



PRINCETON
NUENERGY

Princeton NuEnergy

Black Mass Production & Direct Recycling/Upcycling Solutions

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NAATBatt 2025

Confidential

PNE Scaling Prudently with Strategic Pilots and Facilities

Core Business
Segments

Black Mass
Production

Direct Recycling
(Cathode-to-Cathode™)

Upcycling

PNE Innovation



Direct Recycling, Upcycling, Cathode Production Pilot Facility & Materials Testing Center

- Enabling cathode sample validation to support customer qualification, de-risk scale-up, and accelerate commercialization.
- The largest cathode innovation and pilot facility in the northeastern U.S. further solidifies PNE's leadership in the space.



Headquarter Office & R&D Lab

- Enabling cathode sample validation to qualify material performance and initiate customer sampling programs.



5,000 tpa Black Mass Production Facility

- Obtained all permits and producing black mass now
- Preparing black mass line expansion and scalable cathode production.



Rejuvenated Cathode Production Joint-Pilot Facility & Black Mass Production

- Enabling ton-level Rejuvenated CAM sample validation
- accelerate scale-up to 3,000 tpa black mass production to meet customer specifications.



PNE's multi-level validation across strategic U.S. locations ensures strong performance at every scale-up stage—reducing risk, enabling customer qualification, and speeding commercialization.

PNE uniquely blends global expertise with local execution to meet rising domestic demand for secure, sustainable battery materials.

America's Top GreenTech Companies 2024 & 2025

World's Top Greentech Companies 2025

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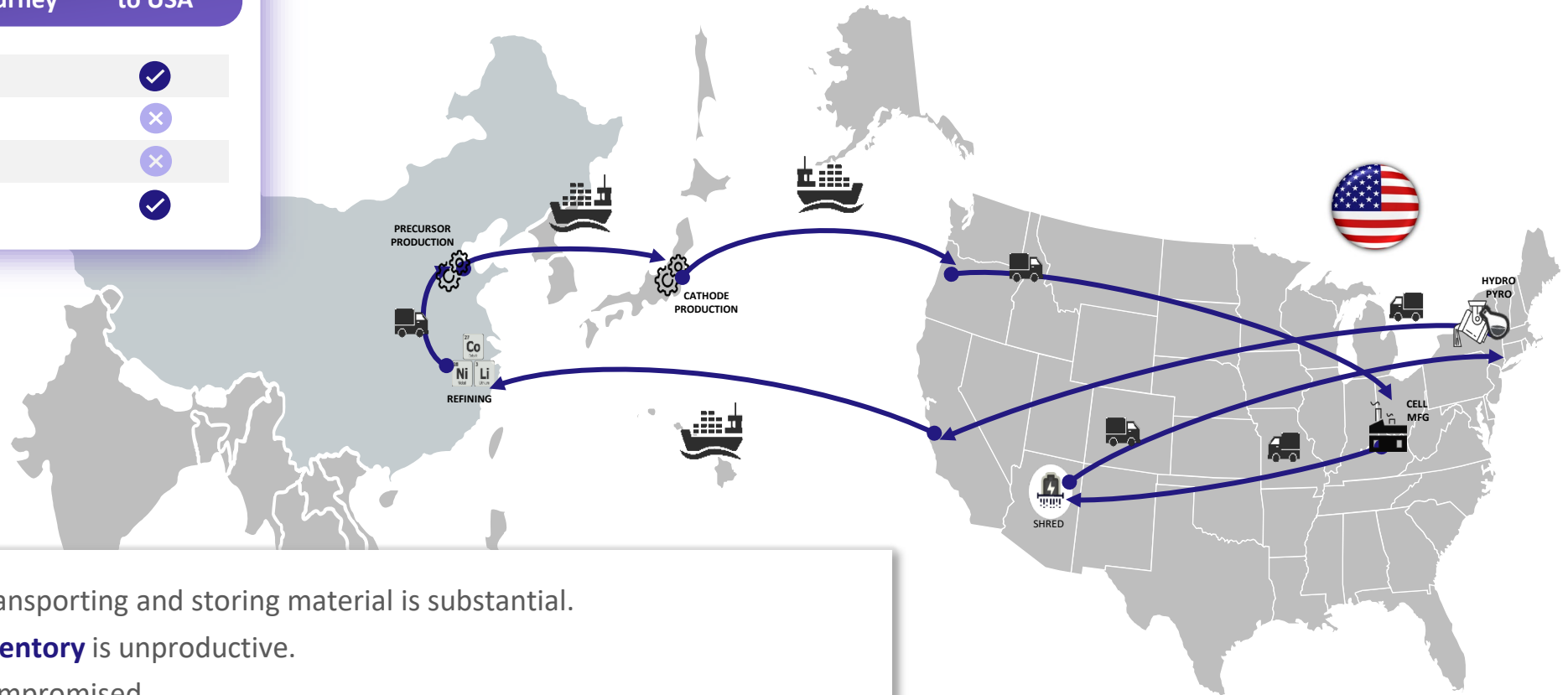
Traditional Supply Chains Less Than Ideal

Scorecard

Today's Global Journey

Onshore to USA

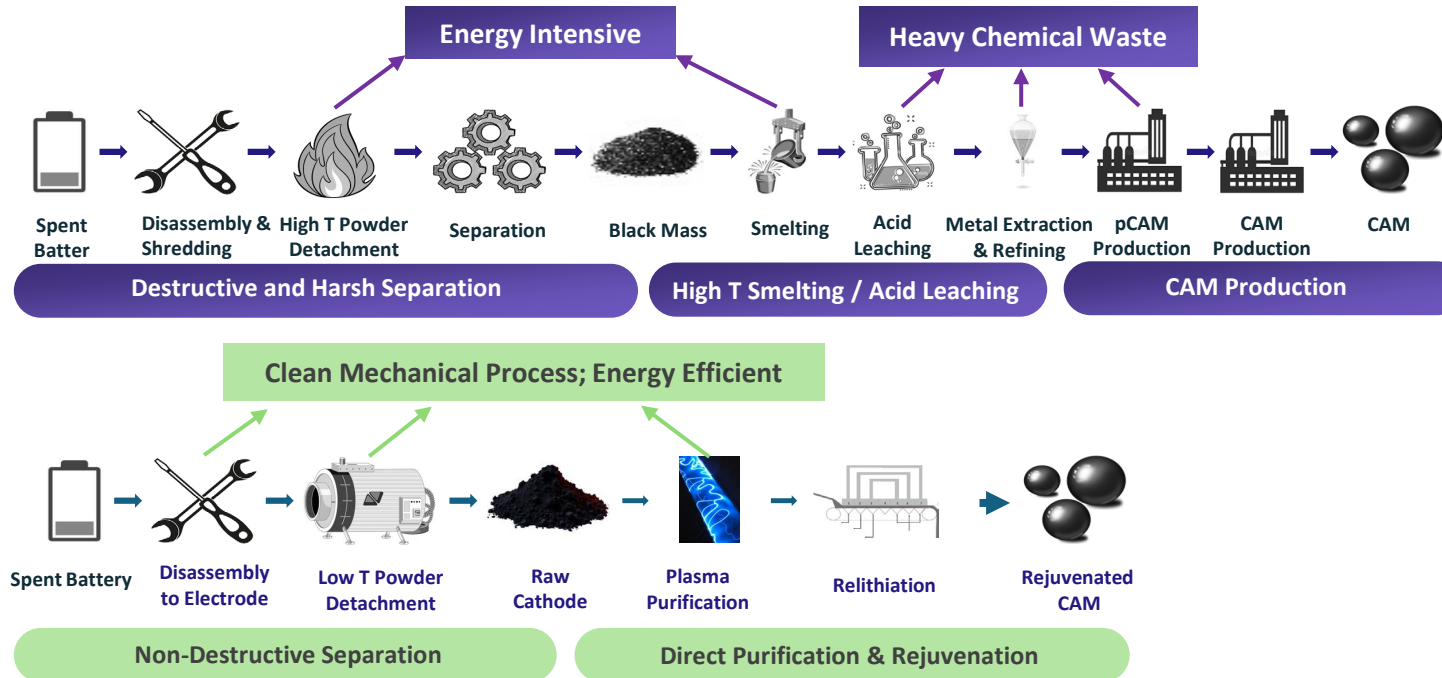
- | | | |
|---------------------|---|---|
| • Time | ✗ | ✓ |
| • Cost | ✗ | ✗ |
| • Environment | ✗ | ✗ |
| • Domestic Sourcing | ✗ | ✓ |



Today

- The **time** and **cost** of transporting and storing material is substantial.
- Materials **tied up in inventory** is unproductive.
- **Domestic security** is compromised.

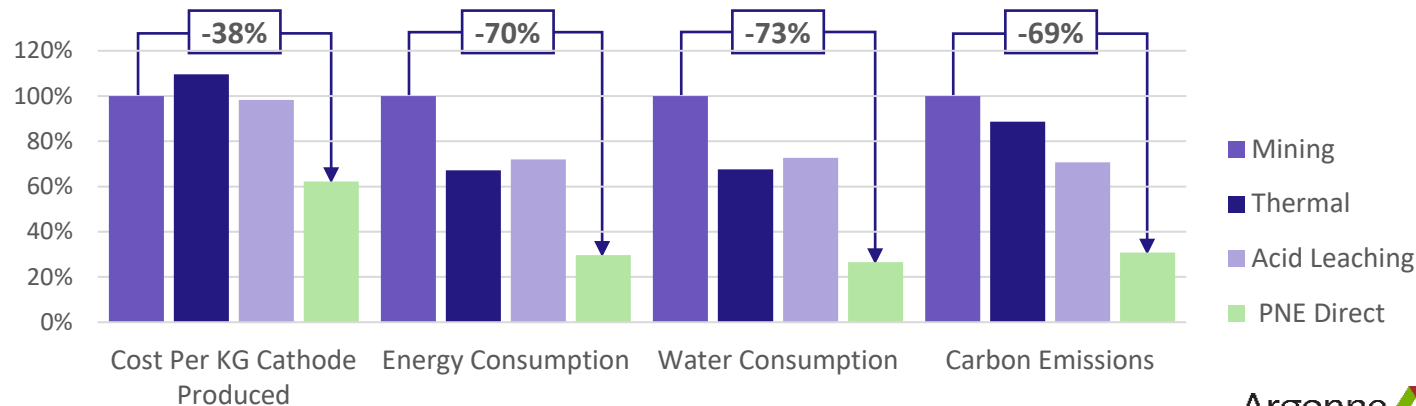
Direct Recycling is Far Superior to Conventional Processes




38% reduction in production cost relative to mining

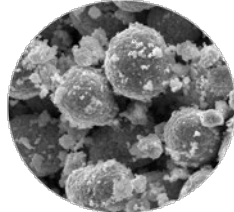

Environmental Benefits
69% less CO₂ emissions


Circular Economy
Critical Materials Security

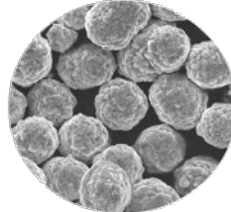


Rejuvenated CAM Shows Comparable Performance

NCM

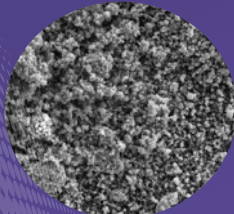


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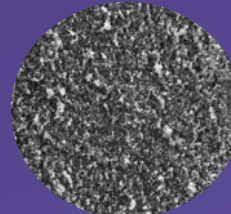


Rejuvenated

LFP

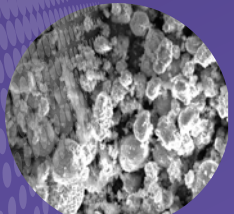


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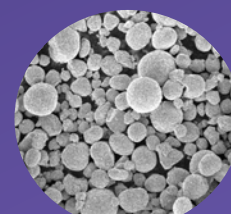


Rejuvenated

NCA

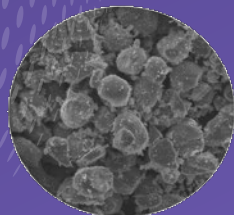


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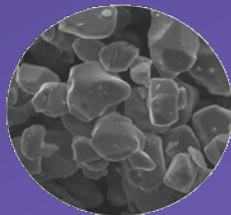


Rejuvenated

LCO

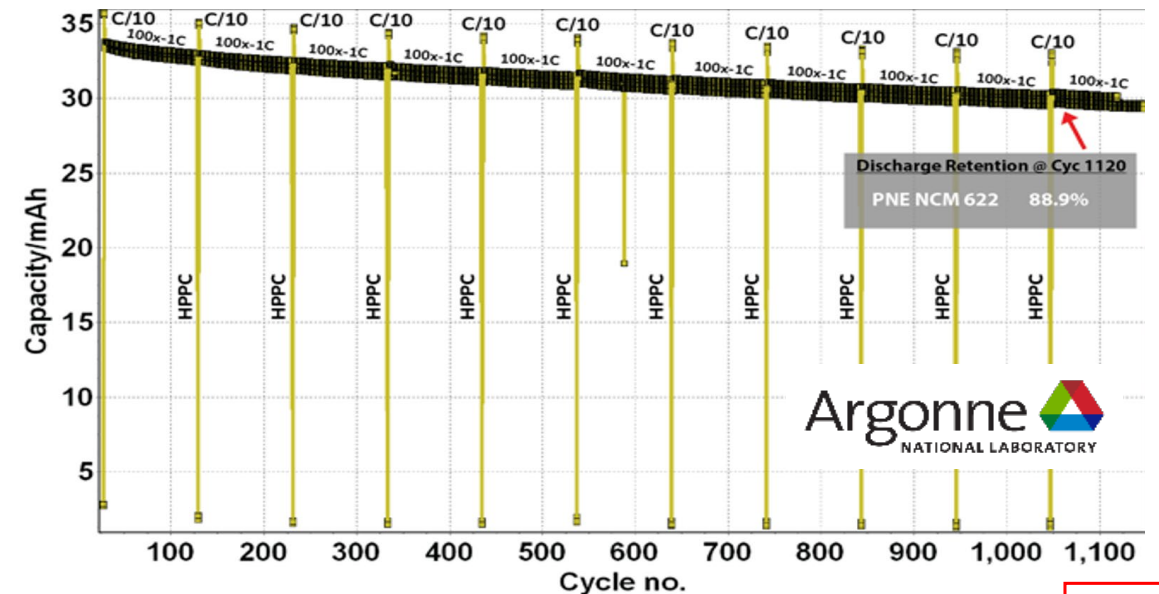
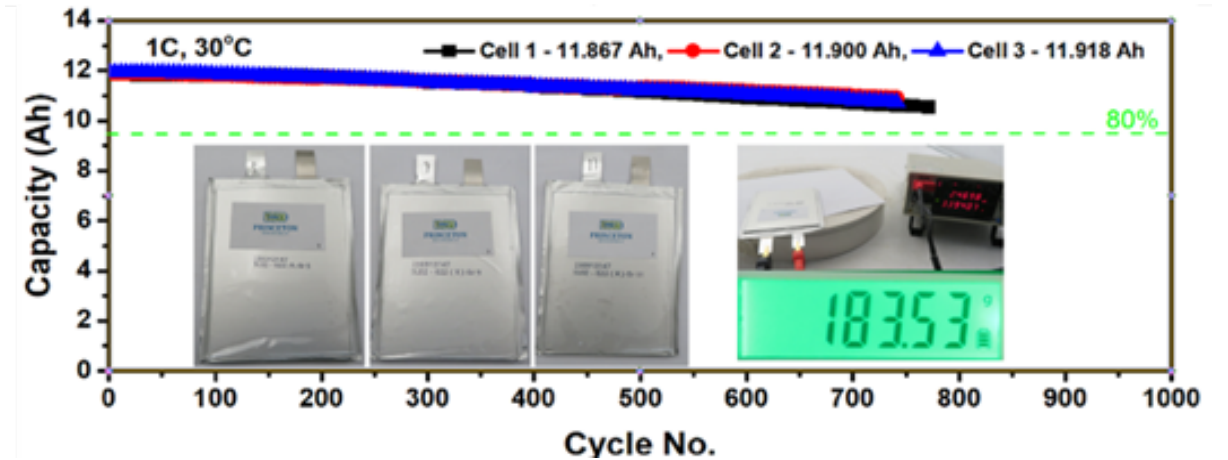


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Rejuvenated

Over 80% Capacity Retention After 1000 Cycles in Large Pouch Cells



Black Mass Facility Established in South Carolina

- Black mass facility is fully permitted and compliant with all regulatory standards within only **8** months;
- PNE takes only **9** months from procurement to commissioning stage, compared to industry average of 24 – 36 months.
- Black mass production line is fully operational and running at steady state.
- Achieved a recycling yield of **over 97%**, much higher than industry norm of 92–95%.



Direct Recycling and Upcycling Pilot Facilities

PNE Testing Center Strengthens Our Testing Capability



Direct Recycling Joint-Pilot Production Facility @ McKinney, TX



Direct Recycling & Upcycling Pilot Facility @ Princeton, NJ



New Jersey Testing Center Capabilities

Materials Characterization Lab

1. JEOL SEM
2. Bruker XRD
3. Anton Paar BET
4. MRB PSD
5. ThermoFisher ICP-OES
6. ThermoFisher F-ISE
7. TA Instruments TGA/DSC
8. Materials Tap Density Tester
9. Materials True Density Tester
10. Materials Press Density Tester
11. Karl Fisher (Moisture)
12. ThermoFisher Titrator
13. Carbon/sulfur analyzer
14. XPS, TEM, Raman, FIB, etc.

Cell Fabrication and E-Chem Testing Lab

1. Cleanroom/Dry room/Large glovebox
2. Slurry mixer (100g-5kg/batch)
3. TA Instruments Rheometer
4. Roll To Roll Reverse Comma Coater
5. NMP Recovery System
6. Hot/Cold Rolling Press Machine
7. Electrode Die Cutter
8. Automatic Layer by Layer Stacking Machine
9. Ultrasonic Metal Spot Welder Welding Machine
10. Pouch Formation Machine
11. Electrolyte injection system
12. Pouch Cell 3 in 1 Vacuum Sealing Machine
13. Battery cyclers with environmental chambers
14. Electrochemical workstations



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Thank You

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