification and SOP.

ANL will provide cell assembly and testing resources to provide an unbiased, third-party dataset. They will also help as 6K scales from prototype systems in the BCE to full-scale production systems in the PLUS CAM plant.

iii. Critical Handoffs and Interdependencies

Producing battery grade materials required to meet stringent end customer demands requires deep engagement with all stakeholders. The interaction between multiple stakeholders creates interdependencies that require critical handoffs to be managed without mistakes or delays. The overarching goal is to ensure these are defined and managed between the key upstream team members and down-stream partners and sub-recipients:

- Upstream partners (Albemarle and Retriev):
 - Materials requirements defined by 6K → upstream partners
 - Partner delivers materials → 6K's materials evaluation and qualification
 - 6K + Partner negotiates supply agreement → Partner delivers material to spec
- Downstream sub-recipients (EnerSys, EnPower):
 - Materials requirements defined by team members → 6K
 - 6K delivers materials → downstream partners build cells, validate the materials
 - Partner + 6K negotiate supply agreement → 6K delivers material to spec
- Additional sub-recipient: (ANL)
 - 6K provides cell build requirements → ANL builds cells
 - ANL provides cell reports → 6K acts on data where required

The critical handoffs denoted by → symbol. For each step, a formal process is implemented to receive, approve, and signoff. Moreover, the data produced by team members, partners, and 6K are shared with appropriate parties for knowledge, improvement, or other required action.

There will be critical handoffs from unforeseen events within the project. In such cases, an escalation process is in place to manage unplanned critical handoffs. All escalated critical events (handoffs) are documented and reviewed with the project management team, to include the DOE, stakeholders, and Steering Committee.

iv. Management Plan Technical and Managerial Aspects

6K's Project Management Plan (PMP) is developed at the onset of the PLUS CAM Project to define the project and sub-projects' scope, performance, goals, objectives, and deliverables. The PMP is baselined and approved at the onset of the project. This effort – baselining – establishes the initial reference for project scope, schedule, deliverables, and budget. Once baselined, project execution and performance can be measured and managed against the baseline. Changes to the baseline are managed through the change control process enabling the project to process with minimal risks.

v. Risk Management

Risks represent potential impact on any aspect of the PLUS CAM Project such as schedule, cost, performance, and others. 6K's approach to risk management is to identify potential risks, document risks, and prioritize the risks. Risk probabilities and their impact are assessed from low (1) to high (5). Once identified and assessed, a risk mitigation solution is an action taken to reduce the probability of occurrence and/or impact of a risk.

All potential risks are entered into the PLUS CAM Risk Register and tracked daily by the PI. All PLUS CAM Project management documents, including the Risk Register, are available to the

DOE, stakeholders, and teammates on-line through the PLUS CAM Project website, and reviewed at all monthly/weekly project meetings. **Table 3-4, PLUS CAM Project Risk Register**, below, provides examples of risks that are identified and tracked in the risk register.

Risk	Risk Description	Probability /Impact	Prior Experience and Mitigation Plan	Post Mitigation Risk
Acquire Qualified Workforce	Challenge securing production team to staff facility with qualified personnel in the DACs identified for site.	Medium/ Very High 3/5	<ul style="list-style-type: none"> • Strong success in training and retaining workforce for DACs at 6K Additive (same equipment) • Early engagement with regional economic development team • Competitive salaries and benefits • Collaboration with local community and technical colleges and universities • Signing bonuses 	Low/Low 2/2
UniMelt: Scale from 10 tpa to 50 tpa	UniMelt development in BCE does not meet the required thru-put target for Go/No-go decision to order production equipment.	Low/High 2/4	<ul style="list-style-type: none"> • Leverage 6K Additive lessons learned during planning • UniMelt designed to stage core components to absorb late-stage design changes • Support resources identified and prepared ahead of time 	Low/Low 2/2
Production Plant does not achieve 3,000 tpa run rate	Planned inputs do not achieve expected output quantities causing issues meeting demand.	Med / Med 3/3	<ul style="list-style-type: none"> • Highly experienced team that has launched powder plants • Production intent bench demonstrations on core equip. • Launch SOP at reduced rates, add equipment to offset • Extend engagement with ANL with a focus on scaling 	Low/Low 2/2
Insufficient supply of Nitrate salts for demand	Scale-up of virgin titration of nitrate salts lags demand.	Low / High 2/4	<ul style="list-style-type: none"> • Collaboration with Retriev to increase MMO solution quality • Investment in partners • Internal titration of metals 	Low/Med 2/3

Table 3-4 – Initial Risk Register started, living document which will include partner activity once contracted and kicked off. Critical to line up mitigation plans in the beginning of the project.

vi. Project Change Management

A change request is a request to modify any project document, deliverable, or baseline. Once the WBS and the WBS Dictionary have been established, approved, and baselined, any changes to project that could impact the baseline must be conducted through the change management process. The flow of a change request is as such: A change request submission to the PI → who assesses the impact/benefit of the change request → approve/reject or further review with the

steering committee → incorporate into the project → communicating to appropriate project team members and stakeholders.

This process ensures that changes to the project are considered in an integrated manner while addressing overall project risk, which often arises from changes made without consideration of the overall project objectives or plans. This process is an ongoing activity conducted throughout the life of the project.

vii. Quality Management Program

6K's Quality Management System (QMS) is stemmed from the International Organization for Standardization (ISO) ISO 9001:2015 certification. In addition, the company follows the International Automotive Task Force (IATF) ITAF16949:2016 (formerly ISO/Technical Standard (TS) 16949:2009) and Advanced Product Quality Planning (APQP) to meet the quality control requirements for the design, development, production, and delivery and service of automotive industry. Moreover, 6K will implement several quality measures such as:

- Quality Assurance organization reporting directly to 6K Energy's president
- Enterprise Management System to manage and track materials product life cycle and manufacturing resource planning
- An integrated production control system: Revision-controlled product/process specifications, control plans, work instructions, Failure Mode, and Effects Analysis (FMEA), and root cause analysis (RCA)

viii. Communications Plan

Team communication is managed through regularly scheduled meetings from kick-off meeting, weekly project team meetings, monthly steering committee meetings, to quarterly reporting to DOE. Escalation process will be defined at the beginning of the project to get the fastest response time among internal team members and sub recipients. There are multiple platforms for team members to communicate in a push/pull fashion

- Project website for team members to pull information as needed
- Emails, text, conference calls to push information to the project teams
- Emergency communication via texts and phone calls for escalation
- Each sub-recipient will be managed independently through weekly Product Development Team (PDT) meetings. The information from this proprietary activity will be fed into the DOE meetings.

In addition to the team communication, 6K management meets weekly to discuss critical items across the enterprise. The DOE project is deemed as the most critical program in the company and will be discussed each week.

Regular updates and quarterly meetings are conducted with the 6K Board of Directors and Advisors, which is comprised of industry veterans and luminaries such as Bob Galyen, the second employee of CATL, Ed Liddy, appointed to lead AIG during the financial crisis, and

members who have served on both sides of the aisle in government. 6K management draws on this deep experience across many topics to its full extent through regular communications.

i) Market Transformation Plan

i. Marketing Approach

The unique value proposition of the 6K UniMelt plasma process allows 6K to provide a premium product, NMC811 Single Crystal, at a cost advantage over traditional NMC811 currently produced in China. The clean processing environment highlights the key factors driving cost out of the process by dramatically reducing energy and water use while creating no solid or liquid waste. In addition to NMC811, 6K has demonstrated ability to produce multiple chemistries with the UniMelt process.

6K engages directly with partners throughout the battery value chain. These target partners include leaders and new entrants in raw materials, powder manufactures, cell suppliers and automotive OEMs. Over 25 partners have tested 6K CAM. By utilizing a strategic account management process building on the foundation of partnering vs selling, a philosophy of transparency is used when sharing details to defend claims around development activities, cost assumptions and sustainability metrics.

Identification of Target Markets:

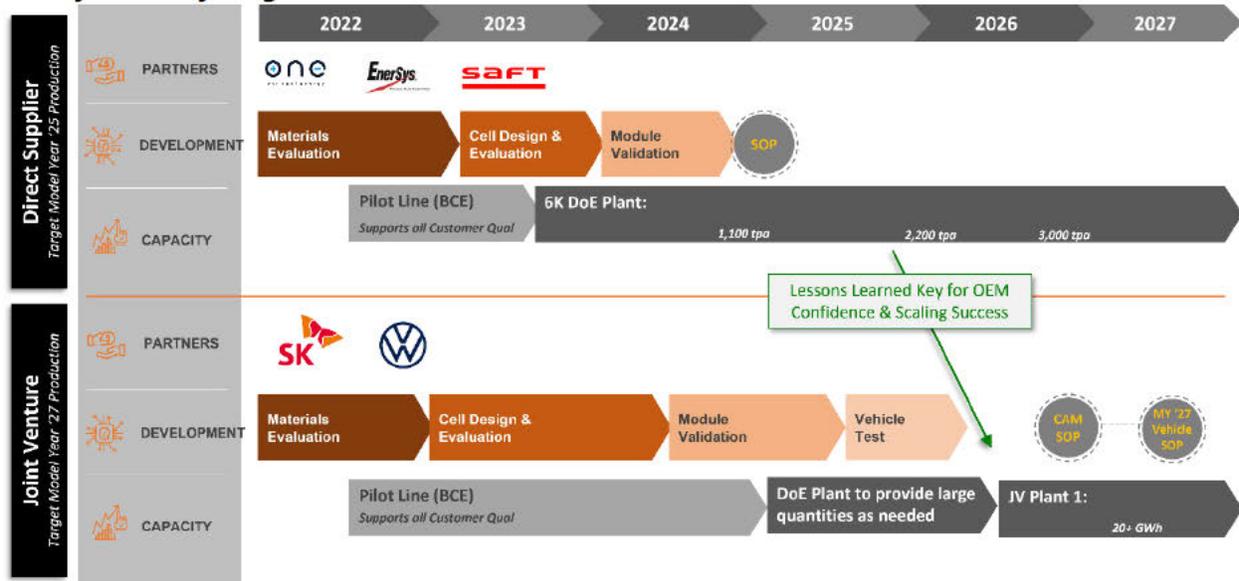


Figure 3-3 – Path to Production and Business Model focuses on direct supplier to small, non-EV customers in USA followed by large-scale engagement with major players.

As depicted above, 6K will go to market with a 2-prong approach outlined below to accelerate time to market with fast moving partners, as well as to de-risk and ensure product and production readiness for the demands of high-volume automotive OEM partners and cell manufactures.

Direct Supplier: 6K operated CAM production to supply fast-moving, non-passenger vehicle partners.

- Market Timing: 2025
- Targets: small and new entrant cell manufacturers targeting commercial and industrial applications, fleet vehicles and DOD / DOE applications.
- Agreements: LOI with ONE, MOU with EnerSys and others in negotiation calling for greater than 15GWh/yr CAM production in North America.

Joint Venture: Production JVs with large automotive OEMs and large cell suppliers to produce CAM which flows directly into cell manufacturing operations.

- Market Timing: 2027
- Targets: global leaders in EV manufacturing and cell supply.
- Status: Selectively engaged with 10 partners based on resource availability. Equity investment secured from one global automotive OEM and one global cell supplier.

6K expects that a subset of both groups will likely enter into Joint Development Agreements (JDAs) to closely engage and develop products to ensure commercialization timelines are met.

ii. Product Development Approach

Competitors:

6K's competition in the battery materials market is from large, well-established companies working on a global scale. These competitors use manufacturing processes that are decades old. As described throughout the proposal 6K plans to compete directly based on the merits of its disruptive technology that delivers equally performing CAM at a favorable price and environmentally sustainable than is available from offshore sources.

While innovative technologies for the synthesizing of metals are continually evolving, at the present time very few similar competitive technologies exist in the market, and the potential competing technologies are not achieving cost parity or the environmental benefits which are achieved with 6K technology.

Market Barriers:

The most concerning barrier to the market exists with traditional risk aversion from large, global manufacturers being early adopters of transformational technology. This risk can be exacerbated when the transformational technology is being produced by a startup company. With proof points from the 6K funded BCE and the DOE backed 6K PLUS CAM plant, 6K plans to mitigate this risk by demonstrating the scalability of the technology.

6K's strategy to work with smaller, niche cell manufacturers to provide high quality, low-cost CAM furthers 6K's ability to build confidence to eliminate the barrier.

Financing:

6K has completed financing of \$100M in capital as of March 30, 2022 and will close an approximately additional \$100M (July 2022) for a total of \$200M in fresh financing. This capital is to accelerate the deployment of battery materials on domestic soil and will be used to provide the necessary cost share for a successful DOE program. 6K's team and investors are fully committed to the mission to bring cathode production to the United States. 6K will also seek support from the DOE Loan Programs Office.

Legal/Regulatory Considerations:

6K's business, manufacturing, and production operate well within all Federal and State legal and/or regulatory statutes. The 6K UniMelt process is exceptionally environmentally responsible and currently exceeds all environmental regulations for the production of battery materials.

Intellectual Property:

6k holds a core value in the development and protection of its intellectual property. 6K has internal programs that require all employees to take onboard training on intellectual property rights and trade secrets, with annual recertification, with financial incentives for employees to participate in 6K's internal intellectual property program.

6K technology is protected by 28 patents issued, and 159 patents pending, for a total of 187 intellectual property patents. Patents are categorized into processing systems, equipment, feedstock methodology and materials. Trade secrets are categorized into feedstock preparation, chemistry design, machine code and software.

6K requires a non-compete agreement for all employees and requires non-disclosure agreements and material transfer agreements with partners prior to engagement.

In addition to patent and trademark protections, 6K protects its technology and trade secrets with current state-of-the-art IT protection methods and technologies. This includes 6K data infrastructure and systems being protected by firewalls, intrusion detection systems, antivirus protection systems, network analyzer systems, and email monitoring systems.

Infrastructure Requirements:

6K's Market Development Plan relies on the development of the manufacturing plant facility to achieve the product capacity needed to support 6K's targeted commercial battery cell manufacturers. The 6K production facility infrastructure will require public infrastructure for high-volume utilities (electricity and water) and access (roads/railway).

Data Dissemination:

6K interprets data dissemination in this context to be non-public information shared with the DOE, stakeholders, project participants and clients under a JDA. Information of this nature are patented technology details, process methodologies and production results. Such information is tightly controlled, maintained in secure repositories, and distributed on an agreed upon need-to-know basis.

4. Technical Qualifications and Resources

a) Team Qualifications and Expertise

6K Resources

Sam Trinch, President of 6K Energy, is the lead senior executive at 6K managing this project. He was responsible for \$1B in annual sales for Lear Electronics in 2009. Since 2009, he has been an executive in the Li-ion space, including a year as the President of China merging Wanxiang, a Chinese Lion battery entity, with

A123 Systems, a US Li-ion battery company. During the last 13 years, he helped deploy 600,000 ft² of electrode, cell, and system production in Michigan as one of the early Li-ion pioneers as well as a plant in Ostrava, Czech Republic for low voltage systems, and kicking off an 80GWh expansion in China.



Saurabh Ullal, COO of 6K Inc., PhD in Chemical Engineering from UCSB, has over 20 years of experience in high temperature material processing, crystal growth and semiconductor equipment industries at ARC Energy and Lam Research with a proven history of leading global teams that delivered products and solutions to meet demanding performance and reliability requirements. Dr. Ullal has published multiple times in peer-reviewed journals and has been granted over twenty US patents.



Thanh Nguyen, SVP of Deployment, has spent over 30 years developing technology. He has been in the Li-ion space for over 10 years, with five years at Johnson Controls (now Clarios) building up a new Li-Ion business group, and five years at Farasis Energy leading global sales. He has worked with major OEMs and niche start-ups in the EV space. While at Farasis, he led a site selection for a 20GWh battery plant with a planned 10GWh starting capacity in Southeast US. The plant was on a 180-acre land with about 4M square foot of production and office space.



Chad McDonald, SVP of Strategy and Business Development, has spent over 25 years in commercial roles including marketing, business development and sales. He has been in the energy storage space for over 12 years, including 10 years at Maxwell Technologies which was acquired by Tesla in 2019. In these roles, Chad has worked very closely with major global automotive OEMs, Grid Energy Storage, and renewable energy partners in the wind and solar industries. Chad also spent 14 years in the home computing and consumer electronics sectors.



Shawn Montgomery, SVP of Advanced Manufacturing, has a BS and MS in Chemistry as well as an MBA. He will take over the plant design and layout as activity progresses with preparing to select 6K's build-out partner. Shawn has over 25 years of experience in domestic and international R&D and scale-up of materials in the chemical, energy, filtration, and HVAC sectors, helping launch A123 Systems powder operations in Changzhou, China.



Thomas Holmes, VP Engineering for 6K has over 30 years' experience predominately at Siemens Healthineers in R&D and manufacturing. He recently led the design, installation, and validation of all custom process equipment for two major plant expansions in the US and China. He received master's degrees in chemical engineering and in materials science. Captain Holmes served in the US Army as a Commander and Battalion Logistics Officer.



Deborah Sung, has close to 10 years of professional experience. With five years of experience in the Li-ion Battery Industry at Farasis, Deborah played a critical role in the site selection project for a 10GWh+ battery plant in Southeast US. During her time with Farasis, she participated in numerous new product launch projects as the project manager



Wyatt Olson, Program Manager, BS in Chemistry, MBA, and over 10 years of experience developing chemical products and leading complex internal projects as well as major customer programs. He has a PMP certification from the Project Management Institute.

Non-6K Key Resources

Joern Tinnemeyer, CTO and SVP of EnerSys, is responsible for global engineering, global quality, and technology development. Joern studied applied mathematics and electrical engineering at the University of Toronto and holds a Master of Science in Astronautics and Space Engineering. His primary focus of expertise includes energy storage systems, system design optimization, safety topologies and control theory. He currently also serves as Chairman of NaatBatt.

Job Rijssenbeek, VP of Li R&D, Albemarle, PhD in Chemistry from Northwestern, and over 20 years of experience between GE and Albemarle developing solutions for various battery chemistries and materials. His current focus is on developing a pipeline of differentiated technology, leading to new products and processes.

Shane Thompson, President, Retrie Technologies, 20+ year career in battery life cycle management. This experience includes leadership in environmental sales, commercial operations, and process development. He currently serves as President of Cirba Solutions (CIRcular BAttery), the rebranding of Retrie. Mr. Thompson has used his knowledge to help drive US policy and regulations related to battery recycling and materials.

John DeCarlo, Chief Technology and Commercialization Officer, over 40 years of industry experience with over 20 at the Coghlin Companies holding senior leadership roles through a substantial portion of the company's growth and evolution. John has led full scale manufacturing of more than a billion dollars of innovative capital equipment. As CTO, John has technical oversight of the engineering services and product development team, and as CCO, he is accountable for the overall success of the company's Scaled Product Launch™ Process.

Andrew Jansen is a chemical engineer in Argonne's Chemical Sciences and Engineering Division who plans and conducts goal-oriented research and development on advanced battery systems, providing technical guidance and program direction. His work includes evaluating developmental cells/batteries with an emphasis on cell chemistry and hardware development for lithium-based battery chemistries for transportation applications.

Project Team Members (sub-recipients) and Upstream Partners

EnerSys: Nearly \$3B in 2021 sales, is a global leader in energy storage with over one hundred years of history and a legacy of delivering solutions to partners and customers in a

wide range of industries and applications. With a long-standing focus on lead acid battery, EnerSys is now shifting its focus to the development and manufacturing of li-ion battery products and will function as a lead supplier of these products to DOE and DOD.

EnPower: Technology advantage lies in its patented multilayer electrodes which address the trade-off between energy and power. The company's R&D facility enables rapid innovation and prototyping in 3-7Ah pouch cells. Technology will be scaled for qualification and production at EnPower's 1.5 GWh, 92k ft² customer qualification facility in Indianapolis, IN.

Argonne National Labs (ANL), grant sub-recipient team member: Provides R&D facilities provide unique capabilities to the scientific community. Through collaborative research agreements, scientists can obtain access to specialized instrumentation and expertise rarely found elsewhere.

In collaborations that combine ANL's expertise with that of industry, academia, and other government laboratories, ANL scientists and engineers deliver research tools and solutions that enable access to affordable, environmentally clean energy, and reduces the nation's dependence on foreign energy sources.

Upstream partners are also extremely critical to 6K's success.

Albemarle: Currently working under a multi-year, multi-million-dollar development agreement for alternate Li solutions, is the world's leading supply Li to the automotive market. Total annual revenue in 2021 was \$3.33B. They have a large Research and Development center in North Carolina staffed with highly experienced scientists and state of the art equipment. Operationally, the own and operate mines in Chile and Australia, with Li deposits available in North Carolina and Nevada.

Retriev Technologies: The United States oldest li-ion recycler developing precursor solutions from end-of-life batteries, is wholly owned by the Heritage Group, a multi-billion \$/yr private environmental services company. They have an existing infrastructure with over 1300 trucks, 90,000 customer touchpoints, and are investing heavily to expand their capabilities.

Coghlin Companies / Columbia Tech: OVER 135 years young, more than 1,000 caring associates, and had nearly \$700M in 2021 revenue. With more than 700,000 square foot production space, they provide product development, manufacturing, global fulfillment, and aftermarket services to capital equipment innovators in the medical, life sciences, energy, homeland security, robotics and automation, communications, 3-D printing, LED, and semiconductor.

b) 6K Infrastructure

6K's Additive division currently has four full production UniMelts systems in operation producing commercial products. At the end of budget year 1, 6K's Additive division's capacity will be expanded to eight UniMelt systems with fully automated support systems for materials loading and unloading. These eight UniMelt systems will be capable of producing 400-600 tpa

of multiple chemistries by the end of 2023. As this facility develops volatile metal products it conducts Process Hazard Analyses that fully comply with the National Fire Protection Association (NFPA) 484 Safety Standard.

6K has a corporate equipment team that support both 6K Additive and 6K Energy, currently comprised of 25 resources with plans to double by the end of 2023. The resources are comprised of material scientists, equipment engineers, and technicians that average 15 years of applicable industry experience.

6K has processes in place that leverage the current capabilities and lessons learned from the 6K Additive team's success in the aspects of infrastructure deployment, automation, operations, and safety management across the 6K Inc. enterprise. This inherent 6K knowledge and expertise will be fully applied to the PLUS CAM Project and is already included in the Risk Register.

6K has an experienced materials development team, including resources that launched the first US LFP-based cathode system. The team is comprised of approximately 25 resources of material scientists, process and cell engineers and technicians, that average 15 years of applicable industry experience. The 6K team has received numerous grants from the DOE (VTO and ARPA-E) and USABC that have facilitated demonstration of the base technology as well as various chemistry solutions: LTO, NMC622, NMC9.5.5, and others.

6K's North Andover Battery Center of Excellence (BCE) is a 33,000 square foot facility dedicated to the R&D and pilot production of battery materials and cells. The facility includes 1,500 square feet for three dry rooms controlling relative humidity to 1% for powder handling, 10% for coating and mixing, and 1% for test cell assembly, respectively.

- The BCE includes raw material pre-processing capabilities that includes wet lab space for precursor preparation, a Netzsch horizontal media mill, ball milling, spray drying at multiple scales, vacuum drying, and a variety of other testing and production lab equipment.
- The BCE features a full suite of post processing capabilities including jet milling at multiple scales, a Hosokawa classifying mill, tube furnaces, and an RHK furnace simulator.
- UniMelt plasma reactors (four in 2022, with expansion space for 10), each are capable of 50+ tpa of cathode capacity.

Analytical capabilities are in place to support the materials development, including XRD, SEM/EDS, optical microscopy, ICP, TGA-DSC, mass spectroscopy, Malvern PSD, BET, He pycnometry⁶, tap density, ONHP analysis, KF titration, residual salt titration, rheology, carbon analysis (Q1 2023), and several other analytical and testing requirements.

⁶ A Helium (He) pycnometer is a laboratory device used for measuring the density—or, more accurately, the volume—of solids, be they regularly shaped, porous, or non-porous, monolithic, powdered, granular or in some way comminuted, employing He displacement and the volume:pressure relationship known as Boyle's Law.

The BCE facility supports the R&D and prototyping of full coin and pouch cell assembly capability, supported by temperature controlled electrochemical test channels (with expansion space for up to 1,000) to enable rapid development cycles.

6K's manufacturing support for the UniMelt systems is provided by Columbia Tech with over 135 years manufacturing and installation experience. Columbia Tech will utilize its 1,000 associates and over 700,000 square foot production facilities to provide the UniMelt product development, manufacturing, and delivery. Additionally, they provide on-going support for preventative maintenance programs and rapid issue resolution.

c) 6K Relevant Past Performance

6K has invested over 13 years and \$120 million dollars designing, building, and testing the microwave plasma technology that is the foundation of the UniMelt system. The UniMelt system has undergone industry validation that rigorously applied scientific and engineering disciplines prove, and subsequently demonstrated, full feasibility of 6K's disruptive microwave plasma innovation. 6K's past performance is discussed in detail in **Section 1.a – Background**, above, and is summarized below.

- *Demonstrated the process in a production unit* – 6K developed and successfully demonstrated the first fully-engineered, full-scale UniMelt plasma production system.
- *Demonstrated the process in an industrialized setting* – 6K proved the UniMelt technology efficiently operates at scale by implementing in an industrialized setting for 6K's Additive division for metal AM powders.
- *Demonstrated UniMelt battery material meets customer specifications at a lower production rate* – 6K successfully demonstrated that high nickel NMC could be consistently made to commercial targets at fast development rates.

d) Key Personnel Commitment

6K is fully committed to the PLUS CAM Project, and the key personnel 6K has selected for this project represent the core resources of the company. 6K commits to ensuring at all identified key personnel will remain on the project throughout their employment with 6K, unless mutually agreed upon between the DOE and 6K.

e) DOE/NNSA FFRDC Technical Services

6K has partnered with ANL to conduct the FFRDC evaluation, testing, and qualification (cycle life, storage life, and rate testing) of 6K's NMC, LFP, and LMO materials. ANL will also conduct full baseline comparisons of the commissioned Gen 1 and Gen 2 UniMelt systems (cycle life, storage life, and rate testing) of the production of NMC, LFP, and LMO products.

f) Foreign Entity Involvement

6K has no foreign involvement in this proposed grant request.

g) Multi-Organizational/Investigator Support

6K is not proposing a multi-organizational entity for this Grant Request.



Project Title: Plasma Low-cost Ultra Sustainable Cathode Active Material (PLUS CAM)

FOA Area of Interest 12

Technical Point of Contact: Richard Holman, PhD

Business Point of Contact: Sam Trinch

Team Member Organizations: Argonne National Labs, EnerSys, EnPower

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Glossary

Acronym	Definition
AA	After Award
ANL	Argonne National Laboratory
AM	Additive Manufacturing
AOI	Area of Interest
APQP	Advanced Product Quality Planning
AS	Aerospace
BCE	Battery Center of Excellence (6K R&D facility in North Andover, MA)
BoM	Bill of Materials
CAM	Cathode Active Material
Co (or C)	Cobalt
CO ₂	Carbon Dioxide
CoGS	Cost of Goods Sold
COR	Contracting Officer's Representative
DEI	Diversity, Equity, and Inclusion
DEIA	Diversity, Equity, Inclusion, and Accessibility
DLA	Defense Logistics Agency
DOD	Department of Defense
DOE	Department of Energy
DV	Design Validation
ESG	Environmental, Social and Governance
EV	Electric Vehicle
Fe	Iron
FMEA	Failure Mode and Effects Analysis
Gen	Generation
GHG	Greenhouse Gas
GWh	Gigawatt/Hour
ISO	International Organization for Standardization
IT	Information Technology
JDA	Joint Development Agreement
JV	Joint Venture
LCA	Lifecycle Analysis
LFP	Lithium Iron Phosphate

Acronym	Definition
LMFP	Lithium Manganese Ferro Phosphate
LMO	Lithium Manganese Oxide
LNMO	Lithium Nickel Manganese Oxide
MJ	Mega joules
NC	North Carolina
Ni (or N)	Nickel
NMC	Nickel, Manganese, Cobalt
NV	Nevada
OEM	Original Equipment Manufacturers
ONE	Our Next Energy
PD	Production Design
PI	Principal Investigator
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
PMO	Project Management Office
PMP	Project Management Plan
QC	Quality Control
QMS	Quality Management System
R&D	Research and Development
RCA	Root Cause Analysis
SBIR	Small Business Innovation Research Program
SMART	Specific, Measurable, Achievable, Relevant, and Timely
SOP	Start of Production
SVP	Senior Vice President
Ti	Titanium
tpa	tonnes per annum
TS	Technical Standard
VP	Vice President
WBS	Work Breakdown Structure

1. Project Overview

High volume plasma production of cathode ready to replace dirty co-precipitation
Enabling domestic production of cathode AND on-shoring of feedstock supply chain

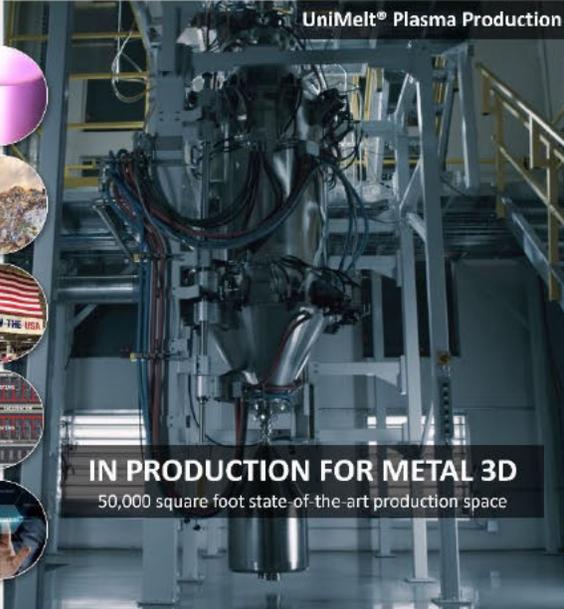
DRAMATIC COST REDUCTIONS
95% FASTER = 50% to 60% reduction in processing cost

NEAR ZERO ENVIRONMENTAL IMPACT
Zero solid/liquid waste, 90% less water, 70% less GHG

COMPETING WITH CHINA HEAD-TO-HEAD
On-shore production at a lower cost than China

CATHODE READY FOR SCALE UP
Premium single crystal cathode meeting spec now

FUTURE PROOF TECHNOLOGY
Chemistry agnostic: deploy future-proof flex-chem plants



UniMelt® Plasma Production

IN PRODUCTION FOR METAL 3D
50,000 square foot state-of-the-art production space

Figure 1-1 – UniMelt plasma production technology is fully scaled, in production, lower cost production than coprecipitation AND dramatically lower impact to the environment, two requirements for repatriation to the US.

a) Background

6K was founded by Dr. Kamal Hadadi who spent 12 years at MIT's Plasma Science and Fusion Center. 6K (previously Amastan) has spent more than 13 years and over \$120 million dollars designing, building, and commercially deploying the UniMelt® microwave plasma technology.

It is the world's only plasma production system capable of high-volume production of low cost, sustainably produced engineered materials, including EV-quality materials. The platform leverages a highly uniform thermal 6,000-degree Kelvin profile in a high throughput production zone (3 inches by up to 8 feet) and a highly reactive plasma environment that forces reaction completion in fractions of the time of conventional processes. Smaller footprint, lower capital expense (CapEx), lower conversion costs, and major reductions of GHG are all core attributes.

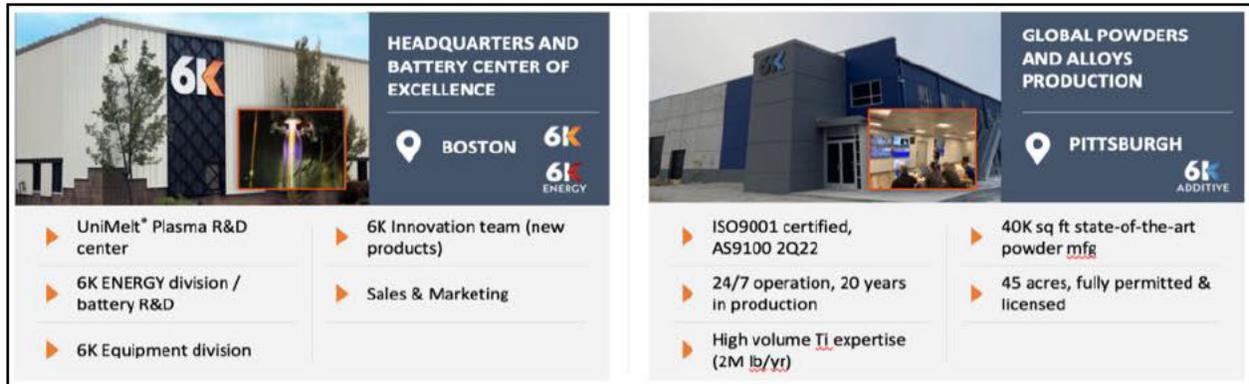


Figure 1-2 – 6K received its first private investment in 2014, has grown to 150 people, and commercialized the world’s only UniMelt Plasma Production for **highly engineered materials**.

Key milestones that support this goal:

- **High Volume UniMelt production systems have been put in service** with high throughput production zone, high throughput UniMelt, and the associated process technologies, proving the contract manufactured and OEM UniMelt systems can be scaled to meet tens of GWh, with components sourced 100% domestically.
- **Over 10 classes of engineered materials** were produced between 2015 and 2017, including: semiconductor materials, battery cathode, metal 3D powders, phosphors for lighting, solid-state laser materials, transparent ceramics, advanced thermal barrier coatings, and more.
- **6K Additive was launched in 2018** and is the world’s only producer of premium metal powders for Additive Manufacturing made from sustainably sourced feedstocks. They have paved the way to produce battery cathode materials by demonstrating a fully industrialized implementation of UniMelt plasma, running 24 hours a day with high uptime and approximately 90% yield in a 50,000 square foot, ISO9001-certified facility.
- **6K Energy was launched in 2019** and comprises executives and battery technologists from A123, Tesla, 24M, LG, Farasis, Clarios, CAM-X, and other global leaders. Its mission is simple: repatriate lithium-ion battery materials production through advanced plasma production and innovative feedstock sourcing.
- **Government funding has been critical** to the development of 6K’s cathode products, starting in 2018 with a Phase I and Phase II contract administered by the DOE VTO office which demonstrated the ability for plasma-produced NMC622 to match performance specs of commercial-quality materials. A DLA Phase I contract demonstrated the ease of extensibility to higher nickel (90% and beyond).
- **6K can reliably produce premium single crystal cathode materials** which meet or exceed partner expectations for CAM performance. 6K’s materials are currently being testing by dozens of Original Equipment Manufacturers (OEM's) and lithium-ion battery cell producers to ensure 6K produced materials are meeting requirements.

- **6K has built numerous partnerships** in its mission to create a fully US domestic supply chain, including publicly announced Heritage/Retriev for recycling of end-of-life cathode, Albemarle for developing low-cost processes for domestic lithium, and Our Next Energy (ONE) where 6K will supply of cathode for the Aries and Gemini platforms.
- **6K Energy’s \$30M Battery Center of Excellence** (opening in July 2002) is a critical component of accelerating and de-risking this proposed cathode production plant implementation. As an advanced battery product development center, it will have ten pilot scale UniMelt cells, and the ability to validate and verify processes prior to being transferred to the scaled production plant (the subject of this proposal).
- **6K will close approximately \$200M in private funding** (July 2022) to accelerate the deployment of battery materials on domestic soil, and which will provide the necessary cost share for a successful DOE program. 6K’s team and investors are fully committed to the mission to bring cathode production to the United States.

b) Project Goal

6K proposes a 3,000 tpa (3,000 metric ton) demonstration plant as the proof point for scaling its UniMelt production platform for Cathode Active Material (CAM) production in the United States. Plasma production technology leapfrogs legacy coprecipitation technology with proven 6,000-degree Kelvin microwave plasma, an ultra-fast, ultra-clean process demonstrating zero solid and liquid waste, using 90% less water, 70% less energy, while generating 70% less Greenhouse Gas (GHG) for NMC811 with process costs substantially lower than coprecipitation in China.

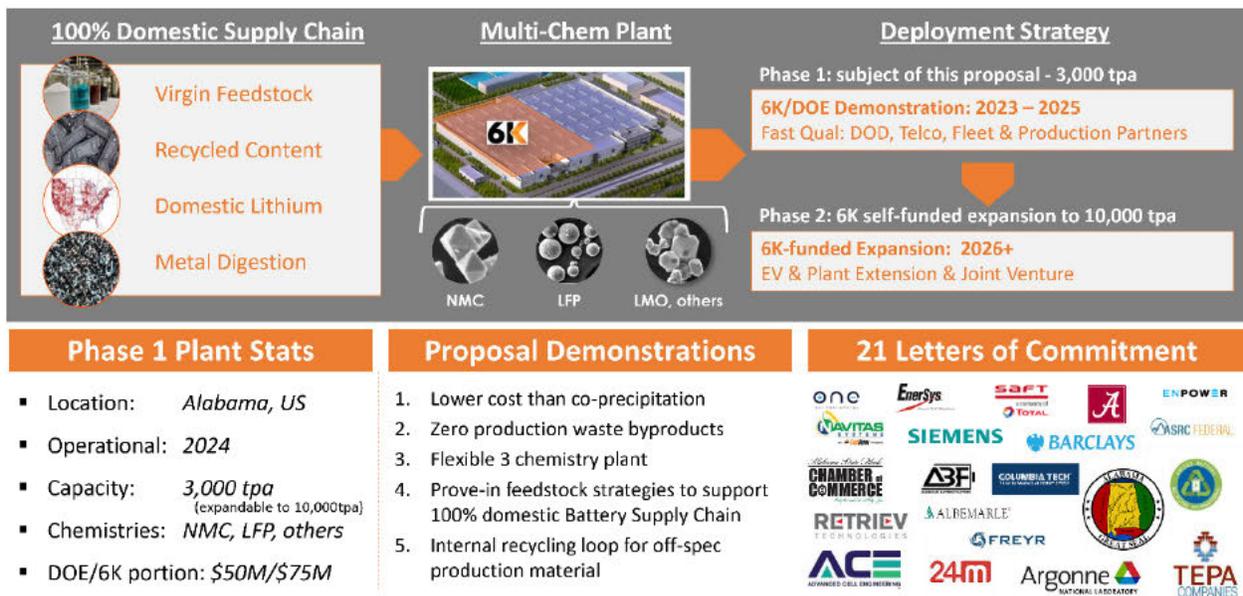


Figure 1-3 – 6K Proposal at a Glance. 6K Primary Project Goal is to demonstrate an economically advantaged and sustainable cathode production capability on US soil based on 6K’s UniMelt plasma production platform.

Note: 6K’s portion in Phase 1, \$75M, includes working capital not part of grant submission.

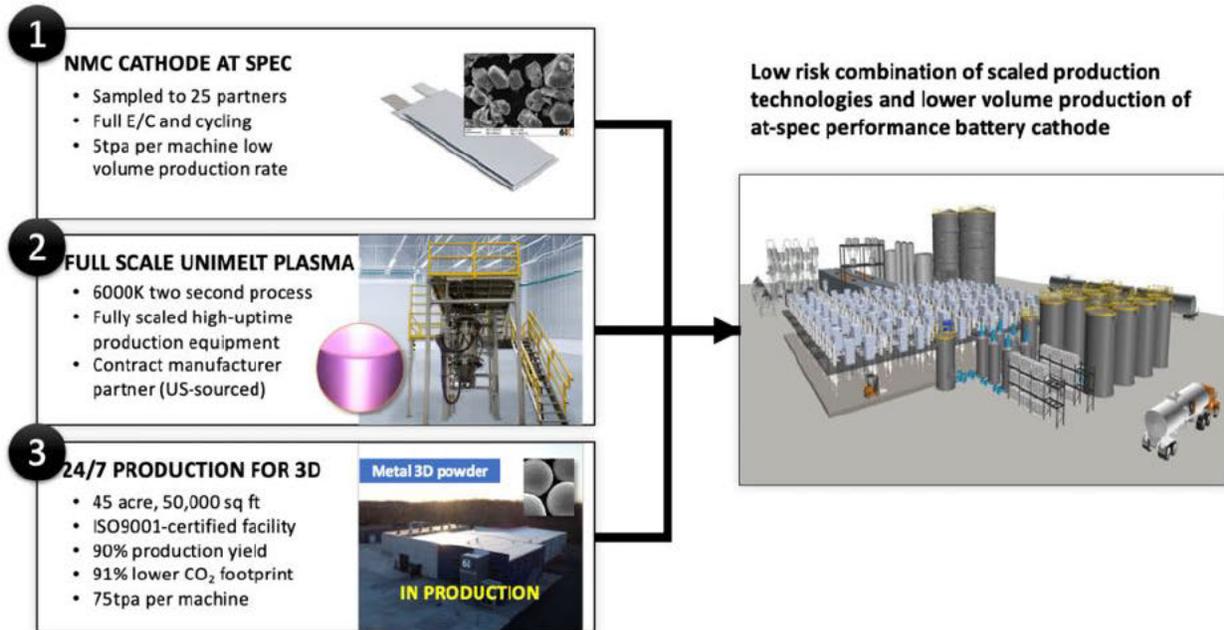


Figure 1-4 – Targeted Improvements. 6K’s PLUS CAM™ plant is a low-risk combination and scaling of three-core proven successes to date that enable the first 3,000 tpa plasma-based cathode production plant.

Targeted Improvements – combination and scaling of known technology baseline

The targeted improvements are specifically the scaled production of at-spec cathode materials using UniMelt production that has been scaled in another volume market. These three foundational areas ensure that the objectives of proposed project can be met with high confidence.

- 1. UniMelt cathode meets customer specifications at pilot production rate (10 tpa):** 6K has demonstrated its NMC cathode viability by meeting all critical specifications for its NMC811 single crystal cathode product, which is being tested by over 20 partners for capacity, power, cycle life, etc., with full cell full depth of discharge cycling trending to more than 1,200 cycles, proving the material can meet customer expectations.
- 2. Fully Industrialized UniMelt Plasma Systems:** 6K has developed and successfully deployed the world’s only microwave-based plasma production UniMelt plasma production system at scale.
- 3. UniMelt Plasma in high volume ISO9001 production plant:** UniMelt has already been deployed in the 6K Additive division for the high-volume production of premium metal 3D powders in a remote, 24 hour 3-shift operation facility, already demonstrating 90% yields, 50-75 tpa with high uptime. The 6K Ni powder has a 91% lower carbon footprint than best competition, high customer acceptance, and is deploying into commercial space, medical, automotive, and industrial applications.

Critical Success Factors for the targeted improvements

To achieve the Project Goal through the advancement of the targeted improvements, the following critical success factors must be achieved:

1. Scaling the Gen 1 UniMelt throughput for cathode production from 10 tpa to 50 tpa for launch, extending to 100 tpa. Note that the 6K Additive production systems are 50-75 tpa today in 3-shift operation running at >80% yield.
2. Implementation of the UniMelt and associated infrastructure and processes to achieve a high uptime (>80%), high plant yield (>80%) output for 3,000 tpa total capacity.
3. Workforce: Hire and train a diverse workforce at wages higher than current local rates
4. Demonstration of the production of multiple chemistries in a single plant with a single UniMelt platform for improved plant utilization efficiency.
5. Implement a viable domestic supply chain for raw material inputs leveraging partners:
 - Digestion of critical metals (Ni, Fe) from domestic sources to produce feedstocks for direct incorporation into 6K's process flow.
 - Demonstration of domestic source of lithium salts with 6K partner Albemarle.
 - Demonstration of cathode produced from recycled nitrate salts from EOL batteries at 75% recycled content in cooperation with 6K partner Retrieval.

c) DOE Impact

1. Proven Plasma Innovation Advantage: DOE funding enables 6K to implement the UniMelt technology in full-scale CAM production, demonstrating that microwave plasma process is superior to coprecipitation, and the basis for future expansion.

2. US Leadership and National Security: project will prove the technology's ability to create a highly competitive domestic cathode plant, which is critical to long term economic competition and battery material independence with China and repatriation of the supply chain. Meeting the goals will enable 6K to supply all DOD programs with 100% domestic content by 2026.

3. Commercial Impacts of Program: 6K's participation in this program accelerates product qualification by commercial and DOD partners, bringing forward the time it takes to launch a revenue generating plant with up to 150 new jobs targeted to disadvantaged communities.

Why is DOE funding critical for 6K's demo plant?

Funding bridges to production scale: 6K has received private funding of almost \$290M by investors. Capital for full-scale demonstration plants is more challenging. DOE support bridges the gap. Once the plant is operational and milestones met, 6K will be able to raise private debt and equity capital to expand and build the next 10-20 GWh and beyond.

Unique and powerful eco-system enablement that increases success: through this DOE grant, it enables and solidifies critical upstream and downstream partnerships that would take longer or be more difficult to lock in. Funding reduces barriers to materials qualification at downstream partners, accelerates introduction into battery supply chain.

d) Equity Plan

Diversity, equity, inclusion, and accessibility (DEIA) principles are incorporated into all aspects of the project in all phases (before, during, and after) as noted throughout the 6K Equity plan. This begins with 6K's site selection criteria that establishes the priority of siting the project

within at least one Disadvantaged Community (DAC) that can benefit from the project. Benefit streams are further described in the Justice40 Initiative section of the Equity Plan. SMART Goals have been established for each budget period and are summarized in a matrix on page 13 of the 6K Equity Plan. The Equity plan identifies specific DEIA and Justice40 Initiative actions and policies for each phase of the project. In all phases, 6K will include the voices of underserved communities and households in the decision-making process. Over time, the project will create up to 150 well-paying jobs. Through education, recruitment, training, and retention initiatives, it is anticipated that at least 40% of the employees will come from DACs and that the workforce will reflect the diversity of the community.

2. Technical Description, Innovation, and Impact

a) Relevance and Outcomes

UniMelt Microwave Plasma Process Technology

6K has developed a flexible, low cost, and highly scalable continuous materials production platform based on its patented UniMelt microwave plasma technology. The use of a microwave plasma provides for a very controlled, uniform, highly reactive, and high temperature reaction zone that enables the synthesis of materials at rates far greater than with conventional methods, and with much greater chemistry and size flexibility. This platform has been deployed to mass production for advanced powders for Additive Manufacturing and is now being applied to the domestic production of battery materials.

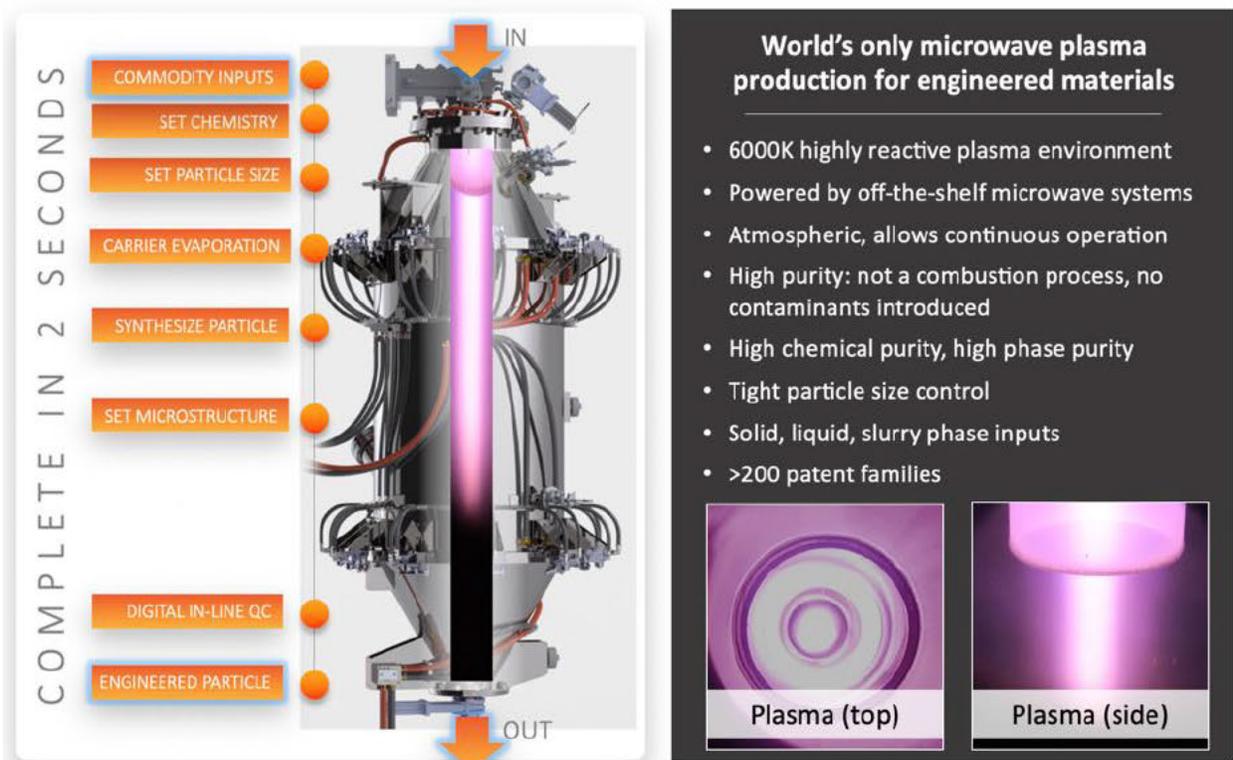


Figure 2-1 – 6K’s UniMelt microwave plasma production system for engineering materials is unique in the materials production industry.

UniMelt a stable and uniform microwave plasma is formed using a gas appropriate to the product chemistry (e.g., oxygen, nitrogen, argon, hydrogen, etc.). A combination of power input and multiple controlled gas feeds are used to tailor the energy content, reaction zone size, and thermal profile to the material being produced. Feedstock containing all necessary elements for the product is fed into the plasma, where any carrier liquids (if present) are quickly evaporated, and the intimately mixed precursor reacts to form the target compound, driven by the high temperature and the reactivity of the ionized species in the plasma. As material leaves the reaction zone and passes farther down the reactor, the microstructure is further developed, controlled by the length and temperature profile of this region. Finally, material is collected either in a cyclone or a baghouse depending on the target material size.

The process takes less than 2 seconds, has a small footprint, and results in exceptionally low conversion costs. Feedstocks are typically aqueous solutions of simple salts, providing tremendous flexibility in formulation chemistry, dopants, etc., however solid feedstocks and slurries have also been successfully utilized. Control of input material size, reaction atmosphere, plasma power, material residence times, and precursor chemistry enable control over particle size, morphology, and microstructure. The flexibility of the technology is demonstrated in Figure 2-2, which contains a sampling of various engineered materials, in addition to battery materials, and particle sizes that have been produced to date, with key examples spanning multiple applications.

Producing cathode battery materials with UniMelt

To produce NMC811 via 6K's UniMelt process, a salt solution containing Ni, Mn, Co, and Li is atomized and delivered to the plasma. The droplets rapidly form a uniform intimate mixture that is converted to the lithium transition metal oxide structure. A final thermal post-process (three hours or less at temperature) completes the crystal development, producing large, uniform single crystal NMC. The final product is a granular powder, and a standard



Figure 2-2 – Sampling of materials produced using 6K UniMelt plasma production system, demonstrating the versatility of chemistry, size, and morphology (microstructure) control.

deagglomeration¹ step is sufficient to produce the free single crystals. The extensibility of this single crystal process has been demonstrated in a DLA Phase 1 program, where single crystal stoichiometry² up to 91% Ni were successfully produced. These two single crystals are shown in Figure 2-3 below.

Objectives Pursued During the 6K PLUS CAM Project

The Primary Goal is to establish and demonstrate a viable cathode production capability on US soil based on 6K's innovative UniMelt Microwave plasma production platform. This will be enabled by 6K's significantly lower manufacturing costs and improved sustainability relative to established cathode production methods like coprecipitation.

In addition to cathode production capability, the Secondary Goal is establishment of a **viable supply of domestic raw materials** for the cathode production process, enabling true energy independence. To that end, a secondary objective of this proposal is to demonstrate viable sources of critical feedstocks via a combination of domestic salt production from existing metal feedstock sources, recycling of EOL batteries as feedstocks, as well as internal process fallout that goes back into the 6K process. 6K partner **Retriev**, and development of existing raw material supply via 6K partnerships with leaders in the space such as **Albemarle**.

When successful, this demonstration project will form the basis for a domestic cathode production capability that frees the US from its current dependence on foreign sources for these materials so critical to the US's energy strategy. 6K is proposing a \$125M³ total project for scaling existing proven processes for a 3,000 tpa flexible chemistry plant.

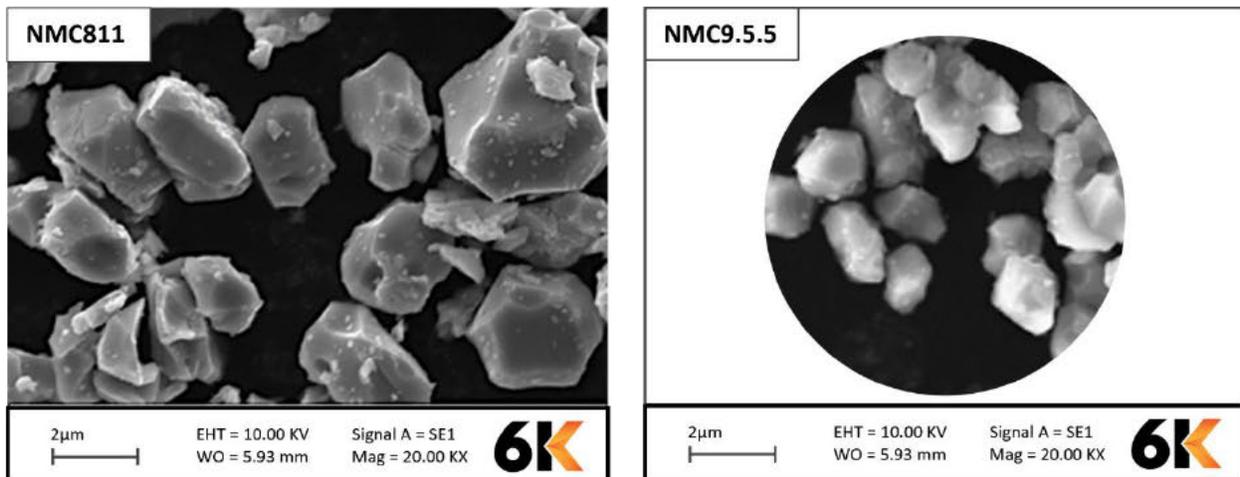


Figure 2-4 – Sampling of uniform single crystal NMC811 (left) and single crystal deagglomeration producing 91% Ni NMC9.5.5 material (right)

¹ Deagglomeration is a size reduction process in which loosely adhered clumps (agglomerates) of powders or crystals are broken apart without further disintegration of the powder or crystal particles themselves.

² Stoichiometry is the relationship between the quantities of reactants and products before, during, and following chemical reactions

³ Includes working capital not included in the grant proposal

The demonstration plant will prove all facets of full-scale UniMelt-based cathode production, including workflows and materials handling, workforce training, feedstock flows, 3-shift operations and more. Following the successful deployment of the plant and meeting critical KPI metrics of yield and uptime, **6K will further self-fund an additional \$50M to expand the plant to a total of 10,000 tpa.** This plant will be profitable and commercially advantaged versus coprecipitation, including versus imported foreign cathode product.

Objectives aligned with the Primary Goal:

1. Demonstrate the efficiency and sustainability of the UniMelt microwave plasma process over conventional coprecipitation processes.
2. Demonstrate the UniMelt system's versatility to create multiple chemistries from a common equipment infrastructure.
3. Demonstrate environmental responsibility of the UniMelt system through reduction of energy and water usage and zero hazardous waste production.
4. Demonstrate support to DACs through the geographical placement of the production facilities and job training.
5. Demonstrate the UniMelt system's ability to achieve initial commercial scale production with a 3,000 tpa output.

Objectives aligned with the Secondary Goal:

1. Demonstrate internal recycling of cathode scrap through digestion and return to process stream.
2. Demonstrate recycled salt solutions from end-of-life batteries in conjunction with 6K partner Retrieiv.
3. Demonstrate Li salt sourcing in conjunction with 6K's partner Albemarle.
4. Demonstrate metal salt production through the digestion of Ni, Co, and scrap steel for iron, building upon previous experience and utilizing existing partnerships.

Relevance of Project to FOA Goals and Objectives

The objective of the *Domestic Battery Cell and Component Manufacturing Demonstration Topic* (Area of Interest 12 (AOI 12)) is to **"accelerate commercialization of innovative manufacturing processes for battery cells, materials, or components that have never been utilized at scale for the electric vehicle (EV) and electric grid market through large-scale pilot demonstration projects."**

- 6K's proposed demonstration plant based on its proprietary UniMelt Microwave Plasma platform directly supports this objective with a volume production demonstration of 6K's innovative materials manufacturing approach that will cost-effectively deliver large-scale critical battery materials at scale for the EV and electric grid markets.

In support of the AOI 12 objective to "...focus on improving cost or performance of commercialized battery chemistries or enabling next-generation battery chemistries":

- 6K will demonstrate how the technology reduces costs through lower capital investment in infrastructure, significant reduction in operating costs, and the elimination of waste disposal costs.

- We will also demonstrate how the same UniMelt production technology can be used to produce multiple battery chemistries, thereby futureproofing the production infrastructure established in part by this grant.

6K's Plasma Technology also directly supports the DOE goal of "ensuring justice and equity, creating jobs, boosting domestic manufacturing, reducing GHG emissions, and advancing a pathway to private sector."

- 6K will demonstrate how the technology reduces energy consumption by 70%, water consumption by 90%, carbon monoxide emissions by 70%, and produces zero liquid/solid waste.
- Our technology advances private sector manufacturing through the creating of domestic manufacturing facilities that will generate a viable, long-term battery chemistry production industry within the United States that delivers products at a more favorable cost than offshore suppliers.

Meeting DOE Technical Targets and Policy Priorities

6K's proposed demonstration directly aligns with DOE technical targets and policy priorities.

- Our UniMelt process is a disruptive technology that will establish a domestic cathode volume production capability at lower production cost than imports from overseas and will do so more sustainably than conventional coprecipitation-based methods.
- The UniMelt technology brings manufacturing diversity to the DOE project portfolio, mitigating risk with its already proven next generation materials production platform.
- Our project builds coordination and partnerships with other battery technologies and suppliers upstream and downstream in the supply chain, increasing chances of a long-term economically successful US battery industry.
- 6K's proposed project will increase high-quality employment and manufacturing opportunities in the United States, and incorporate diversity, equity, inclusion, and accessibility elements with an Equity Plan that focuses on small/minority business, Tribal Nations, and underserved communities. The proposed project targets up to 150 high-quality, high-paying jobs with strong career paths in the battery supply chain to underserved communities. This will expand substantially as 6K expands to 10,000 tpa in its self-funded Phase 2 and builds additional plants in the US.
- The UniMelt process significantly reduces environmental impacts to DACs, allowing environmentally responsible chemical production onshore, fulfilling 6K's commitment to achieve 100% North American sourcing of battery material, eliminating dependency upon foreign entities of concern.

Expected Outcomes

6K expects to successfully demonstrate the UniMelt process in full commercial-scale production, delivering high-quality chemistries at a more favorable cost than offshore suppliers.

Our expected outcomes from this demonstration are:

1. Fully Operational Plant: Construction, implementation, and operation of a domestic revenue-generating cathode plant using UniMelt Plasma production technology
2. Validation of the commercial-scale process:
 - a. Initial production of a of 3,000 tpa CAM plant.
 - b. Space and manufacturing infrastructure to support future expansion to up to 10,000 tpa within the demonstration plant, based on 6K customer demand.
3. Unique Flex-Chemistry: Demonstration of the production of multiple chemistries in a single plant, specifically NMC, LFP, and other chemistries such as LMO, LMFP, etc.
4. Validation of cost-efficiencies achieved with the 6K process.
 - a. 30% lower conversion cost for NMC811 with 6K's Generation 1 (Gen 1) 100 tpa per system process versus traditional coprecipitation methods
 - b. 50% lower conversion cost for NMC811 with 6K's Generation 2 (Gen 2) 400 tpa per system process versus traditional coprecipitation methods.
 - c. Demonstration of an internal recycling loop for cathode production that effectively reduces BoM yield losses to nearly 0%.
5. Sustainability: Demonstration of substantial ESG improvements over conventional coprecipitation of NMC cathode, to be demonstrated at scale and validated by lifecycle analyses (LCA) analyses conducted by team member ANL:
 - a. Major reduction in water consumption, estimated to be up to 90% versus standard coprecipitation plus calcination.
 - b. Improved CO2 footprint, estimated to be a 60-70% reduction versus standard coprecipitation plus calcination.
 - c. Total elimination of liquid waste, a huge issue for coprecipitation, limiting site options for conventional cathode plants which largely dispose of this waste in rivers and oceans.
6. Workforce development: The project will create up to 150 well-paying jobs. Through education, recruitment, training, and retention initiatives, it is anticipated that at least 40% of the employees will come from DACs and that the workforce will reflect the diversity of the community.
7. Domestic Supply Chain: viable domestic supply chain for raw material inputs.
 - a. Digestion of critical metals (Ni, Fe) from domestic sources to produce feedstocks for direct incorporation into 6K's process flow.
 - b. Demonstration of domestic source of lithium salts with 6K partner Albemarle.
 - c. Demonstration of cathode produced from recycled nitrate salts from EOL batteries at 75% recycled content in cooperation with 6K partner Retrieiv.

b) Feasibility

Previous Work and Results: Summary

The microwave plasma-based domestic cathode production capability proposed in this document builds upon five years of development activity bringing CAM to scale-up readiness, which in turn draws on over 10 years of experience developing the fundamental microwave plasma technology and bringing it to market at scale producing powders for the Additive Manufacturing market.

6K is now preparing to scale its cathode synthesis capability into production based on these key demonstrations and customer validation points:

#1. Premium NMC811 cathode product meeting customer specification

1. 6K's single crystal NMC811 cathode has been sampled in multi-kilogram quantities to over 20 customers spanning the battery supply chain, from raw material suppliers to OEM's, who have judged the 6K cathode "as good or better than" powder made conventionally.
2. 6K's single crystal NMC811 process consistently produces a uniform, high phase purity powder with low cation mixing that exhibits full expected capacity, rate capability and first cycle efficiency and demonstrated process consistency.
3. Cycle life has been tested extensively by 6K customers, with confirmation that 6K's cathode performs on par with material made by the conventional approach.
4. Extensibility to numerous chemistries (like NMC9.5.5, LMO, LFP, LTO, etc.) gives 6K the flexibility to adapt to market trends toward higher energy stoichiometries⁴, cobalt-free cathode, and true flexible-chemistry production plants – saving hundreds of millions of dollars in CapEx.

#2. Full scale UniMelt production in its 6K Additive division

1. Implementation into a true 24 hour, three-shift operation industrialized setting, incorporating all production and life safety requirements
2. Achieved full customer acceptance, with ISO9001 certification, and adding AS9100 (aerospace) and ISO13485 (medical) later in 2022
3. Proven out UniMelt plasma platform and all associated support infrastructure for high uptime (achieving 80%) and high yield (approaching 90%)
4. Achieved true production outputs of 50-75 tpa (50 tpa is target for **cathode** launch)
5. 6K Additive has effectively built and trained a workforce to run and support production using UniMelt plasma production systems. This was done in a disadvantaged community

⁴ Stoichiometry refers to the relationship between the quantities of reactants and products before, during, and following chemical reactions

NMC811 single crystal cathode product

6K has completed product development of its first cathode product, single crystal NMC811, and validated performance testing with over 20 global partners. Partner feedback consistently states that 6K product made with plasma meets or exceeds that from coprecipitation, today's existing approach.

6K has also developed processes to produce this product on full scale UniMelt equipment at a rate of approximately 10 tpa. The project will scale to 50 tpa ultimately to 100 tpa on Gen 1 and 400 tpa on Gen 2.

The first two graphs below demonstrate 6K's ability to achieve a run rate with high repeatability while delivering materials to industry partners hitting the target capacity. Figure 2-5 shows the consistency of two critical internal key parameters, the first being 6K partners confirming 6K's ability to achieve the target capacity, and the second showing 6K consistency testing of the product for discharge capacity and Li/Metal ratio over a seven-month period of performance.

Customer cycling data proves the material is able to achieve automotive requirements with latitude to tailor material to meet specific specifications based on strategies like doping and size control managed via Joint Development Agreement with a partner. The cell used to capture the data shown in Figure 2-5 was a multi-layer production intent cell and trending to over 1,200 cycles while retaining 80% of its initial capacity.

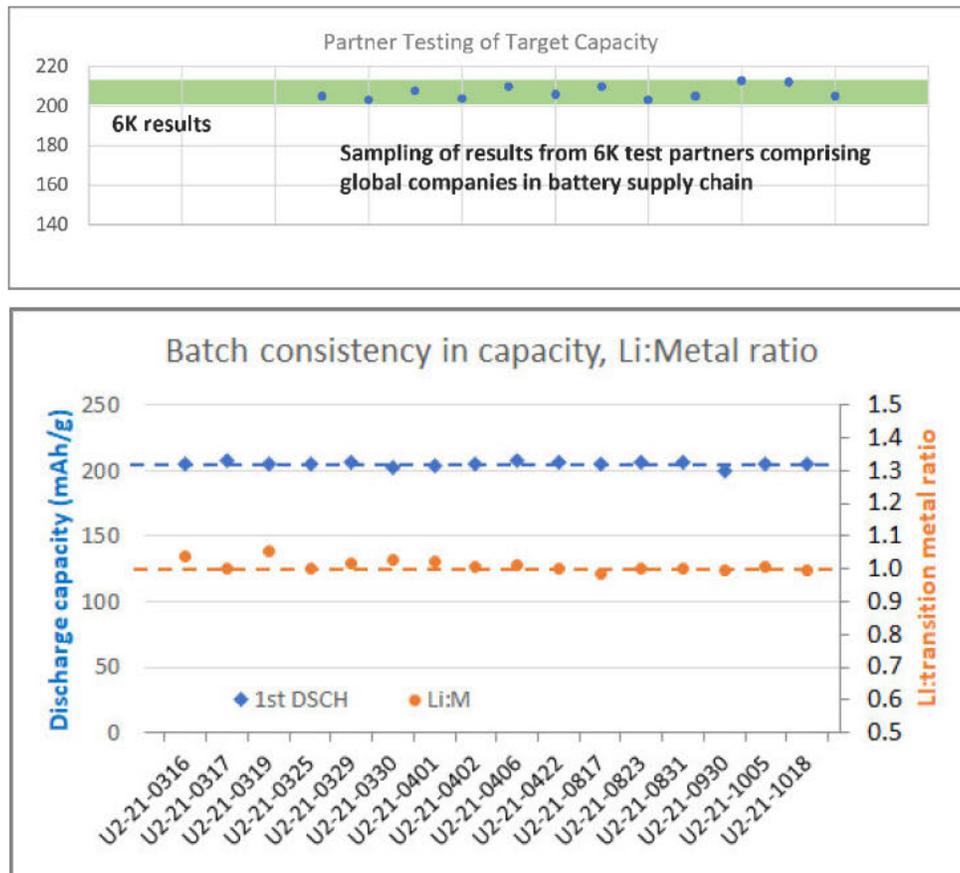


Figure 2-5 – Product consistency and target capacity validated by 6K quality control and verified by partner testing

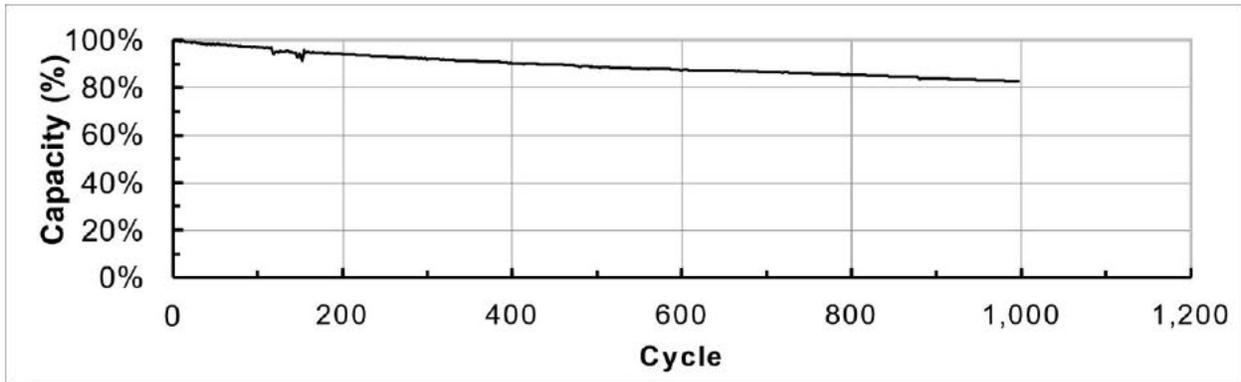


Figure 2-6 – Global cell maker **cycle data** in lithium-ion pouch cells with 6K's (undoped) NMC811 single crystal cathode, performance projected to >1200 cycles @80% retention (on par with their incumbent)

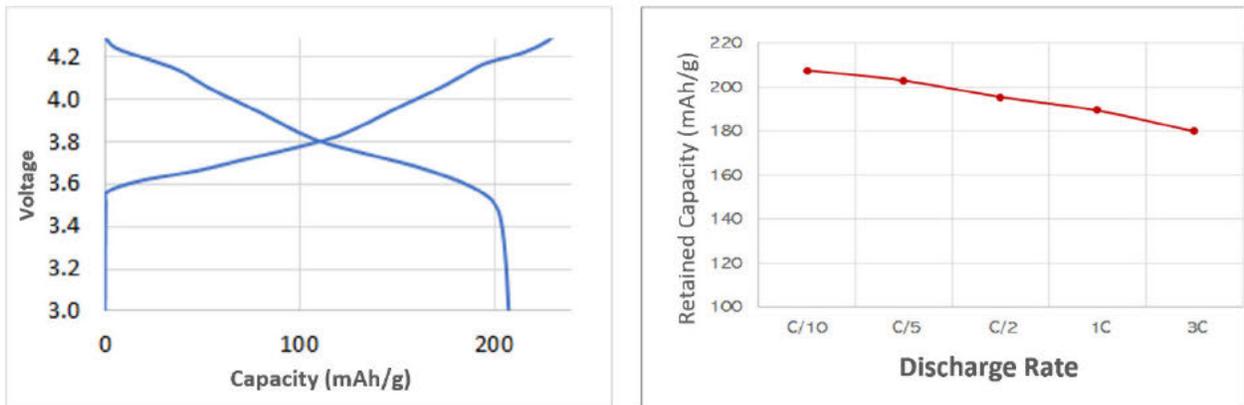


Figure 2-7 – Other examples of critical parameters tracked are voltage charge and discharge and rate performance.

Multi-Chemistry capability provides a future-proof US-based industry

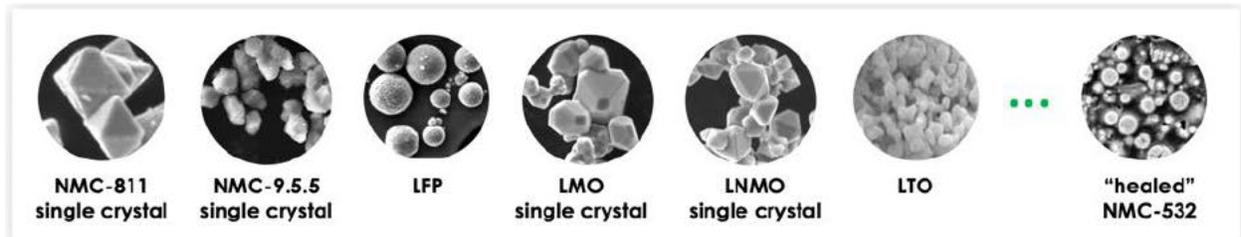


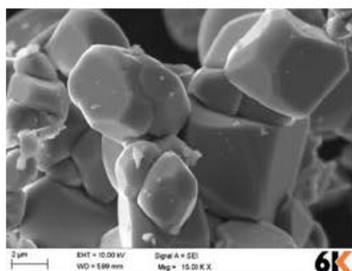
Figure 2-8 – 6K's UniMelt Production is chemistry agnostic and has produced over 15 different battery classes and chemistries, supporting 6K's plan to introduce a multi-chemistry plant, illustrating the ability to flexibly allocate production CapEx to serve market needs as they change.

6K's cathode production technology has unparalleled chemistry flexibility, allowing for multiple chemistries to be produced in the same plant, giving 6K the ability to reallocate production as the market and chemistries evolve over time. This makes 6K's technology nimbler and eliminates concerns over creating stranded capacity.

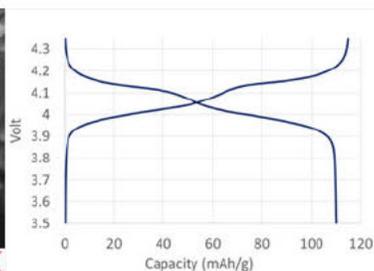
The flexibility stems from the unique way in which material is synthesized in 6K's plasma reactor. Intimately mixed feedstocks are fed into the reactor, with the size of the feedstock, whether solid or liquid, chosen based on the desired final product characteristics. Reactions happen extremely fast (fractions of a second), driven both by the 6,000 Kelvin plasma and by the highly reactive ionized plasma species. Feedstock types (aqueous, solid, and even slurries) and plasma gas(es) are selected to provide the best combination of cost and product characteristics.

Taking advantage of this capability, 6K will produce single crystal NMC, LMO and LFP concurrently within the proposed cathode demonstration plant.

- **LMO cathode:** 6K commenced development activities on LMO in Q4 2021, and **within three quarters** has demonstrated full capacity and efficiency, phase purity, and the ability to dope for high temperature stability, as shown in **Figure 2-9** below.
- **LFP cathode:** 6K is now in active development of its LFP cathode product, and is making similarly rapid progress, currently achieving 85% of target capacity in a desirable spherical morphology. Sampling of 6K LFP is expected to begin in Q4 of 2022.



a.) 6K LMO cathode



b.) 6K LMO voltage profiles



c.) Effect of doping on 45C cycling

Figure 2-9 – LMO cathode produced using 6K's process a.) SEM of single crystal form of LMO, b.) Voltage profile and capacity of LMO produced by 6K, and c.) Effect of doping on elevated temperature cycling performance in accelerated testing demonstrating the successful incorporation of dopants in LMO.

UniMelt Plasma Full Scale Production for premium sustainable 3D metal powders



Figure 2-10 – 6K Additive has proven all aspects of high volume, high uptime production using the UniMelt plasma innovation, including workforce development, 24 hour 3-shift operation, redundancy, and ISO certification.

A critical proof point for this proposal is the existing implementation of UniMelt plasma to deliver a premium product as part of 6K Additive operating division. This accelerates and de-risks the work plan for this proposal by leveraging solved scaling issues.

- Proven the ability to develop, train, and operate a 24/7 workforce for UniMelt plasma
- Worked through infrastructure and supporting equipment requirements for continuous high volume production meeting ISO certification
- Proven UniMelt equipment can operate with high uptime and high yield for premium products to demanding markets (aerospace, defense, auto, etc.)
- Proven a supply chain and developed contracting manufacturing capabilities to domestically source, build, and commission high volume equipment

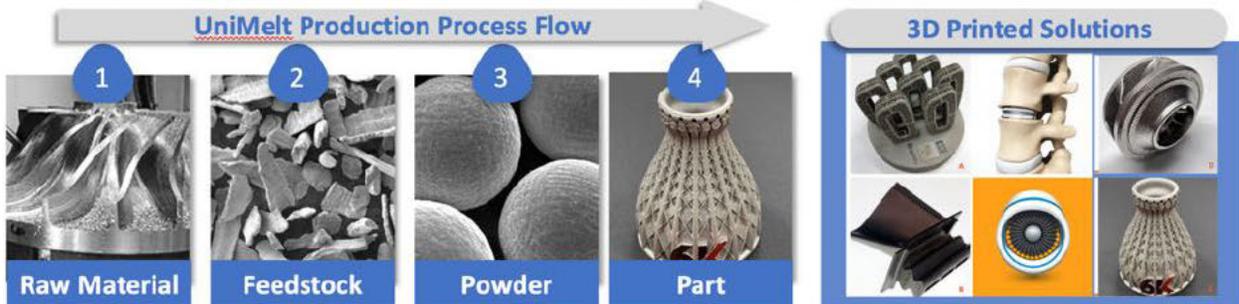


Figure 2-11 – 6K Additive has launched a ground-breaking product enabled by UniMelt plasma, the world’s only sustainably-sourced 3D metal powders. Third Party Life Cycle Assessment proves a 91% lower carbon footprint.

Workforce development

6K will employ its existing staffing model to ensure that DEIA principles are incorporated into all aspects of the project in all phases (before, during, and after) as noted throughout the 6K Equity plan. 6K has built a 45,000 square foot facility in Burgettstown, a borough in Washington County, Pennsylvania, which produces Additive Manufacturing powders for 6K's Additive division. Over a one-year period 6K recruited, hired, and trained a highly diverse team of 40 personnel with varying skillsets and experience levels. This facility has been operational for three years with excellent employee retention and job satisfaction. 6K uses its employee retention program to provide ongoing career growth through technical training and internal advancement programs. The result has been the stable development of a quality workforce with exceptionally low turnover.

6K's site selection criteria for the new production facility prioritizes DAC locations that can benefit from the specific DEIA and Justice40 Initiative actions and policies identified in the 6K Equity Plan for each phase of the project. 6K is currently developing local community partnerships to provide capacity-building and workforce development training, connecting disadvantaged community members to the project through jobs and community benefits.

- 6K has already begun to engage with local community organizations to identify and reach out to local disadvantaged business enterprises (DBEs) that could serve as consultants/contractors/subcontractors.
- With input from the local community, 6K is establishing percentage goals for DBE contractor participation.
- 6K is initiating discussions with local community and technical colleges and universities for curriculum development and career planning for potential job candidates.
- Through education, recruitment, training, and retention initiatives, it is anticipated that at least 40% of the employees will come from DACs and that the workforce will reflect the diversity of the community.

6K will consult with community-based organizations and the community to develop a Community Benefits Agreement and Good Neighbor Agreement with measurable outcomes. 6K will collaborate with local community groups to inform DACs of opportunities for jobs and training and establish hiring goals for underserved populations so that the workforce represents the local community. In conjunction with state and local partners, 6K will seek to provide workforce education, training, apprenticeships, certification, and licensing.

c) Innovation and Impacts

In this section, 6K will compare and quantify the primary advantages of its **UniMelt plasma** innovation versus the **chemical coprecipitation** process used almost exclusively in the industry today. Main components:

1. Number of steps, complexity, and speed of the processes
2. The reduction of process cost by 50%-60%
3. The reduction of impact to environmental factors by 70%-100%

4. The ability to develop 100% domestically sourced feedstocks from a combination of battery recycling, internal recycling loops, domestic lithium, and digestion of metals

Current State of the Art: chemical coprecipitation

The current state of the art for the production of cathode battery materials relies on the traditional coprecipitation plus calcination process.

In this process, a solution of Ni, Co, and Mn sulfates is slowly titrated with base in a large, stirred tank reactor over the course of many hours to coprecipitate a suspension of the mixed metal hydroxide precursor material. Lithium cannot be added at this step because of the vastly difference aqueous chemistry between lithium and transition metal salts.

Upon completion of the precursor particle growth period, the mixed metal hydroxide particles must then be separated from the reaction byproducts by filtration and washed extensively to eliminate residual sulfate and sodium ions, consuming substantial amounts of water and generating massive quantities of waste. Given the limited market and the quantities of sulfate waste, it is **not cost effective to “recycle” the sulfate, and as such it is primarily disposed of by pumping into rivers and oceans.** The salinity this contributes limits the quantities that can be dumped into rivers, and thus greatly constrains site selection for conventional plants.

Once washed, the precursor particles must be dried (consuming energy), sieved, and then dry blended with the lithium source (lithium hydroxide for NMC811.) The blended precursor is then processed in large calcination furnaces (typically roller hearth kilns) in multiple thermal steps that can last 10-16+ hours in total, representing considerable energy consumption. If the material is to be converted into the desirable single crystal morphology, additional processing and firing steps are then required. The net effect is a process that takes multiple days, is energy and water intensive, generates massive quantities of liquid waste, and that today is largely dominated by Chinese suppliers. The need for a domestic production capability to be environmentally responsible, and cost-competitive with Chinese production makes long term viability of the traditional approach in the US challenging.

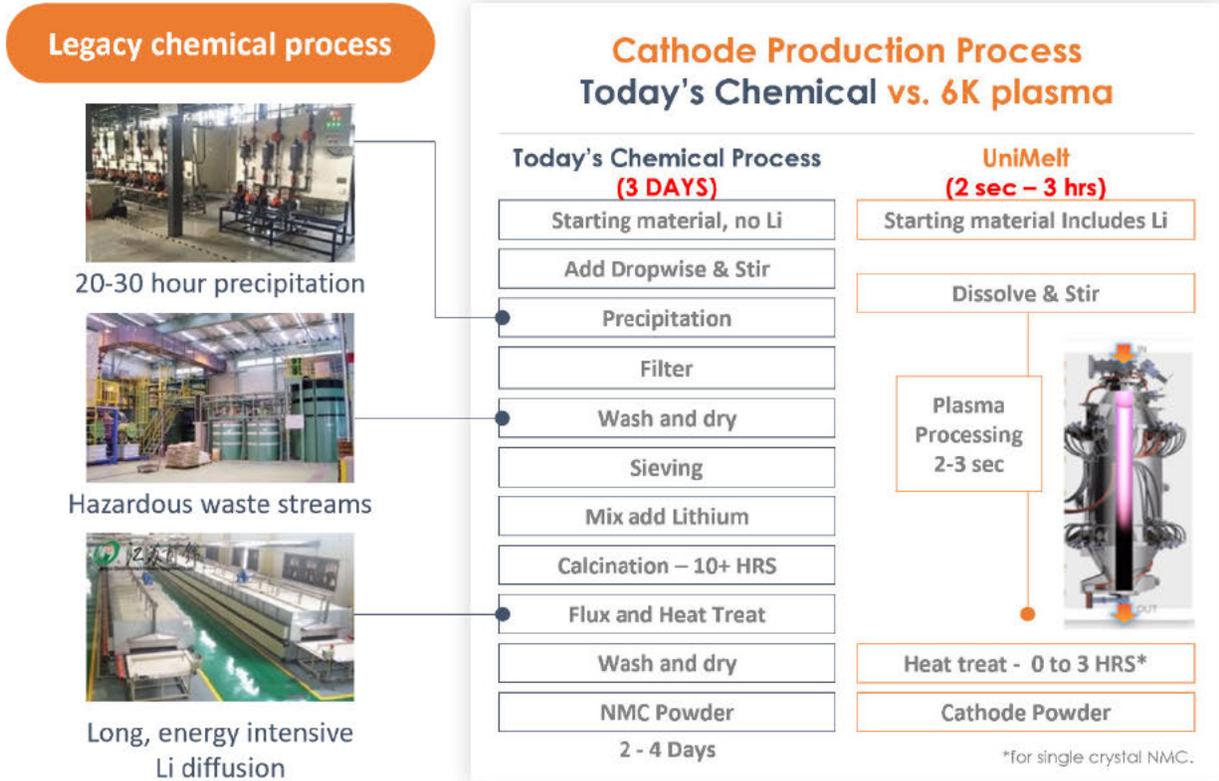


Figure 2-12– Visual representation of legacy coprecipitation versus UniMelt makes it clear how energy, water, waste, and cost are greatly reduced with a transformational solution.

Impact on Advancing the State-of-the-Art: UniMelt plasma for battery cathode

As described above, the UniMelt production process represents a massive simplification relative to the conventional process that is unfettered by the limitations of traditional synthetic routes, reducing what is normally a multiday process down to a few hours. This simplicity and resulting chemistry flexibility allow for the elimination of numerous process steps, reduction of water and energy usage, and complete elimination of liquid waste, at a production cost that is multiple dollars per kilogram lower than the conventional route, without sacrificing product quality, as demonstrated in the feasibility section above. Moreover, the process is not limited to a single chemistry, enabling one 6K plant to make multiple cathode types, and more importantly, providing the flexibility to adapt to future changes in the market and battery chemistries, enabling a level of futureproofing that is unique in the industry. The benefits over the current state of the art for production of NMC are summarized in **Table 2-1** below.

Contains Trade Secrets, Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure

Item	6k UniMelt Plasma	Coprecipitation	Comments
Cost			
Process Cost (US)	(b) (4)	\$3/kg-\$6/kg higher	References: ANL Report, conversations with cathode makers, plus, premium for single crystal adds~10%-15%
Environmental, Social and Governance			
Water Use	90% Less	135 liters/1kg NMC	Argonne National Labs
Energy Use	Up to 70% Less	99 MJ/1kg NMC	Argonne National Labs
Solid Process Waste	Zero	Minimal	
Liquid Process Waste	Zero	Major sulfate and alkaline waste post coprecipitation	Significant disposal issues with sulfate waste
NOx Process Waste	Scrubbed for zero net output ^A	n/a	NOx process waste is recycled
Steam Loss	Today: Vented ^B Future: Recovered ^C	Vented	Included in the above water use ^C
Yield			
Zero Loss Production	Efficient: Direct re-digestion of off-spec powder for use as feedstock	Inefficient: More steps to recover	All 6K in-process fallout is returned into the process
Plant Advantages			
Footprint	(b) (4) square foot per 10,000 tpa	150k-160k square foot per 10,000 tpa	References: on-line sources on Eco-Pro cathode plant
CapEx Redeployment			
NMC622 to NMC811	Easy / Fast	Difficult / Expensive: Different process, feedstock	This is a seamless transfer for 6K, a clean out and change in the feedstock chemistry ratios
NMC to LFP	Quick Redeploy	Not possible, Complete retrofit required	Changes in the front-end feed systems. Majority unchanged
Notes:			
A – All NOx to be scrubbed to produce nitric acid for feedstock production			
B – Clean steam is vented			
C – Future recovery and recycling of steam in a heat exchanger will further lower water and energy consumption			

Table 2-1 Advantages of 6K NMC811 cathode production versus the current state of the art of coprecipitation plus calcination (10 GWh plant equivalent)

Dramatic Cost Savings

Of equal importance to the technical performance is economic viability, and 6K's UniMelt Production Technology provides significant cost savings relative to conventional cathode production methods. An extensive and detailed bottoms-up manufacturing cost model has been developed and vetted by multiple customers and investors, and it demonstrates that when applied to the production of high Ni NMC cathode, the UniMelt process enables more than 50% conversion cost reduction relative to the standard coprecipitation and calcination approach used today. For example, for the production of the desirable single crystal form of NMC811, the total conversion cost (cost of goods sold, not including bill of material) is (b) (4) for a plant utilizing the Gen 1 reactor, decreasing to (b) (4) for the higher throughput Gen 2 reactor currently in development. These conversion costs enable a long-term viable cathode

production capability on US soil. The source of the cost reductions can be understood by comparing the process flow versus standard coprecipitation, shown in Figure 2-12. The 6K process has far fewer steps, eliminating potential sources of yield loss and allowing a smaller plant size, requiring less capital, using a fraction of the water (~10%) and energy (~30%) by eliminating the majority of the thermal processing required and eliminating all solid and liquid waste generation, all of which results in significant cost savings.

Massive sustainability impacts

Any long-term viable domestic cathode production capability must also deliver significant improvements in sustainability relative to the incumbent coprecipitation process. By eliminating the precursor coprecipitation process and its huge water consumption, significantly reducing the thermal processing required, and totally eliminating waste generation, 6K's cathode production has massive environmental benefits.

For example, using ANL's model of water and energy consumption and waste generation for production of high nickel NMC, a conventional plant producing would consume 135 liters of water, generate 135 liters of liquid waste, and consume 99 MJ of energy for every kilogram of cathode produced.

In contrast, a 6K plant of the same size will reduce water consumption by 90%, reduce energy consumption by up to 70%, and completely eliminate the production of waste. These advantages not only represent cost savings, but also facilitate permitting, give greater flexibility in site selection, and eliminate negative effects on the host community.

Innovations in establishing a domestic supply chain of raw materials

Launching cathode production is step one of 6K's domestic cathode strategy, however domestic raw material supply must also be established to create a truly stable and independent battery supply chain. Production of NMC cathode material relies on salts produced almost exclusively

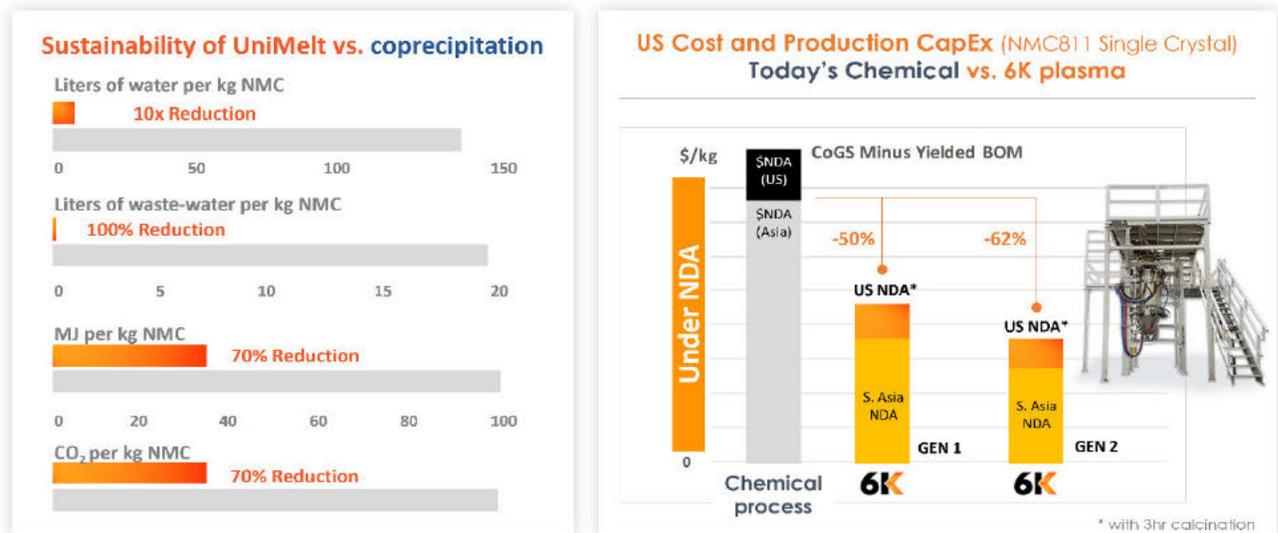


Figure 2-13 – Advantages of UniMelt technology versus today's coprecipitation, 1) 70%-100% reduction on key environmental impacts, and 2) 50%-60% reduction in the process cost of NMC811 cathode. These two advantages will enable the near term AND continued repatriation of battery cathode production to US soil.

in China, from raw materials sourced in China, Africa, South America, etc. Similar challenges exist for the raw materials required to produce LFP and LMO. This global supply chain channeled through the US's chief economic rival is both costly and high risk. To lessen the risk to its US-based cathode production capability, 6K will source and demonstrate generation of the critical raw materials required for the production of its cathode products.

Key components of the 6K strategy:

- a. Domestic lithium sources collaborating with partner Albemarle
- b. Demonstrate production of LFP feedstocks from scrap iron
- c. Demonstrate the production of Ni and Co nitrate salts by digestion of metals
- d. Blending in sources of recycled domestic content collaborating with partner Retrieval
- e. Developing an internal cathode recycling loop to approach 100% feedstock yields

Developing domestic Lithium sources

As part of its ongoing relationship with Albemarle, 6K will establish a supply agreement for Li salt from Albemarle's existing mines in Silver Peak, NV (brine), Salar de Atacama, Chile (brine) and/or Kings Mountain, NC (spodumene⁵). Final conversion of the salt to the nitrate form will initially be demonstrated at 6K in budget period 1. 6K has a separate multi-year, multi-million-dollar partnership effort to support the development, and supply to this proposal.

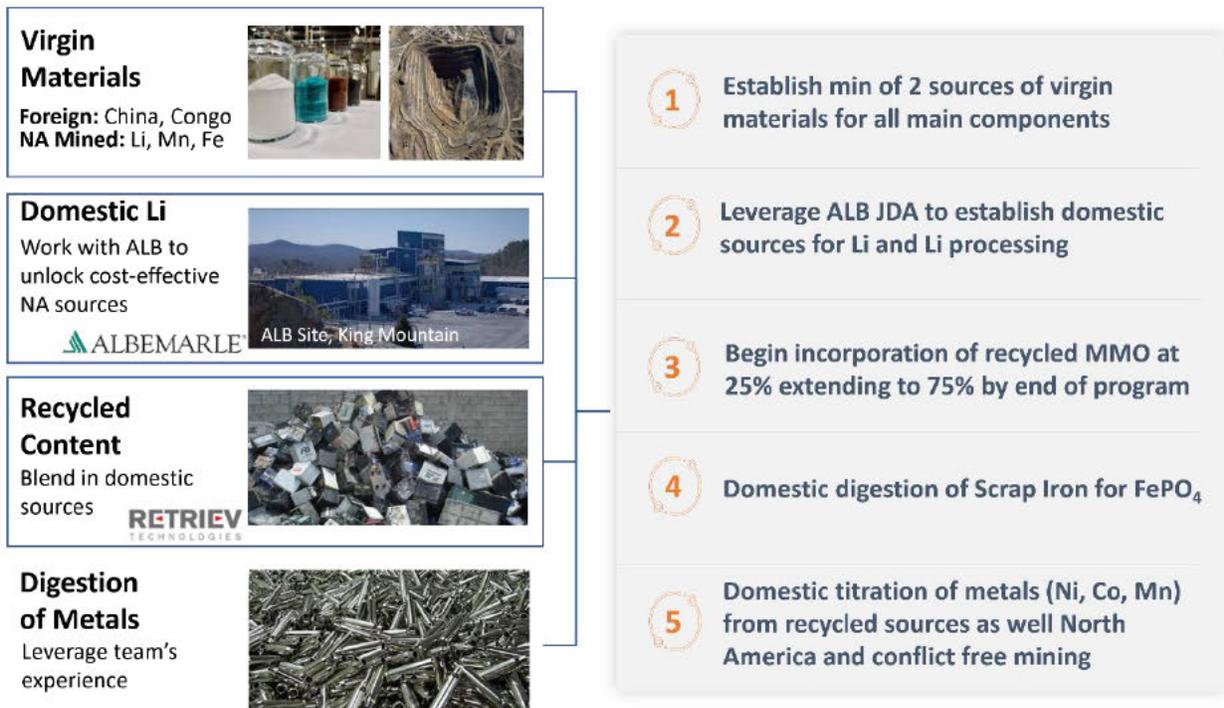


Figure 2-14 – 6K is creating an ecosystem of partners to enable the long-term goal of 100% domestic feedstock.

⁵ Spodumene is a pyroxene mineral consisting of lithium aluminum inosilicate, LiAl(SiO₃)₂, and is a source of lithium.

Creating domestic LFP feedstocks from scrap iron

Building upon past experience of the team members, 6K will demonstrate the production of iron salt from scrap for LFP production. The US exports over 1M tons per month of scrap iron and steel (<https://www.usgs.gov/centers/national-minerals-information-center/iron-and-steel-scrap-statistics-and-information>), so supply exists to cover the needs of the domestic energy storage market, both automotive and stationary, and the conversion of scrap to iron salts is a well-established process that has been previously rolled out to production by 6K team members. In budget period 2, 6K will establish a prototype capability to produce iron salts and use these materials to produce LFP via the UniMelt process at the kg scale. Electrochemical testing in cells will be conducted and completed in budget period 3. As with NMC, 6K will evaluate potential partners for iron salt production in budget period 3, concluding with a go/no-go decision on partnering.

Creating domestic feedstocks from recycled content

To further secure domestic supplies of critical feedstocks, 6K will work in conjunction with its recycling partner Retriev to develop a recycled supply of Ni, Co, Mn, and Li salts sufficient to supply up to an equivalent of 3GWh of NMC capacity by 2026. By closely coordinating 6K's and Retriev's activities, the overall cost, water, waste and energy requirements of the closed loop cathode recycling and production process can be minimized. For example, enabled by 6K's use of nitrate salts as direct feedstocks into its cathode production process, Retriev can eliminate the crystallization and separation of discrete salts from the process flow, instead finishing the recycling process at the mixed salt solution stage. To quantify the ESG benefits of this approach, 6K will engage with ANL to conduct LCA analysis for the closed loop process from end-of-life battery recycling to new cathode production.

Proof of concept for this approach has already been completed, where mixed nitrate salt solutions were used by 6K to produce single crystal NMC811 cathode with 100% of the Co content provided by the recycled salt solution (17% total recycled content). During the course



Figure 2-15 – 6K will collaborate with partner Retriev to develop feedstocks from end-of-life batteries, blending in 25% mixed metal oxides to start, and increasing to more than 75% during this program.

of the program, 6K will demonstrate performance parity with virgin salts at 25% recycled content (budget period 1), 50% recycled content (budget period 2), and more than 75% content (budget period 3.)

Internal cathode production recycling loop for 100% yield of feedstocks

6K’s direct cathode conversion process enables a greatly simplified recycling route for cathode production scrap resulting from off-spec material, equipment hold-up/cleanout, etc. Scrap cathode powder from the manufacturing process can be recycled by directly digesting the cathode back to the stock solution used as feedstock for the production process. In the case of NMC, scrap cathode powder can be dissolved in a solution comprised primarily of nitric acid, producing a nitrate salt solution that can be fed directly back into the 6K production stream in any quantity desired, including the Li content. As a result of this simplified process route for recycling scrap cathode, 6K has the potential to operate with nearly 100% yield of input raw materials.

Overall Impact on Industry and Environment by Advancing State-of-the-Art

6K’s impact can be summarized in the two figures below.

Given the challenges to scale coprecipitation plants, it was hard to find direct comparisons for a 10,000 tpa plant; however, a Korean vendor published target numbers to highlight their “next generation” plant, which failed in comparison to a 6K UniMelt plant producing NMC811.

First, the ability for 6K to locate the plant offers a higher degree of optionality given the lack of needing to manage any solid or liquid hazardous waste. Furthering 6K’s optionality is the amount of land and the size of the building required, both approximately 50% of the size needed for the advanced coprecipitation plant.

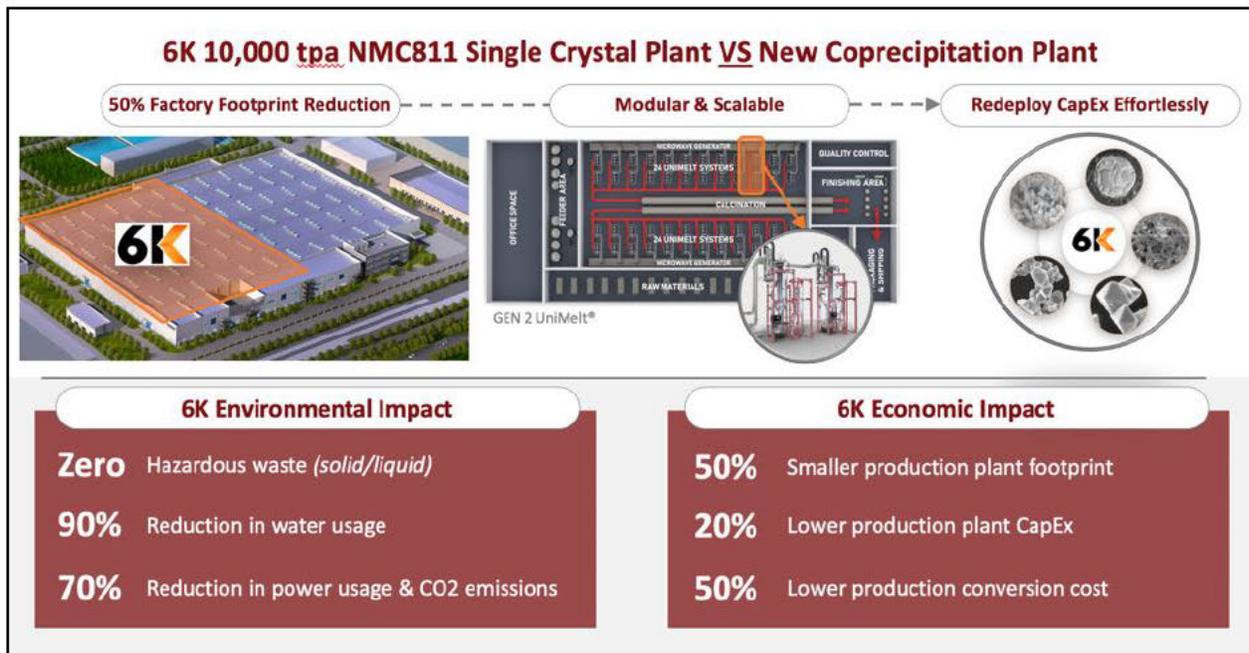


Figure 2-16 – 6K’s impact on the industry for replacement of traditional coprecipitation processes for cathode is profound, and cuts across process cost, footprint, plant CapEx, and numerous environmental impacts.



Figure 2-17 – With 6K's UniMelt technology, you do not have to choose between powering your life and saving the planet, while employing US workers in a burgeoning market.

The modularity of the equipment allows for start-up ahead of full capacity installation as well as the flexibility to completely change chemistry solutions after a program ends and a new solution is required. The overall cost of the CapEx would be more than 30% lower if fully built out with the 6K next generation (Gen 2) solution, while still delivering more than 20% savings with Gen 1.

The US cannot afford to deploy traditional coprecipitation. Over a five-year period, 6K saves \$10B, 30M tons CO₂, and 135,000 Olympic pools of waste – just for 400 GWh announced capacity by 2025 alone.

The benefits of the disruptive 6K UniMelt Plasma processing technology are shocking when applied to the stated capacity of Li-ion production in the United States in 2025, 400GWh.

Cost has always been, and will remain for the foreseeable future, the number one factor in selecting suppliers for high volume automotive products. This requirement is multiplied for CAM as it is the most expensive component on the vehicle. If all the stated capacity reaped the cost benefit of 6K vs coprecipitation, \$10B of cost would be eliminated.

The cost is realized by reducing the need to dispose of the equivalent of 135,000 Olympic swimming pools of hazardous waste, and completely eliminating the need to use 120,000 Olympic pools of water to produce the material, all while reducing energy consumption by up to 70% offsetting a massive amount of trees needed to offset the impact of 30M tons of CO₂.

3. Work Plan and Market Transformation Plan

a) Project Objectives

The Primary Goal is to establish and demonstrate a viable cathode production capability on US soil based on 6K's innovative UniMelt Microwave plasma production platform. This will be

enabled by 6K's significantly lower manufacturing costs and improved sustainability relative to established cathode production methods like coprecipitation.

In addition to cathode production capability, the Secondary Goal is establishment of a **viable supply of domestic raw materials** for the cathode production process, enabling true energy independence. To that end, a secondary objective of this proposal is to demonstrate viable sources of critical feedstocks via a combination of domestic salt production from existing metal feedstock sources, recycling of EOL batteries as feedstocks to the 6K process with 6K partner **Retriev**, and development of existing raw material supply via 6K partnerships with leaders in the space such as **Albemarle**.

Expected Outcomes

6K expects to successfully demonstrate the UniMelt process in full commercial-scale production, delivering high-quality chemistries at a more favorable cost than offshore suppliers.

Our expected outcomes from this demonstration are:

1. **Fully Operational Plant**: Construction, implementation, and operation of a domestic revenue-generating cathode plant using UniMelt Plasma production technology
2. **Validation of the Commercial-Scale Process**:
 - a. Initial production of a of 3,000 tpa CAM plant
 - b. Space and manufacturing infrastructure to support future expansion to up to 10,000 tpa within the demonstration plant, based on 6K customer demand
3. **Unique Flex-Chemistry**: Demonstration of the production of multiple chemistries in a single plant, specifically NMC, LFP, and other chemistries such as LMO, LMFP, etc.
4. **Validation of Cost-Efficiencies**: Achieved with the 6K process
 - a. 30% lower conversion cost for NMC811 with 6K's Generation 1 (Gen 1) 100 tpa per system process versus traditional coprecipitation methods
 - b. 50% lower conversion cost for NMC811 with 6K's Generation 2 (Gen 2) 400 tpa per system process versus traditional coprecipitation methods
 - c. Demonstration of an internal recycling loop for cathode production that effectively reduces BoM yield losses to nearly 0%
5. **Sustainability**: Demonstration of substantial ESG improvements over conventional coprecipitation of NMC cathode, to be demonstrated at scale and validated by lifecycle analyses (LCA) analyses conducted by team member ANL:
 - a. Major reduction in water consumption, estimated to be up to 90% versus standard coprecipitation plus calcination
 - b. Improved CO2 footprint, estimated to be a 60-70% reduction versus standard coprecipitation plus calcination

- c. Total elimination of liquid waste, a huge issue for coprecipitation, limiting site options for conventional cathode plants which dispose of this waste largely in rivers and oceans
6. **Workforce Development**: Phase 1 of the project will create up to 150 well-paying jobs. Through education, recruitment, training, and retention initiatives, 6k anticipates that at least 40% of the employees will come from DACs and that the workforce will reflect the diversity of the community
7. **Domestic Supply Chain**: Viable domestic supply chain for raw material inputs
 - a. Digestion of critical metals (Ni, Fe) from domestic sources to produce feedstocks for direct incorporation into 6K's process flow
 - b. Demonstration of domestic source of lithium salts with 6K partner Albemarle
 - c. Demonstration of cathode produced from recycled nitrate salts from EOL batteries at 75% recycled content in cooperation with 6K partner Retrieval

b) Technical Scope Summary

The project will be conducted in three budget periods (shown for simplicity as starting in 2023 and finishing in 2025). A summary of the overall approach, and the associated Expected End Results is provided below.

Budget Period 1: Starting the plant construction and workforce development, scaling up production capability, and starting the demonstration of metal salts production domestically

6K will kick off the plant construction process. It will also start a sound foundation for the plant's workforce training with a strong D&I framework. From the technology side, 6K will order its Gen 1 UniMelt. In parallel, the metal salt production digestion of Ni and Co effort will be underway along with its internal recycling of cathode scrap and end-of-life (EOL) batteries effort.

Expected End Results Budget Period 1 (2023):

- Site secured, architectural drawings completed, permits completed, and construction underway.
- UniMelt systems (Gen 1) will be placed on order.
- Operator training program will be developed with support local HBCU.
- Internal Ni and Co domestic raw materials production process is validated.
- Internal recycling loop demonstration initial results.

Budget Period 2: Plant in operation, equipment qualification, metal salts, recycled cathode.

The plant construction will finish with key operators on board. The customer qualification process will start on Gen 1 equipment. Gen 2 equipment will be ordered for the next demonstration of expansion. Ni and Co metal salt production will be scaled up with a partner. 6K will start the effort on Fe metal salt. The internal recycling of scrap cathode will demonstrate 25% of the process fallout is returned to the production process.

Expected End Results Budget Period 2 (2024):

- Plant construction will be completed, equipment installed.
- UniMelt equipment will be commissioned and validated.
- Workforce training program completed, and key operators will be hired and trained.
- Ni and Co domestic raw materials scaling with partner.
- Internal Fe raw material domestic feedstock developed and validated.
- Recycled content demonstration showing equivalent specification to virgin feedstocks.

Budget Period 3: Three-shift operations, SOP and expansion, metal salts, recycled cathode.

Three shifts operation will be in place for the plant. 6K will implement a plan to ensure a strong workforce pipeline. Gen 1 UniMelt will enter SOP. Gen 2 will be validated and qualified. Fe domestic salt production scale up begins with a partner. 6K continues to demonstrate the recycled cathode content from 50%, to 75%, of recycled cathode by the end of this period.

Expected End Results Budget Period 3 (2025):

- UniMelt and cathode material successfully qualified for production.
- Ramp up period approaching yield and throughput targets.
- D&I training will be administered quarterly for new employees.
- Capable of three-shift plant operation in place.
- Workforce pipeline development, including apprenticeship program launched and formal training curriculums for local community and technical colleges.
- Demonstrating greater than 75% recycled content product.

c) Work Breakdown Structure and Task Description

6K will manage the PLUS CAM Project using the Project Management Institute, Inc.'s (PMI) Project Management Body of Knowledge (PMBOK) methodology. This methodology uses a Work Breakdown Structure (WBS) to subdivide the project into manageable, defined tasks, allowing each task to be resourced, tracked, and reported over the life of the project.

6K's WBS describes the PLUS CAM Project work activities in three budget phases:

- Budget Period 1 (2023): Starting the plant construction and workforce development, scaling up production capability, and starting the demonstration of metal salts production domestically.
- Budget Period 2 (2024): Plant in operation, equipment qualification, and metal salts development, and scaling up with partners, first recycled cathode content demonstration.
- Budget Period 3 (2025): Plant SOP with three-shift operations and ready for expansion per market demand, developing and rolling out the training for the future pipeline workforce, continuation of metal salts scaling up with partners, demonstrating the next levels of recycled cathode content.

Description of Specific Activities

The PLUS CAM project WBS is divided into four major work streams:

- Plant Development: plant construction and setup will be completed by the end of 2024
- Equipment Deployment: Gen 1 UniMelt will be transferred from BCE to the plant and SOP beginning in 2025. Gen 2 UniMelt will be transferred from BCE to the plant and SOP beginning early 2026.
- Workforce Development: By the end of 2025, the plant will be capable of being fully staffed for 24/7 operations. In parallel, 6K will launch apprenticeship programs and formal training on battery materials production with local community and technical colleges, and high schools.
- Domestic salt production demonstration of Ni, Co, Fe, and recycled cathode content: 6K will develop the process and will seek appropriate domestic partners to scale up the key metal salts – Ni, Co, and Fe. By 2027, 6K will establish a 100% domestic salt supply chain. Alongside the salt work streams, 6K will demonstrate increasing recycled content in cathode materials from production scrap and EOL batteries throughout the project.

Summary of Work Breakdown Structure

6K's WBS is graphically summarized in **Figure 3-1, PLUS CAM Project Work Breakdown Summary Overview**, below. This graphic shows the planned work activities over the three-year Grant period (2023 – 2025), and the work activities that continue after the Grant period of performance (2026).

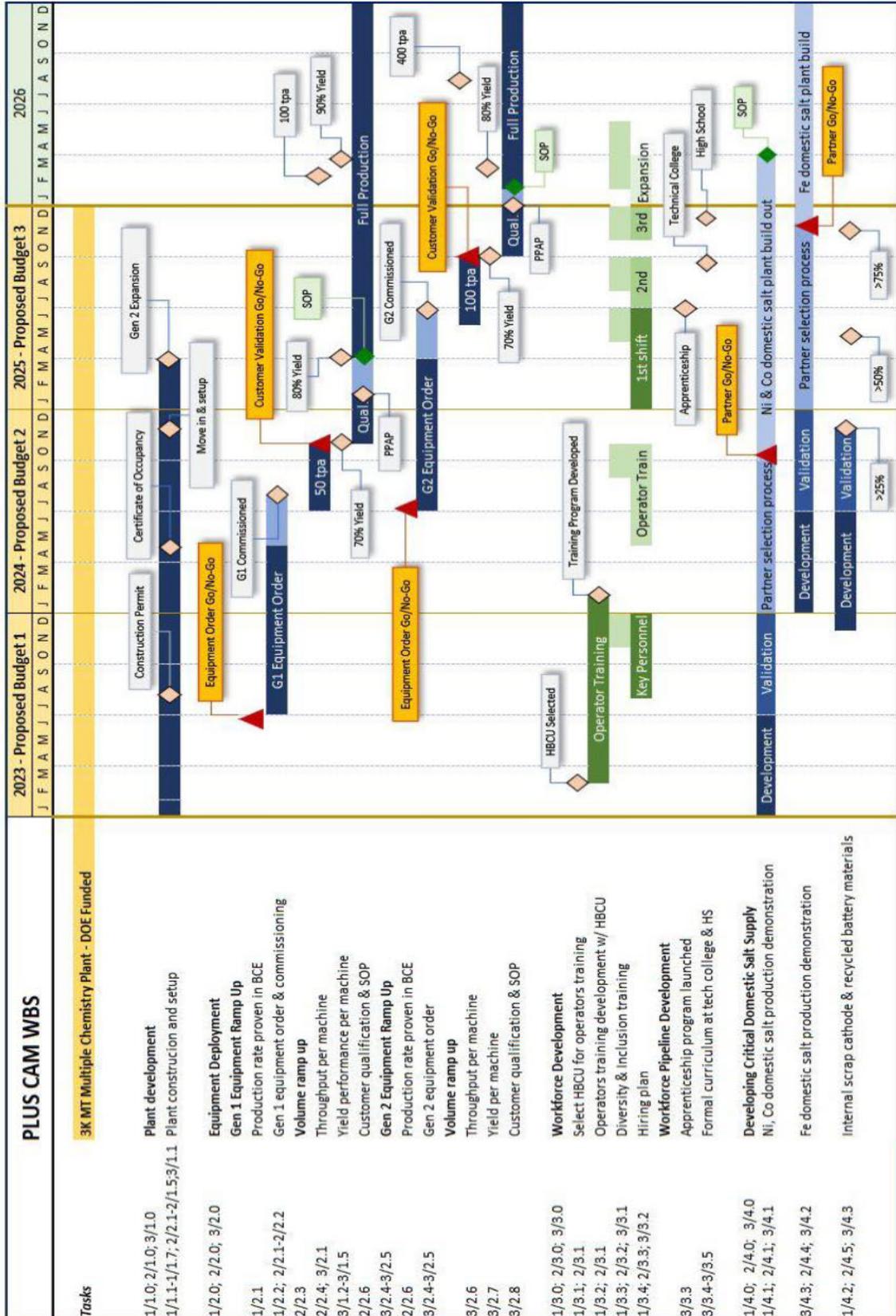


Figure 3-1 – PLUS CAM Project Work Breakdown Structure

d) Milestone Summary

The milestones are summarized in **Table 3-1, PLUS CAM Project Milestone List**, below. All the milestones are SMART with specific criteria and deliverables where appropriate with an approval process to move to the next task(s). For instance, “Land Acquisition Complete” milestone will produce a land title and an agreement from local municipalities to allow the construction company to start the work. The WBS will formally document each milestone’s checklist and signoff signatures.

WBS	Description	SMART	2023				2024				2025				2026			
			1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q
1/1.0; 2/1.0	Plant Development																	
1/1.1-1/1.7; 2/1.1-2/1.4	Plant construction and setup	Yes	x	x	x			x	x	x								
2/1.5; 3/1.1	Gen 2 expansion											x						
1/2.0; 2/2.0; 3/2.0	Equipment Deployment																	
	Gen 1 Equipment Ramp-up																	
1/2.1	Production rate proven in BCE	Yes	x															
1/2.2; 2/2.1-2/2.2	Gen 1 equipment order and commissioning	Yes						x	x									
	Volume Ramp-up																	
2/2.3	Throughput per machine - 50 tpa and 100 tpa	Yes								x						x		
2/2.4; 3/2.1	Yield performance per machine - achieving 70% and 80% yield	Yes								x	x							
3/2.2-3/2.5	Gen 1 Customer qualification and SOP	Yes										x	x					
	Gen 2 Equipment Ramp-up																	
2/2.6	Production rate proven in BCE	Yes						x										
3/2.4-3/2.5	Gen 2 equipment order and commissioning	Yes										x	x					
	Volume Ramp-up																	
3/2.6	Throughput per machine - achieve 100 tpa and 400 tpa	Yes											x					x
3/2.7	Yield performance per machine - 70% and 80% yield	Yes											x			x		
3/2.8	Gen 2 Customer qualification and SOP	Yes												x	x			
1/3.0; 2/3.0; 3/3.0	Workforce Development																	
1/3.0; 2/3.0; 3/3.0	HBCU selected for operators training	Yes	x															
1/3.1; 2/3.1	Operators training development with HBCU	Yes						x										
1/3.2; 2/3.1	Diversity and inclusion training for the workforce	Yes				x			x				x	x	x	x	x	x

1/3.3; 2/3.2; 3/3.1	Key Personnel and Hiring Plan	Yes		x			x	x	x	x	x		
Workforce Pipeline Development													
3/3.3	Apprenticeship program launched	Yes							x				
3/3.4-3/3.5	Formal curriculum launched at tech college and high schools	Yes								x	x		
1/4.0; 2/4.0; 3/4.0 Developing Critical Domestic Salt Supply													
1/4.1; 2/4.1; 3/4.1	Ni, Co Domestic Salt Production Demonstration	Yes	x	x			x						x
3/4.3; 2/4.4; 3/4.2	Fe Domestic Salt Production Demonstration						x	x				x	
1/4.2; 2/4.5; 3/4.3	Internal Cathode Recycling Demonstration	Yes					x	x		x	x		

Milestones notation: Y/T.S; Where Y = Budget Year (1-3) / T = Task (1-4) . S = Subtask (1-n).

Table 3-1 – PLUS CAM Project Milestone List,

No Go Decision Points

Go/No Go Decision Points are considered a phase gate for the PLUS CAM Project. These go/no go decision points are incorporated into the WBS and appear in the Project Schedule and may be listed in the Risk Register. Similarly, to milestones, go/no go decisions are SMART with criteria specific to its decisions and formal signoff process. For example, “Gen 1 Equipment Order Go/No Go” decision points requires Gen 1 UniMelt to reach a desired throughput rate at 6K’s BCE with documentation of consecutive runs hitting throughput rate. The document will be signed off by a process engineering leader and a manufacturing engineering leader and ultimately signoff from the PI.

The PLUS CAM Project Go/No Go Decision Points are summarized in Table 3-2 - PLUS CAM Go/No Go Decision Points, below.

WBS	Description	2023				2024				2025			
		1	2	3	4	1	2	3	4	1	2	3	4
1/2.1	Gen 1 equipment order go/no-go		x										
2/2.4	Gen 1 customer qualification go/no-go									x			
2/2.6	Gen 2 equipment order go/no-go						x						
3/2.6	Gen 2 customer qualification go/no-go												x
2/4.1	Ni & Co domestic salt production partner go/no-go							x					
3/4.2	Fe domestic salt production partner go/no-go												x

Milestones notation: Y/T.S; Where Y = Budget Year (1-3) / T = Task (1-4) . S = Subtask (1-n).

Table 3-2 – PLUS CAM Go/No Go Decision Points

e) End Project Goal

The true goal of this activity is to lay the groundwork for a transformational technology to support the long-term goal of a sustainable li-ion battery materials ecosystem in the United States which is not reliant on foreign adversaries. 6K will demonstrate a means to this by accomplishing the specific end project goals in the table below.

Project Goal	Criteria	Comment
Gen 1 UniMelts deployed at 100 tpa	System fed continuously at rate for 24hrs	Deployed in production end 2025
Gen 2 UniMelts deployed at 400 tpa	System fed continuously at rate for 24hrs	Proven at BCE in 2025, released to plant in 2026
Plant Run-at-Rate achieves 3,000 tpa, 2 chemistries	2nd chemistry running on systems at rate	Plant at full rate in 2026
Conversion cost benefit vs coprecipitation	Achieve cost targets within 10%	Measurement taken +3 months from SOP
Demonstrate ESG benefit vs coprecipitation	Energy, Water, Waste benefits	LCA with third-party to validate
Hire workforce from DACs	40% of total plant HC	Core element of workforce development plan
Domestic Supplier for Li feedstock	Supply agreement for Li completed	Long-term goal to produce in USA
25% recycled NMC811 CAM	Equal performance to virgin salts, commercially available	100% for low-volume applications
Capability to perform domestic metal salts production	Demonstrate process to convert Ni, Co, and Fe	Limited Co 2nd life sources available, process virgin
Demonstrate recycling loop to reuse in-line material fallout	Recaptured material has equal performance	Focus on reactor and baghouse

Table 3-3 Project Goal criterion demonstrates how End Project Goals are achieved.

At the conclusion of each objective, an assessment will be collaboratively conducted with the DOE to determine if the goal (outcome) was achieved, and the DOE's acceptance or exception is noted. If the goal is not achieved, the exceptions are noted and follow-up actions, if any, are presented and agreed upon.

f) Project Schedule

As described earlier, 6K will follow the PMBOK project management methodology and utilize Microsoft Project and SharePoint as main tools to manage the overall project. Other tools will be utilized as needed depending on the teams' collaboration preferences. **Figure 3-1, PLUS CAM Project Work Breakdown Summary Overview**, above, shows the WBS as a Gantt chart, reflecting the preliminary PLUS CAM Project Schedule. **Table 3-1, PLUS CAM Project Milestone List** shows all the milestones in the three-year budget period. **Table 3-2, PLUS CAM Go/No Go Decision Points**, lists out the go/no go decisions points for the project.

g) Buy American Requirements for Infrastructure Projects

6K's infrastructure requirements include the construction of a production facility, components of the UniMelt systems, and miscellaneous supporting infrastructure. All iron, steel, manufactured goods and/or construction materials used for 6K's infrastructure requirements are procured domestically through American businesses. All public infrastructure (i.e., access

(roads, rail) and utilities (electricity, gas, water, and sewage)) will be procured through the local municipalities or industrial providers.

h) Project Management

i. Project Management Organization and Management

6K’s PLUS CAM Project is organized into multiple task project teams, each with a dedicated project manager who is focused on the specific objectives, goals, and deliverables of the specific project team as defined by the PI. The individual sub-project team managers report to one of two senior-level project managers: a technical project manager, and a production project manager. These two senior program managers report to 6K’s PLUS CAM Project PI, who coordinates and monitors all work activities across the individual project teams. The PI is the single point of accountability for 6K’s PLUS CAM Project and is responsible for the project oversight, control, and integration of team activities, and has full authority for managerial, technical, and operational decision making for the entire PLUS CAM Project. The PI leads the PLUS CAM Project Steering Committee, facilitates the weekly/monthly project status meetings, and is responsible for all project deliverables. The 6K PLUS CAM Project program organizational structure and interface to the DOE is depicted in Figure 3-2, *PLUS CAM Project Program Structure*, below.

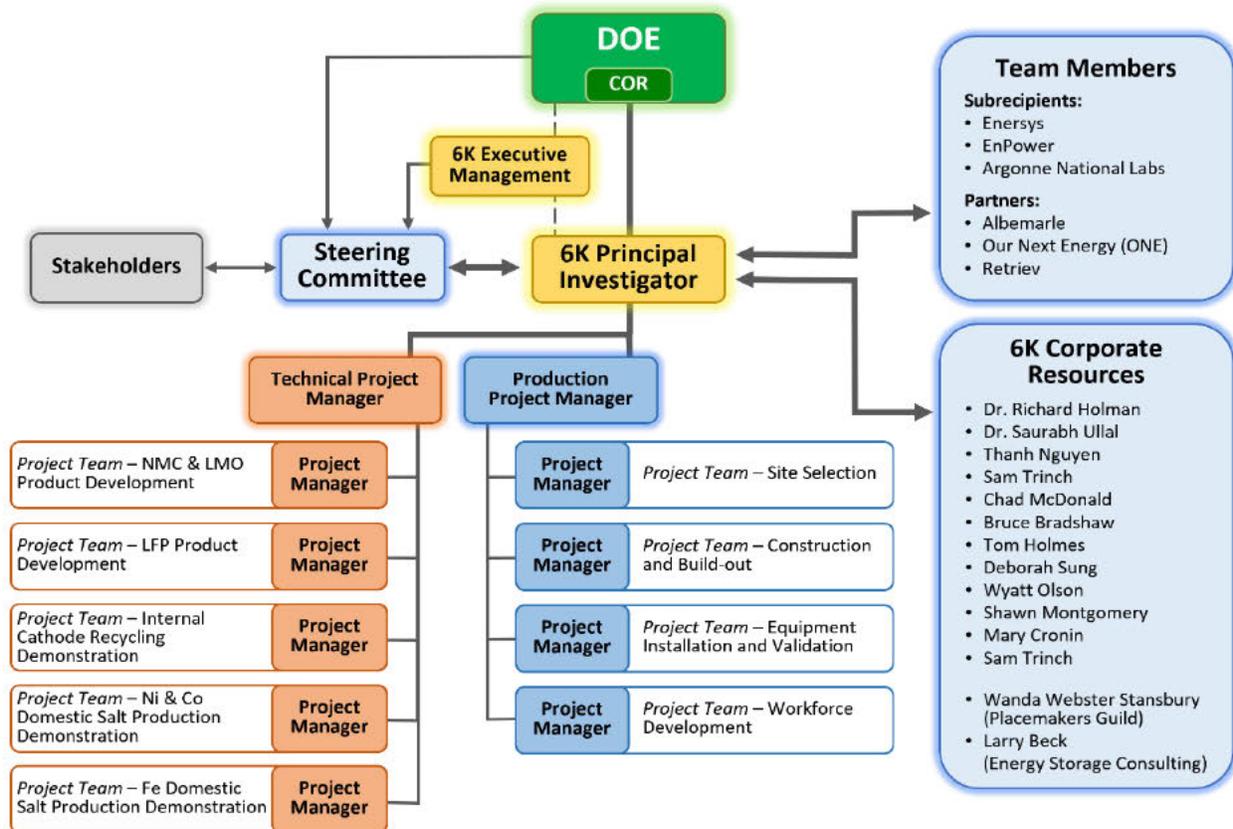


Figure 3-2 – Project Management Office is structured to maximize team resources and leverage team expertise

Dr. Richard Holman, Principal Investigator:

6K's PLUS CAM Project PI is Dr. Richard Holman. Dr. Holman has an extensive background in materials science, electrochemical technologies, and production of material products. Dr. Holman received his Ph.D. in materials science from the Massachusetts Institute of Technology in 2001. He spent over 10 years at A123Systems where he joined at its inception and ultimately served as Director of Core Cell Engineering, followed by six years at 24M technologies where he served as VP of Product Development working on next-generation lithium-ion technology. Dr. Holman has over 17 years of experience in the battery industry taking products from concept to production in the electric vehicle (EV), power grid, and power tool markets.

Dr. Holman reports directly to Sam Trinch, President, 6K Energy, and has full authority to represent 6K's management in all aspects of 6K's PLUS CAM Project. Reporting to Dr. Holman are two 6K project managers; a technical project manager, and a production project manager. Dr. Holman also leads the PLUS CAM Project Steering Committee.

PLUS CAM Project Steering Committee:

The PLUS CAM Project Steering Committee is an advisory group that provides oversight and offers directional decisions on various aspects of the project. This committee sets the strategic direction for the project tasks, provides project goals and scope, determines how success of the project task is measured, monitors the performance of the overall project, prioritizes project activities, and assists the PI by eliminating barriers, issue resolution and problem solving. The Steering Committee membership consists of executives and subject matter experts from 6K, DOE, stakeholders, teammates, and industry participants as needed. 6K participation in the Steering Committee includes the Chief Executive Officer, Chief Financial Officer, Chief Operations Officer, President of 6K Energy, Senior Vice President (SVP) of Business Development and Strategy, SVP of Deployment, and Vice President (VP) of Government Affairs. Broad Government participation is encouraged and guided by the COR.

ii. Team Member Roles

6K has cultivated key down-stream partners, EnerSys and EnPower, who will benefit from this grant by helping offset their costs to evaluate and test 6K materials ahead of formal qualification for SOP. Each of these partners are global leaders in their specific fields of energy storage and are staffed with experienced teams in both R&D and mass production. In-kind contributions will be made available from each partner in order to conduct the work needed to evaluate 6K materials. Specifically, EnerSys and EnPower will be conducting material characterization in a coin cell, half-cell, and full cell for electrochemical testing, and preliminary full cell abuse testing. The deliverable from this activity will be a report summarizing the results and making a Go/No-Go decision to proceed towards the full qualification and SOP.

ANL will provide cell assembly and testing resources to provide an unbiased, third-party dataset. They will also help as 6K scales from prototype systems in the BCE to full-scale production systems in the PLUS CAM plant.

iii. Critical Handoffs and Interdependencies

Producing battery grade materials required to meet stringent end customer demands requires deep engagement with all stakeholders. The interaction between multiple stakeholders creates interdependencies that require critical handoffs to be managed without mistakes or delays. The overarching goal is to ensure these are defined and managed between the key upstream team members and down-stream partners and sub-recipients:

- Upstream partners (Albemarle and Retriev):
 - Materials requirements defined by 6K → upstream partners
 - Partner delivers materials → 6K's materials evaluation and qualification
 - 6K + Partner negotiates supply agreement → Partner delivers material to spec
- Downstream sub-recipients (EnerSys, EnPower):
 - Materials requirements defined by team members → 6K
 - 6K delivers materials → downstream partners build cells, validate the materials
 - Partner + 6K negotiate supply agreement → 6K delivers material to spec
- Additional sub-recipient: (ANL)
 - 6K provides cell build requirements → ANL builds cells
 - ANL provides cell reports → 6K acts on data where required

The critical handoffs denoted by → symbol. For each step, a formal process is implemented to receive, approve, and signoff. Moreover, the data produced by team members, partners, and 6K are shared with appropriate parties for knowledge, improvement, or other required action.

There will be critical handoffs from unforeseen events within the project. In such cases, an escalation process is in place to manage unplanned critical handoffs. All escalated critical events (handoffs) are documented and reviewed with the project management team, to include the DOE, stakeholders, and Steering Committee.

iv. Management Plan Technical and Managerial Aspects

6K's Project Management Plan (PMP) is developed at the onset of the PLUS CAM Project to define the project and sub-projects' scope, performance, goals, objectives, and deliverables. The PMP is baselined and approved at the onset of the project. This effort – baselining – establishes the initial reference for project scope, schedule, deliverables, and budget. Once baselined, project execution and performance can be measured and managed against the baseline. Changes to the baseline are managed through the change control process enabling the project to process with minimal risks.

v. Risk Management

Risks represent potential impact on any aspect of the PLUS CAM Project such as schedule, cost, performance, and others. 6K's approach to risk management is to identify potential risks, document risks, and prioritize the risks. Risk probabilities and their impact are assessed from low (1) to high (5). Once identified and assessed, a risk mitigation solution is an action taken to reduce the probability of occurrence and/or impact of a risk.

All potential risks are entered into the PLUS CAM Risk Register and tracked daily by the PI. All PLUS CAM Project management documents, including the Risk Register, are available to the

DOE, stakeholders, and teammates on-line through the PLUS CAM Project website, and reviewed at all monthly/weekly project meetings. **Table 3-4, PLUS CAM Project Risk Register**, below, provides examples of risks that are identified and tracked in the risk register.

Risk	Risk Description	Probability /Impact	Prior Experience and Mitigation Plan	Post Mitigation Risk
Acquire Qualified Workforce	Challenge securing production team to staff facility with qualified personnel in the DACs identified for site.	Medium/ Very High 3/5	<ul style="list-style-type: none"> • Strong success in training and retaining workforce for DACs at 6K Additive (same equipment) • Early engagement with regional economic development team • Competitive salaries and benefits • Collaboration with local community and technical colleges and universities • Signing bonuses 	Low/Low 2/2
UniMelt: Scale from 10 tpa to 50 tpa	UniMelt development in BCE does not meet the required thru-put target for Go/No-go decision to order production equipment.	Low/High 2/4	<ul style="list-style-type: none"> • Leverage 6K Additive lessons learned during planning • UniMelt designed to stage core components to absorb late-stage design changes • Support resources identified and prepared ahead of time 	Low/Low 2/2
Production Plant does not achieve 3,000 tpa run rate	Planned inputs do not achieve expected output quantities causing issues meeting demand.	Med / Med 3/3	<ul style="list-style-type: none"> • Highly experienced team that has launched powder plants • Production intent bench demonstrations on core equip. • Launch SOP at reduced rates, add equipment to offset • Extend engagement with ANL with a focus on scaling 	Low/Low 2/2
Insufficient supply of Nitrate salts for demand	Scale-up of virgin titration of nitrate salts lags demand.	Low / High 2/4	<ul style="list-style-type: none"> • Collaboration with Retriev to increase MMO solution quality • Investment in partners • Internal titration of metals 	Low/Med 2/3

Table 3-4 – Initial Risk Register started, living document which will include partner activity once contracted and kicked off. Critical to line up mitigation plans in the beginning of the project.

vi. Project Change Management

A change request is a request to modify any project document, deliverable, or baseline. Once the WBS and the WBS Dictionary have been established, approved, and baselined, any changes to project that could impact the baseline must be conducted through the change management process. The flow of a change request is as such: A change request submission to the PI → who assesses the impact/benefit of the change request → approve/reject or further review with the

steering committee → incorporate into the project → communicating to appropriate project team members and stakeholders.

This process ensures that changes to the project are considered in an integrated manner while addressing overall project risk, which often arises from changes made without consideration of the overall project objectives or plans. This process is an ongoing activity conducted throughout the life of the project.

vii. Quality Management Program

6K's Quality Management System (QMS) is stemmed from the International Organization for Standardization (ISO) ISO 9001:2015 certification. In addition, the company follows the International Automotive Task Force (IATF) ITAF16949:2016 (formerly ISO/Technical Standard (TS) 16949:2009) and Advanced Product Quality Planning (APQP) to meet the quality control requirements for the design, development, production, and delivery and service of automotive industry. Moreover, 6K will implement several quality measures such as:

- Quality Assurance organization reporting directly to 6K Energy's president
- Enterprise Management System to manage and track materials product life cycle and manufacturing resource planning
- An integrated production control system: Revision-controlled product/process specifications, control plans, work instructions, Failure Mode, and Effects Analysis (FMEA), and root cause analysis (RCA)

viii. Communications Plan

Team communication is managed through regularly scheduled meetings from kick-off meeting, weekly project team meetings, monthly steering committee meetings, to quarterly reporting to DOE. Escalation process will be defined at the beginning of the project to get the fastest response time among internal team members and sub recipients. There are multiple platforms for team members to communicate in a push/pull fashion

- Project website for team members to pull information as needed
- Emails, text, conference calls to push information to the project teams
- Emergency communication via texts and phone calls for escalation
- Each sub-recipient will be managed independently through weekly Product Development Team (PDT) meetings. The information from this proprietary activity will be fed into the DOE meetings.

In addition to the team communication, 6K management meets weekly to discuss critical items across the enterprise. The DOE project is deemed as the most critical program in the company and will be discussed each week.

Regular updates and quarterly meetings are conducted with the 6K Board of Directors and Advisors, which is comprised of industry veterans and luminaries such as Bob Galyen, the second employee of CATL, Ed Liddy, appointed to lead AIG during the financial crisis, and

members who have served on both sides of the aisle in government. 6K management draws on this deep experience across many topics to its full extent through regular communications.

i) Market Transformation Plan

i. Marketing Approach

The unique value proposition of the 6K UniMelt plasma process allows 6K to provide a premium product, NMC811 Single Crystal, at a cost advantage over traditional NMC811 currently produced in China. The clean processing environment highlights the key factors driving cost out of the process by dramatically reducing energy and water use while creating no solid or liquid waste. In addition to NMC811, 6K has demonstrated ability to produce multiple chemistries with the UniMelt process.

6K engages directly with partners throughout the battery value chain. These target partners include leaders and new entrants in raw materials, powder manufactures, cell suppliers and automotive OEMs. Over 25 partners have tested 6K CAM. By utilizing a strategic account management process building on the foundation of partnering vs selling, a philosophy of transparency is used when sharing details to defend claims around development activities, cost assumptions and sustainability metrics.

Identification of Target Markets:

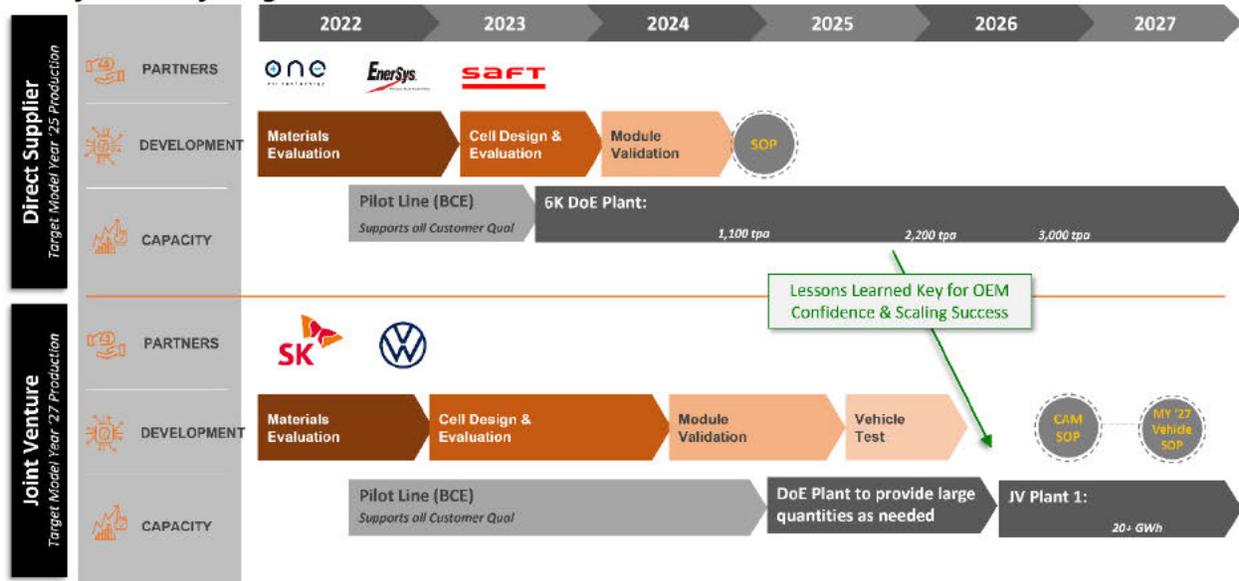


Figure 3-3 – Path to Production and Business Model focuses on direct supplier to small, non-EV customers in USA followed by large-scale engagement with major players.

As depicted above, 6K will go to market with a 2-prong approach outlined below to accelerate time to market with fast moving partners, as well as to de-risk and ensure product and production readiness for the demands of high-volume automotive OEM partners and cell manufactures.

Direct Supplier: 6K operated CAM production to supply fast-moving, non-passenger vehicle partners.

- Market Timing: 2025
- Targets: small and new entrant cell manufacturers targeting commercial and industrial applications, fleet vehicles and DOD / DOE applications.
- Agreements: LOI with ONE, MOU with EnerSys and others in negotiation calling for greater than 15GWh/yr CAM production in North America.

Joint Venture: Production JVs with large automotive OEMs and large cell suppliers to produce CAM which flows directly into cell manufacturing operations.

- Market Timing: 2027
- Targets: global leaders in EV manufacturing and cell supply.
- Status: Selectively engaged with 10 partners based on resource availability. Equity investment secured from one global automotive OEM and one global cell supplier.

6K expects that a subset of both groups will likely enter into Joint Development Agreements (JDAs) to closely engage and develop products to ensure commercialization timelines are met.

ii. Product Development Approach

Competitors:

6K's competition in the battery materials market is from large, well-established companies working on a global scale. These competitors use manufacturing processes that are decades old. As described throughout the proposal 6K plans to compete directly based on the merits of its disruptive technology that delivers equally performing CAM at a favorable price and environmentally sustainable than is available from offshore sources.

While innovative technologies for the synthesizing of metals are continually evolving, at the present time very few similar competitive technologies exist in the market, and the potential competing technologies are not achieving cost parity or the environmental benefits which are achieved with 6K technology.

Market Barriers:

The most concerning barrier to the market exists with traditional risk aversion from large, global manufacturers being early adopters of transformational technology. This risk can be exacerbated when the transformational technology is being produced by a startup company. With proof points from the 6K funded BCE and the DOE backed 6K PLUS CAM plant, 6K plans to mitigate this risk by demonstrating the scalability of the technology.

6K's strategy to work with smaller, niche cell manufacturers to provide high quality, low-cost CAM furthers 6K's ability to build confidence to eliminate the barrier.

Financing:

6K has completed financing of \$100M in capital as of March 30, 2022 and will close an approximately additional \$100M (July 2022) for a total of \$200M in fresh financing. This capital is to accelerate the deployment of battery materials on domestic soil and will be used to provide the necessary cost share for a successful DOE program. 6K's team and investors are fully committed to the mission to bring cathode production to the United States. 6K will also seek support from the DOE Loan Programs Office.

Legal/Regulatory Considerations:

6K's business, manufacturing, and production operate well within all Federal and State legal and/or regulatory statutes. The 6K UniMelt process is exceptionally environmentally responsible and currently exceeds all environmental regulations for the production of battery materials.

Intellectual Property:

6k holds a core value in the development and protection of its intellectual property. 6K has internal programs that require all employees to take onboard training on intellectual property rights and trade secrets, with annual recertification, with financial incentives for employees to participate in 6K's internal intellectual property program.

6K technology is protected by 28 patents issued, and 159 patents pending, for a total of 187 intellectual property patents. Patents are categorized into processing systems, equipment, feedstock methodology and materials. Trade secrets are categorized into feedstock preparation, chemistry design, machine code and software.

6K requires a non-compete agreement for all employees and requires non-disclosure agreements and material transfer agreements with partners prior to engagement.

In addition to patent and trademark protections, 6K protects its technology and trade secrets with current state-of-the-art IT protection methods and technologies. This includes 6K data infrastructure and systems being protected by firewalls, intrusion detection systems, antivirus protection systems, network analyzer systems, and email monitoring systems.

Infrastructure Requirements:

6K's Market Development Plan relies on the development of the manufacturing plant facility to achieve the product capacity needed to support 6K's targeted commercial battery cell manufacturers. The 6K production facility infrastructure will require public infrastructure for high-volume utilities (electricity and water) and access (roads/railway).

Data Dissemination:

6K interprets data dissemination in this context to be non-public information shared with the DOE, stakeholders, project participants and clients under a JDA. Information of this nature are patented technology details, process methodologies and production results. Such information is tightly controlled, maintained in secure repositories, and distributed on an agreed upon need-to-know basis.

4. Technical Qualifications and Resources

a) Team Qualifications and Expertise

6K Resources

Sam Trinch, President of 6K Energy, is the lead senior executive at 6K managing this project. He was responsible for \$1B in annual sales for Lear Electronics in 2009. Since 2009, he has been an executive in the Li-ion space, including a year as the President of China merging Wanxiang, a Chinese Lion battery entity, with

A123 Systems, a US Li-ion battery company. During the last 13 years, he helped deploy 600,000 ft² of electrode, cell, and system production in Michigan as one of the early Li-ion pioneers as well as a plant in Ostrava, Czech Republic for low voltage systems, and kicking off an 80GWh expansion in China.



Saurabh Ullal, COO of 6K Inc., PhD in Chemical Engineering from UCSB, has over 20 years of experience in high temperature material processing, crystal growth and semiconductor equipment industries at ARC Energy and Lam Research with a proven history of leading global teams that delivered products and solutions to meet demanding performance and reliability requirements. Dr. Ullal has published multiple times in peer-reviewed journals and has been granted over twenty US patents.



Thanh Nguyen, SVP of Deployment, has spent over 30 years developing technology. He has been in the Li-ion space for over 10 years, with five years at Johnson Controls (now Clarios) building up a new Li-Ion business group, and five years at Farasis Energy leading global sales. He has worked with major OEMs and niche start-ups in the EV space. While at Farasis, he led a site selection for a 20GWh battery plant with a planned 10GWh starting capacity in Southeast US. The plant was on a 180-acre land with about 4M square foot of production and office space.



Chad McDonald, SVP of Strategy and Business Development, has spent over 25 years in commercial roles including marketing, business development and sales. He has been in the energy storage space for over 12 years, including 10 years at Maxwell Technologies which was acquired by Tesla in 2019. In these roles, Chad has worked very closely with major global automotive OEMs, Grid Energy Storage, and renewable energy partners in the wind and solar industries. Chad also spent 14 years in the home computing and consumer electronics sectors.



Shawn Montgomery, SVP of Advanced Manufacturing, has a BS and MS in Chemistry as well as an MBA. He will take over the plant design and layout as activity progresses with preparing to select 6K's build-out partner. Shawn has over 25 years of experience in domestic and international R&D and scale-up of materials in the chemical, energy, filtration, and HVAC sectors, helping launch A123 Systems powder operations in Changzhou, China.



Thomas Holmes, VP Engineering for 6K has over 30 years' experience predominately at Siemens Healthineers in R&D and manufacturing. He recently led the design, installation, and validation of all custom process equipment for two major plant expansions in the US and China. He received master's degrees in chemical engineering and in materials science. Captain Holmes served in the US Army as a Commander and Battalion Logistics Officer.



Deborah Sung, has close to 10 years of professional experience. With five years of experience in the Li-ion Battery Industry at Farasis, Deborah played a critical role in the site selection project for a 10GWh+ battery plant in Southeast US. During her time with Farasis, she participated in numerous new product launch projects as the project manager



Wyatt Olson, Program Manager, BS in Chemistry, MBA, and over 10 years of experience developing chemical products and leading complex internal projects as well as major customer programs. He has a PMP certification from the Project Management Institute.

Non-6K Key Resources

Joern Tinnemeyer, CTO and SVP of EnerSys, is responsible for global engineering, global quality, and technology development. Joern studied applied mathematics and electrical engineering at the University of Toronto and holds a Master of Science in Astronautics and Space Engineering. His primary focus of expertise includes energy storage systems, system design optimization, safety topologies and control theory. He currently also serves as Chairman of NaatBatt.

Job Rijssenbeek, VP of Li R&D, Albemarle, PhD in Chemistry from Northwestern, and over 20 years of experience between GE and Albemarle developing solutions for various battery chemistries and materials. His current focus is on developing a pipeline of differentiated technology, leading to new products and processes.

Shane Thompson, President, Retrie Technologies, 20+ year career in battery life cycle management. This experience includes leadership in environmental sales, commercial operations, and process development. He currently serves as President of Cirba Solutions (CIRcular BAttery), the rebranding of Retrie. Mr. Thompson has used his knowledge to help drive US policy and regulations related to battery recycling and materials.

John DeCarlo, Chief Technology and Commercialization Officer, over 40 years of industry experience with over 20 at the Coghlin Companies holding senior leadership roles through a substantial portion of the company's growth and evolution. John has led full scale manufacturing of more than a billion dollars of innovative capital equipment. As CTO, John has technical oversight of the engineering services and product development team, and as CCO, he is accountable for the overall success of the company's Scaled Product Launch™ Process.

Andrew Jansen is a chemical engineer in Argonne's Chemical Sciences and Engineering Division who plans and conducts goal-oriented research and development on advanced battery systems, providing technical guidance and program direction. His work includes evaluating developmental cells/batteries with an emphasis on cell chemistry and hardware development for lithium-based battery chemistries for transportation applications.

Project Team Members (sub-recipients) and Upstream Partners

EnerSys: Nearly \$3B in 2021 sales, is a global leader in energy storage with over one hundred years of history and a legacy of delivering solutions to partners and customers in a

wide range of industries and applications. With a long-standing focus on lead acid battery, EnerSys is now shifting its focus to the development and manufacturing of li-ion battery products and will function as a lead supplier of these products to DOE and DOD.

EnPower: Technology advantage lies in its patented multilayer electrodes which address the trade-off between energy and power. The company's R&D facility enables rapid innovation and prototyping in 3-7Ah pouch cells. Technology will be scaled for qualification and production at EnPower's 1.5 GWh, 92k ft² customer qualification facility in Indianapolis, IN.

Argonne National Labs (ANL), grant sub-recipient team member: Provides R&D facilities provide unique capabilities to the scientific community. Through collaborative research agreements, scientists can obtain access to specialized instrumentation and expertise rarely found elsewhere.

In collaborations that combine ANL's expertise with that of industry, academia, and other government laboratories, ANL scientists and engineers deliver research tools and solutions that enable access to affordable, environmentally clean energy, and reduces the nation's dependence on foreign energy sources.

Upstream partners are also extremely critical to 6K's success.

Albemarle: Currently working under a multi-year, multi-million-dollar development agreement for alternate Li solutions, is the world's leading supply Li to the automotive market. Total annual revenue in 2021 was \$3.33B. They have a large Research and Development center in North Carolina staffed with highly experienced scientists and state of the art equipment. Operationally, the own and operate mines in Chile and Australia, with Li deposits available in North Carolina and Nevada.

Retriev Technologies: The United States oldest li-ion recycler developing precursor solutions from end-of-life batteries, is wholly owned by the Heritage Group, a multi-billion \$/yr private environmental services company. They have an existing infrastructure with over 1300 trucks, 90,000 customer touchpoints, and are investing heavily to expand their capabilities.

Coghlin Companies / Columbia Tech: OVER 135 years young, more than 1,000 caring associates, and had nearly \$700M in 2021 revenue. With more than 700,000 square foot production space, they provide product development, manufacturing, global fulfillment, and aftermarket services to capital equipment innovators in the medical, life sciences, energy, homeland security, robotics and automation, communications, 3-D printing, LED, and semiconductor.

b) 6K Infrastructure

6K's Additive division currently has four full production UniMelts systems in operation producing commercial products. At the end of budget year 1, 6K's Additive division's capacity will be expanded to eight UniMelt systems with fully automated support systems for materials loading and unloading. These eight UniMelt systems will be capable of producing 400-600 tpa

of multiple chemistries by the end of 2023. As this facility develops volatile metal products it conducts Process Hazard Analyses that fully comply with the National Fire Protection Association (NFPA) 484 Safety Standard.

6K has a corporate equipment team that support both 6K Additive and 6K Energy, currently comprised of 25 resources with plans to double by the end of 2023. The resources are comprised of material scientists, equipment engineers, and technicians that average 15 years of applicable industry experience.

6K has processes in place that leverage the current capabilities and lessons learned from the 6K Additive team's success in the aspects of infrastructure deployment, automation, operations, and safety management across the 6K Inc. enterprise. This inherent 6K knowledge and expertise will be fully applied to the PLUS CAM Project and is already included in the Risk Register.

6K has an experienced materials development team, including resources that launched the first US LFP-based cathode system. The team is comprised of approximately 25 resources of material scientists, process and cell engineers and technicians, that average 15 years of applicable industry experience. The 6K team has received numerous grants from the DOE (VTO and ARPA-E) and USABC that have facilitated demonstration of the base technology as well as various chemistry solutions: LTO, NMC622, NMC9.5.5, and others.

6K's North Andover Battery Center of Excellence (BCE) is a 33,000 square foot facility dedicated to the R&D and pilot production of battery materials and cells. The facility includes 1,500 square feet for three dry rooms controlling relative humidity to 1% for powder handling, 10% for coating and mixing, and 1% for test cell assembly, respectively.

- The BCE includes raw material pre-processing capabilities that includes wet lab space for precursor preparation, a Netzsch horizontal media mill, ball milling, spray drying at multiple scales, vacuum drying, and a variety of other testing and production lab equipment.
- The BCE features a full suite of post processing capabilities including jet milling at multiple scales, a Hosokawa classifying mill, tube furnaces, and an RHK furnace simulator.
- UniMelt plasma reactors (four in 2022, with expansion space for 10), each are capable of 50+ tpa of cathode capacity.

Analytical capabilities are in place to support the materials development, including XRD, SEM/EDS, optical microscopy, ICP, TGA-DSC, mass spectroscopy, Malvern PSD, BET, He pycnometry⁶, tap density, ONHP analysis, KF titration, residual salt titration, rheology, carbon analysis (Q1 2023), and several other analytical and testing requirements.

⁶ A Helium (He) pycnometer is a laboratory device used for measuring the density—or, more accurately, the volume—of solids, be they regularly shaped, porous, or non-porous, monolithic, powdered, granular or in some way comminuted, employing He displacement and the volume:pressure relationship known as Boyle's Law.

The BCE facility supports the R&D and prototyping of full coin and pouch cell assembly capability, supported by temperature controlled electrochemical test channels (with expansion space for up to 1,000) to enable rapid development cycles.

6K's manufacturing support for the UniMelt systems is provided by Columbia Tech with over 135 years manufacturing and installation experience. Columbia Tech will utilize its 1,000 associates and over 700,000 square foot production facilities to provide the UniMelt product development, manufacturing, and delivery. Additionally, they provide on-going support for preventative maintenance programs and rapid issue resolution.

c) 6K Relevant Past Performance

6K has invested over 13 years and \$120 million dollars designing, building, and testing the microwave plasma technology that is the foundation of the UniMelt system. The UniMelt system has undergone industry validation that rigorously applied scientific and engineering disciplines prove, and subsequently demonstrated, full feasibility of 6K's disruptive microwave plasma innovation. 6K's past performance is discussed in detail in **Section 1.a – Background**, above, and is summarized below.

- *Demonstrated the process in a production unit* – 6K developed and successfully demonstrated the first fully-engineered, full-scale UniMelt plasma production system.
- *Demonstrated the process in an industrialized setting* – 6K proved the UniMelt technology efficiently operates at scale by implementing in an industrialized setting for 6K's Additive division for metal AM powders.
- *Demonstrated UniMelt battery material meets customer specifications at a lower production rate* – 6K successfully demonstrated that high nickel NMC could be consistently made to commercial targets at fast development rates.

d) Key Personnel Commitment

6K is fully committed to the PLUS CAM Project, and the key personnel 6K has selected for this project represent the core resources of the company. 6K commits to ensuring at all identified key personnel will remain on the project throughout their employment with 6K, unless mutually agreed upon between the DOE and 6K.

e) DOE/NNSA FFRDC Technical Services

6K has partnered with ANL to conduct the FFRDC evaluation, testing, and qualification (cycle life, storage life, and rate testing) of 6K's NMC, LFP, and LMO materials. ANL will also conduct full baseline comparisons of the commissioned Gen 1 and Gen 2 UniMelt systems (cycle life, storage life, and rate testing) of the production of NMC, LFP, and LMO products.

f) Foreign Entity Involvement

6K has no foreign involvement in this proposed grant request.

g) Multi-Organizational/Investigator Support

6K is not proposing a multi-organizational entity for this Grant Request.