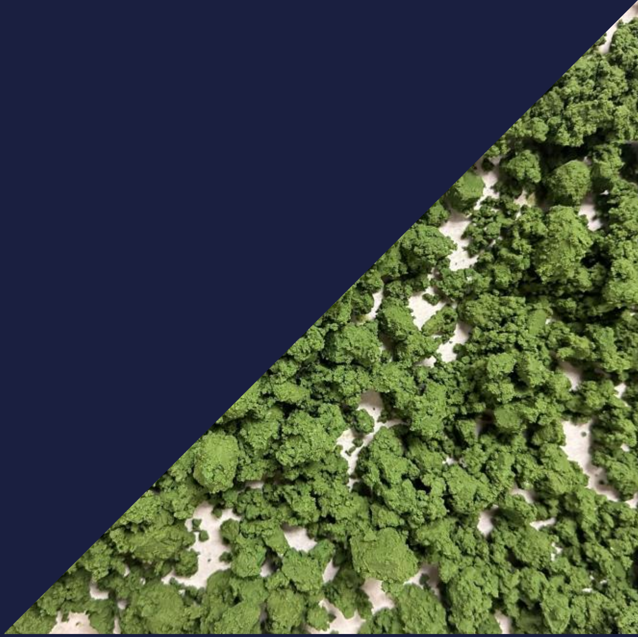
NTH CYCLE



REDEFINING THE CRITICAL METALS SUPPLY CHAIN

NAATBatt Lithium Battery Recycling Workshop VII: Closing the Circle
Meet The Recyclers Presentation

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Nth Cycle A metals refining technology company enabling the clean energy transition

VISION

Leading the **domestic, clean recovery** of critical minerals needed for the energy transition

STRATEGY

Localized refining capacity through **electro-extraction** to displace old, carbon intensive technologies and reduce waste

1 THE OYSTER, our patented electro-extraction system

Market Ready	Modular	Co-Located	Clean	Universal
Instead of the promise of domestic refining years away, able to match the speed needed to address the local supply of raw materials and legislative requiremen ts today.	A flexible, fully customizable platform able to produce the critical metals needed now, and adjust to changing volumes, feedstocks and specifications as needed.	An unmatched end-to-end partner solution that integrates with their equipment, at their facility, and converts their spent batteries, ore, or scrap into materials they own.	The industry's cleanest metal refining technology that accelerates net zero targets by eliminating the environmental damage of smelting and the chemical waste of hydrometallurgy.	Produces a universally accepted, high-value final product for consistent, reliable end-use across clean-energy markets.

2 Nth Cycle AT A GLANCE

Incorporated in 2017
10+ years of R&D,
5 patents

Deploying **commercial production** of high-purity MHP (Q3 2024)

HQ in Burlington, MA
50+ employees

Rapid deployment: low capital intensity, short-lead time procurement

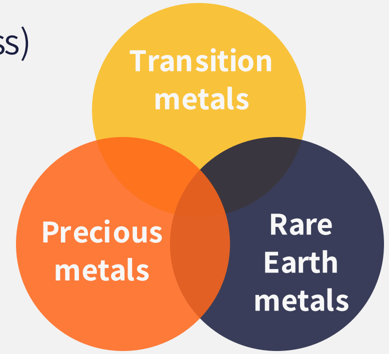
3 Target APPLICATIONS

Recycling

EV batteries (black mass)
Industrial catalysts
E-waste from CE

Mining

Waste to value
Mined ores
Bleed streams



THE PROBLEM

Outdated Technology

Decades-old, energy intensive smelting & hydrometallurgical methods of extraction equate to centralized facilities with high GHG emissions and significant amounts of chemical waste, creating non-circular supply chains and excessive transport routes due to highly distributed materials.

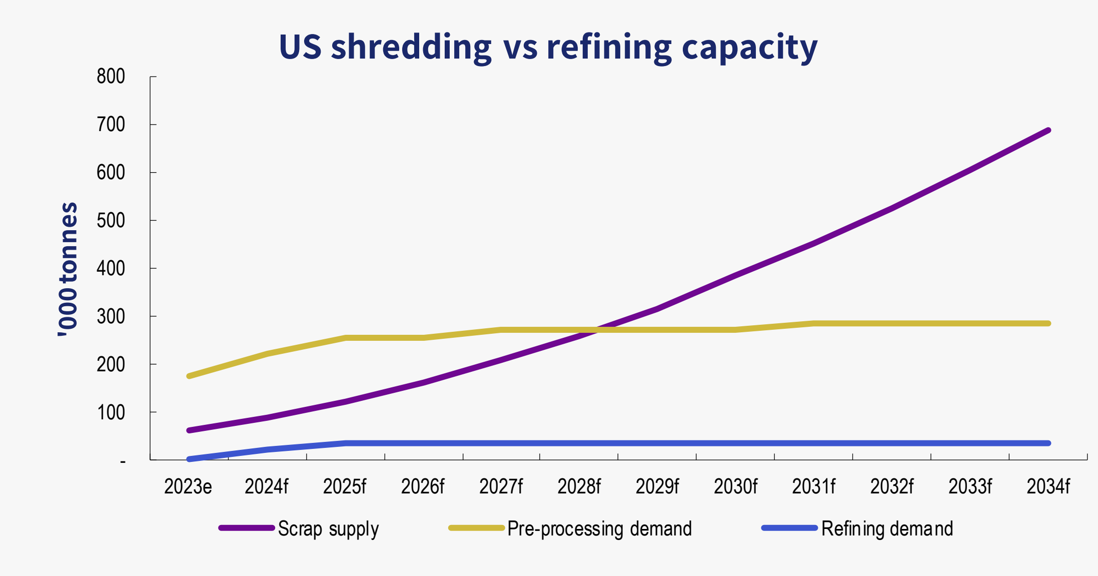
Sourcing Risks

Critical minerals often located in areas with significant supply chain risk, low traceability and extracted in non-ESG compliant ways. Lack of refining capacity causes materials to be exported to be refined overseas.

U.S. DEPARTMENT OF ENERGY

"REFINING is the most critical gap in the domestic lithium-ion battery supply chain."

United States Department of Energy



Source: FastMarkets Battery 10-year forecast Q1 2024

Nth Cycle's **Electro-extraction** solution

Market Ready

Instead of the promise of domestic refining years away, able to match our existing supply of raw materials and all legislative requirements - **now**.

Co-Located

A local refining system that can be installed in any facility in under 18 months and convert spent lithium-ion batteries and scrap into high-grade materials - all at one location.

Modular

A fully customizable platform than can provide multiple industries with the metals they need – and adjust to any volume, chemistry, or ratio changes in the future.

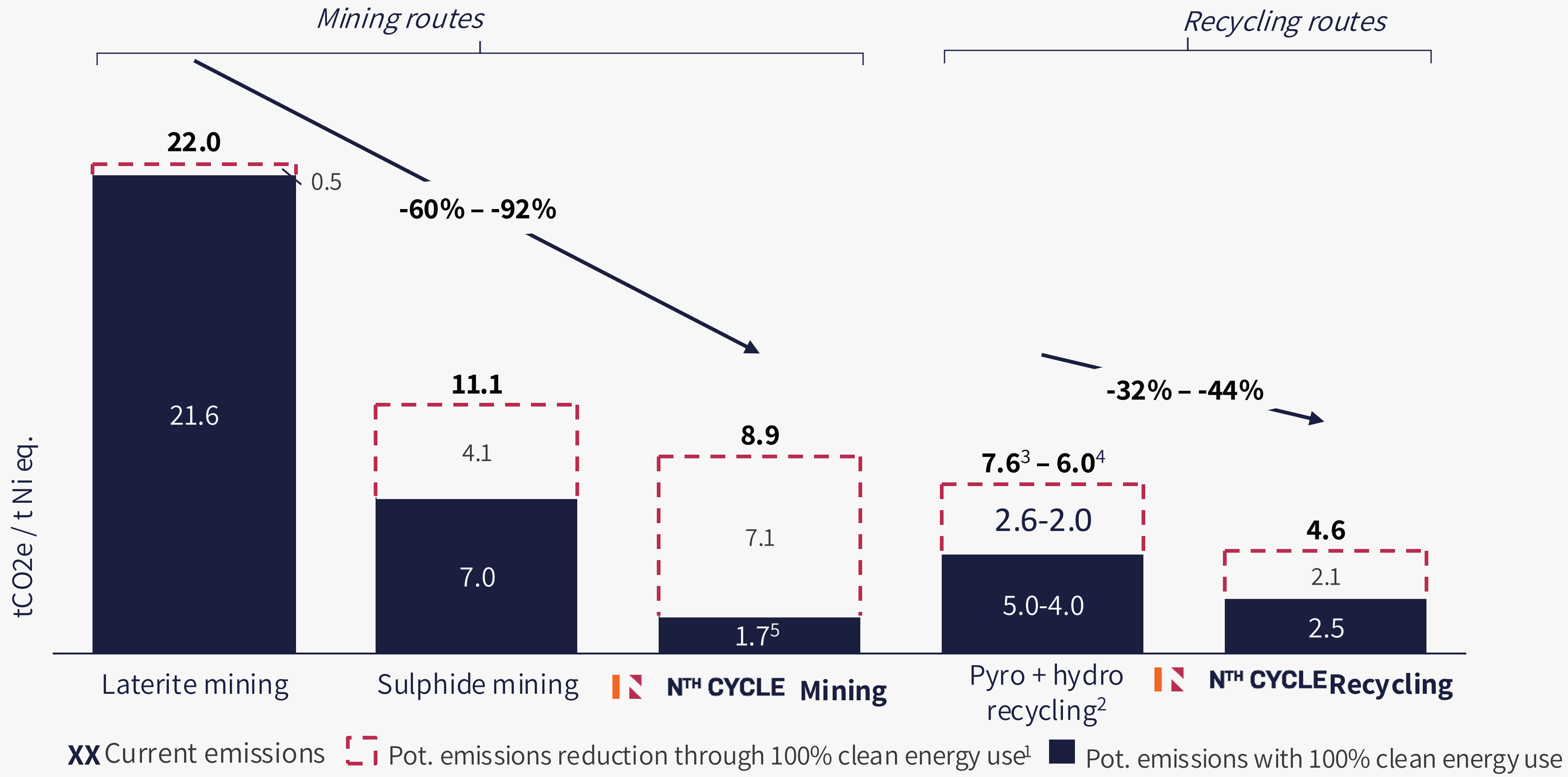
Clean

The industry's cleanest metal refining technology – patented electro-extraction – accelerates net zero targets by eliminating the environmental damage of smelting and the chemical waste it creates.

Universal

Produces a universally accepted, final product for end-use across all clean-energy markets, industrial applications, consumer products, and more.

Third-Party verification highlights Nth Cycle's emissions are significantly lower than current mining and recycling routes.



1. Electrification / decarbonization of transportation is not assumed for the purpose of this analysis (consistent throughout the document)
2. Assumes a low temperature pyro process converts 10% of the graphite to CO2, based on multiple expert conversations & Nth Cycle input; also providing a range for the lithium recovery in the pyro step [0%-90%] due to the many claims in the space. This pyro + hydro recycling route is modeled assuming Western emissions regulations.
3. Assumes 0% lithium is recovered in the pyro step and 10% of graphite is converted to CO2. These values could change based on process variability
4. Assumes 90% lithium is recovered in the pyro step and 10% of graphite is converted to CO2. These values could change based on process variability
5. Very low emissions from Nth Cycle's mining process are enabled by 100% clean electricity, consumption of CO2, and re-generation of all consumables

NTH CYCLE

NTH CYCLE ESTIMATED CO_2 EMISSIONS

For Ni mining from concentrate

92% lower
vs. HPAL laterite mining

76% lower
vs. sulphide mining

For Ni recycling from scrap

44% lower
vs. pyro + hydro refining

Note: assuming 100% renewable energy

We can refine metals across **every clean-energy industry.**

Transition

Rare Earth

Flexibility to process different feedstocks

RECYCLED ELEMENTS

NI-CO-MN

CU

RARE EARTH ELEMENTS

RECYCLING FEEDSTOCKS

US EV RECYCLING SCRAP (MANUFACTURING + EOL)

BLACK MASS

NI-HEAVY CATALYSTS

E-WASTE (PCBs, magnets, scrap, etc.)

EV MOTORS

EOL WIND TURBINES

CURRENT FOCUS OF OPERATIONS

IN DEVELOPMENT

The OYSTER (Electro-Extraction)

Products

MHP, Ni/Co hydroxide, NMC

Sellable today for any application (EV, Alloy, Specialty) or to PCAM/CAM producers.

Nd-Pr oxide powders

Goes back into the supply chain of rare earth elements.

Refined Cu products

Goes back into the supply chain for many electronics, transmission, and renewable energy.

COMMERICAL PRODUCTION FACILITY FOR PARTNERS

The United States' first production of NMC hydroxide

Commissioning	Q3 2024
Capacity	2,000 tpa black mass
Feedstock	Ni/Co scrap or industrial waste
Products	High-purity NMC hydroxide, Ni hydroxide, Li carbonate, industrial grade graphite
Permitting	<6 months
Construction	12 months
Site	Existing Industrial Building 20,000 sqf under a lease agreement
Purpose	De-risks future larger deployments by: • Testing wide range of black mass types and Ni-Co scrap • Commercial validation of electro-extraction technology • Market validation of Nth Cyle's high quality domestically-recycled product • Fully wrapped EPC for lower touch future deployments • Allows partners to campaign test material in advance of larger co-located deployments

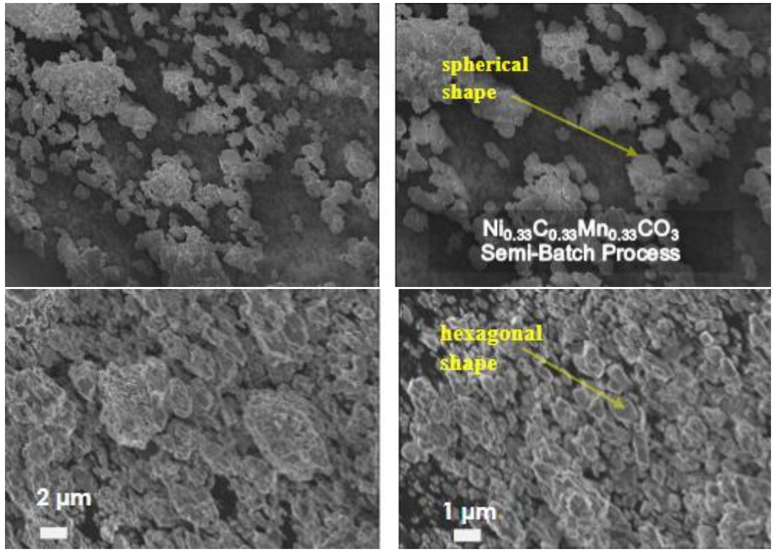
NTH CYCLE'S NMC PRODUCT

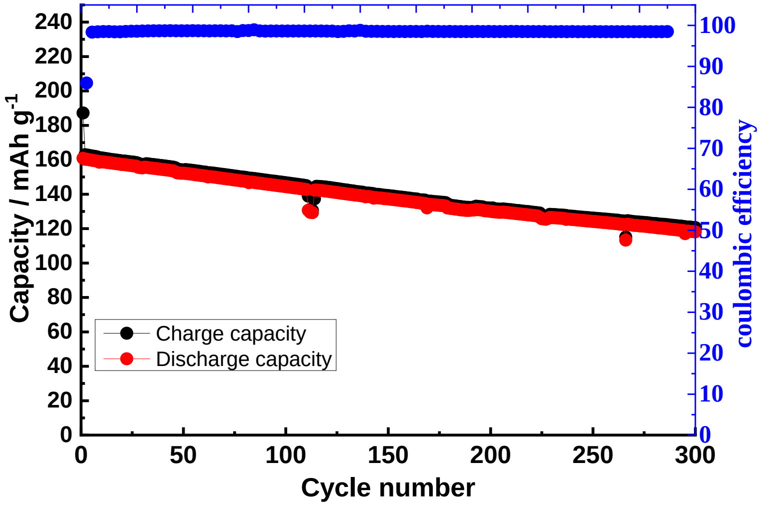
Nth Cycle's High-purity NMC hydroxides

- Low deleterious materials
- 100% recycled content
- Meets potential to be used as pCAM material
- Domestically produced
- IRA and EU Battery Passport Compliant

Nth Cycle's product shows similar results as commercial pCAM material

Nth Cycle tested its recycled product (NMC111) by doing pouch cell testing in collaboration with the DOE's ORNL for its use as a precursor cathode active material, showing the following results...





Similar morphology when compared side-by-side to a commercial NMC111 precursor...

- Battery precursor materials, whether recycled or virgin, need to have a specific morphology including both spherical shapes (with the right particle size) and crystals that will support the material's consistent electrochemical performance over time.
- Nth Cycle's fully recycled unoptimized carbonate consistently meets these specifications.

Similar electrochemical performance when compared to a commercial NMC111...

- The recycled material achieves the same theoretical capacity (170 mAh/g) and behavior (charge-discharge) expected from an optimized cathode material.
- The recycled material achieves the same retention in capacity after tested through 200 cycles compared to standard NMC111 commercial material.

Proving the ability to integrate Nth Cycle's recycled material as a final pCAM when mixed in the right ratio.

NTH CYCLE'S BUSINESS MODEL

Deployment follows a tolling business model to maximize value capture for both parties

Own & Operate revenue model → Tolling fee + price participation

Partner/Customer	▪ Scrap collectors/recyclers ▪ Refineries (waste and bleed streams)
Project size	▪ **Co-located** on partner site, integrated into operations ▪ Systems designed to discreetly fit partner volumes
Pricing	▪ **Tolling fee** ($/kg material processed), sized to achieve shared value uplift ▪ **Participation** on product sale (% of net revenue)
Contractual structure	▪ Nth Cycle funds construction, owns and operates assets ▪ Partner retains ownership of materials processed ▪ Target contract duration – 7-10 years
Value	▪ Bolt on to partners process, that immediately improves product value ▪ Reduces weight of final product and transportation costs ▪ Modular to allow for growth over time

TOLLING AGREEMENT

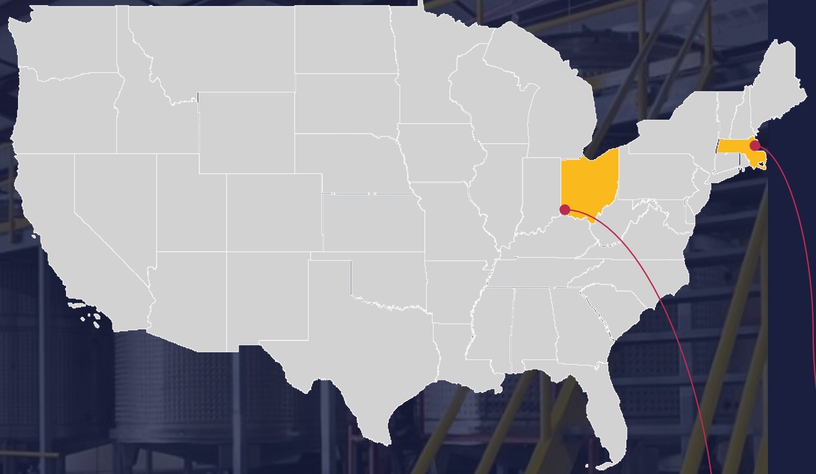
Nth Cycle will design, finance, construct, install, own or lease and operate the Nth Cycle system

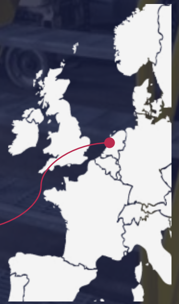
Nth Cycle to operate and maintain assets under flexible contract terms

NTH CYCLE

Note: Nth Cycle's Ohio facility will not operate under a tolling model

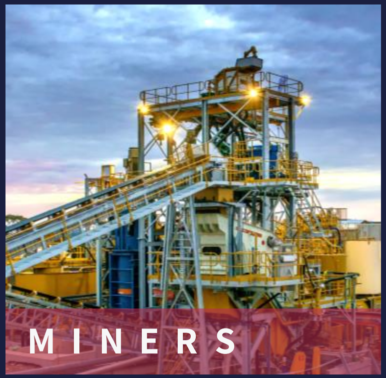
NTH CYCLE OPERATIONS





EUROPE
European expansion 2025

OUR PARTNERS



BURLINGTON, MA

HEADQUARTERS

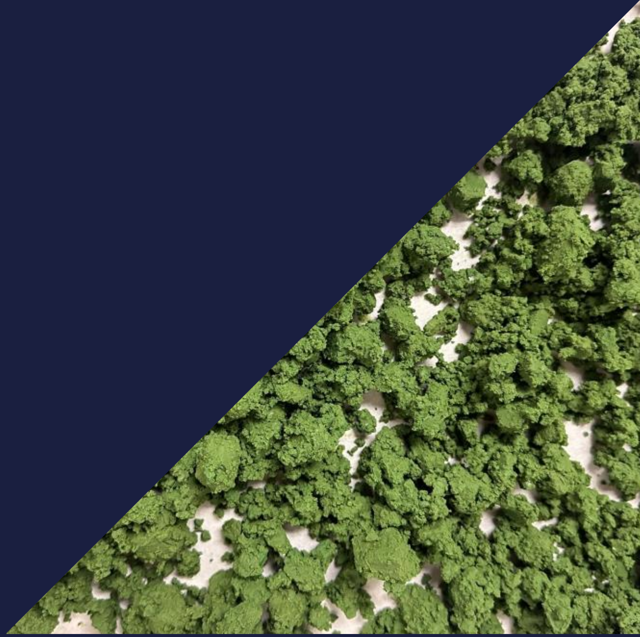
- 50,000 sq. ft with the Lab fully operational **Q1 2024**
- Commercial-scale cell design & assembly (**500 cells/m** capacity)
- Additional Commercial-scale pilot systems for new metals, materials and partner samples
- Multi-commodity **R&D**

FAIRFIELD, OH

COMMERCIAL PRODUCTION FACILITY

- 1 Commercial-Scale Unit **commissioning in Q3 2024**
- Processing capacity: 2,000 tpa black mass
- Commercial plant to test partner black masses
- 20,000 sq. ft

NTH CYCLE



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Thank you!

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