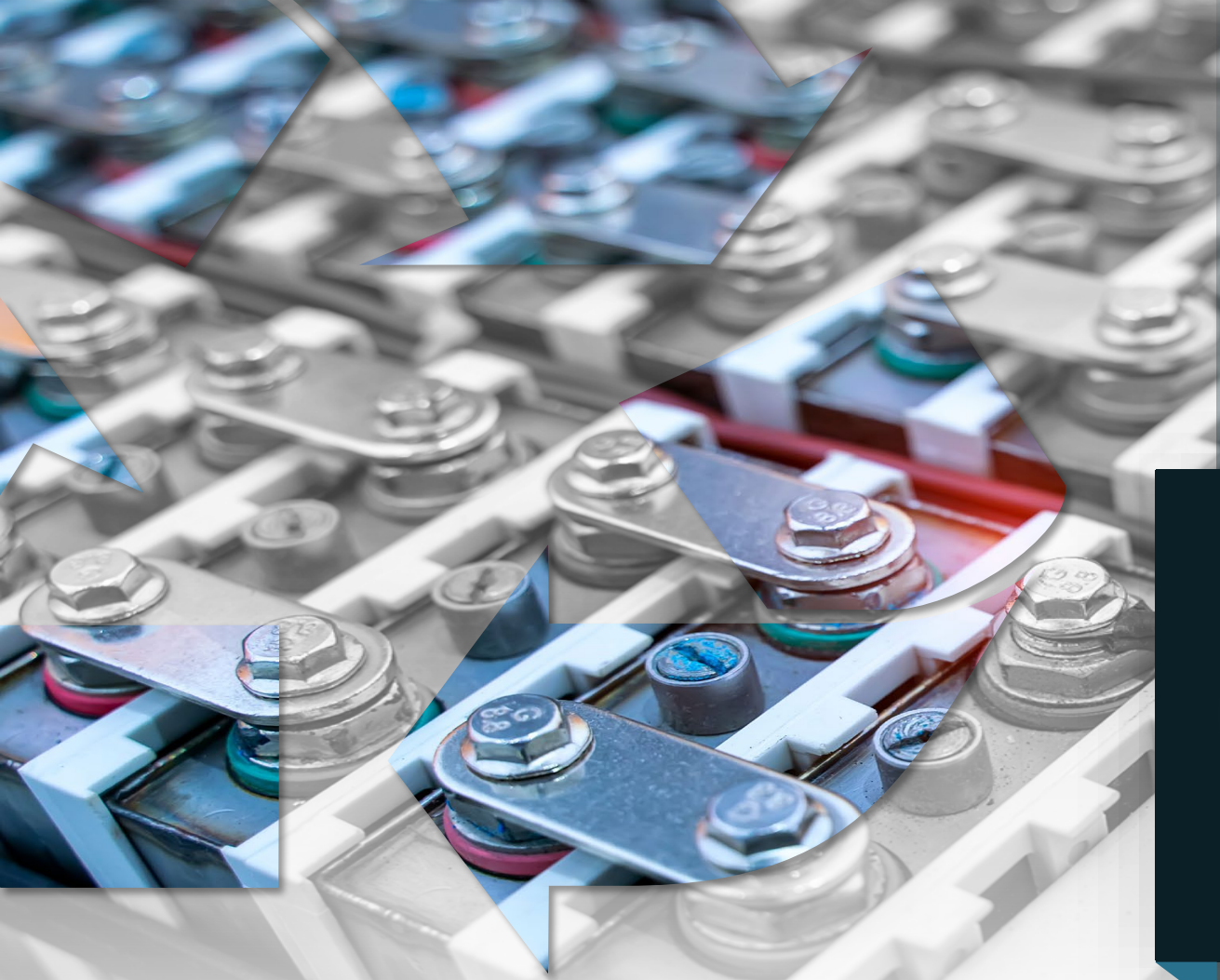

Lithium-ion Battery Direct Recycling Solution

Cost effective, environmentally-friendly solution supporting the circular economy

January 2023

PRINCETON NUENERGY

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About Princeton NuEnergy

2014
Fundamental Research

2019
Founding

2022.12
DOE $12M Award

2023.02
Pilot Launch

Origins

Fundamental Research Conducted at Princeton Plasma Physics Laboratory & Princeton NuEnergy Formation

PPPL PRINCETON PLASMA PHYSICS LABORATORY

PRINCETON NUENERGY

2014 - 2019

Academic Achievements

Princeton University IP Accelerator Program	2022 Tiger Entrepreneur Award	Princeton University Website Recognition

PRINCETON UNIVERSITY

Grants

US Department of Energy SBIR Phase I and Phase II Grants ($1.4mm)

Energy Efficiency & Renewable Energy Grant ($12.0mm)

Clean Tech Open
National Grand Prize Winner

CLEAN TECH OPEN

NJ Cleantech Seed Grant

NJ EDA ECONOMIC DEVELOPMENT AUTHORITY

Commercialization

Pilot Production

500-ton Joint Pilot Production Line

PRINCETON NUENERGY

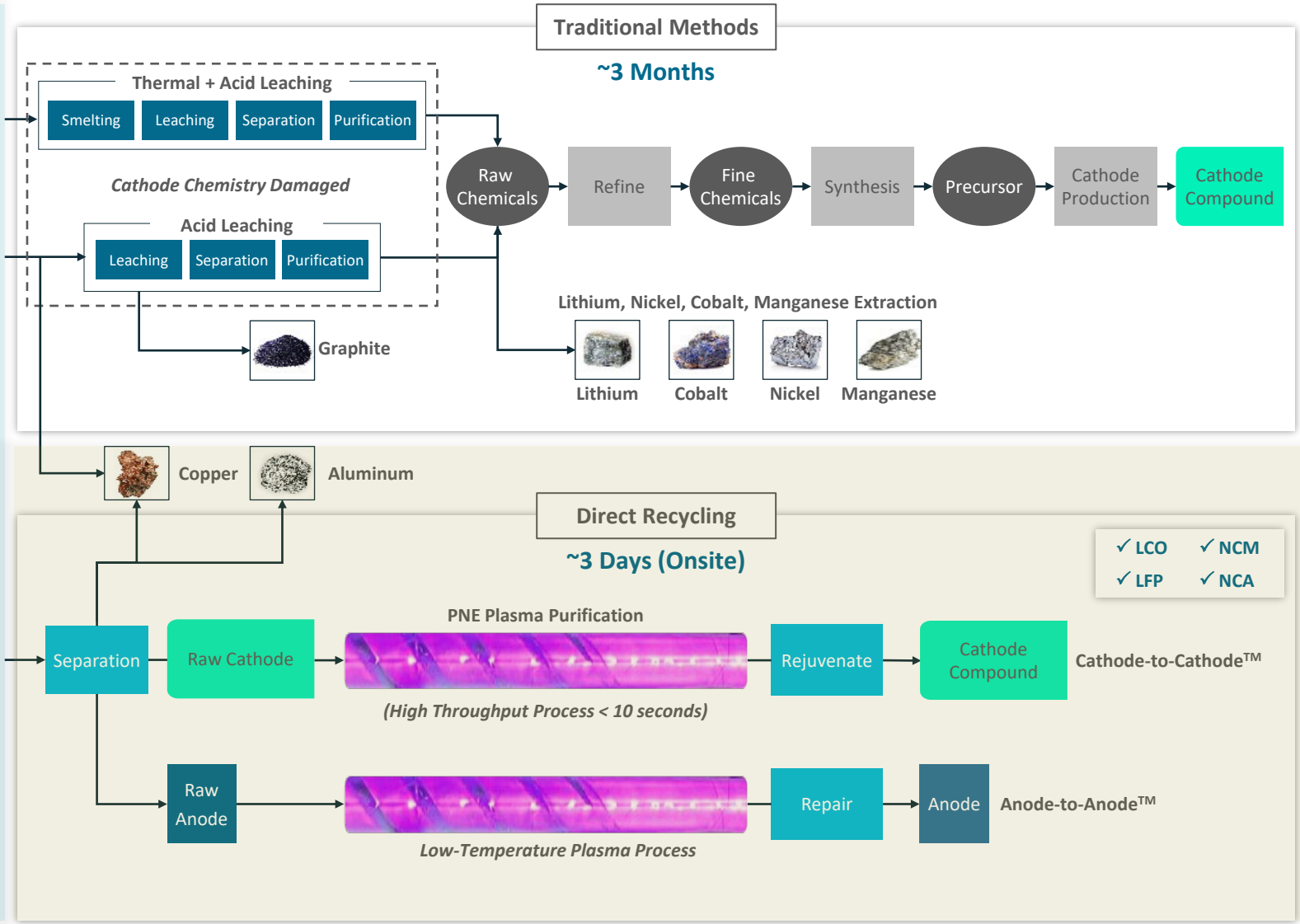
wistron
Wistron GreenTech (Texas) Corporation

2022 - 2023

What We Do: Direct Recycling using a Low-Temperature Plasma Assisted Process

PNE's process does not break down the cathode and anode, simplifying the recycling chain and leading to reduced costs and lower environmental impact

Shred



- Old science that produces raw chemicals.
- Burdened by time, cost, and environmental impact!
- Low-temperature plasma-assisted purification removes trace impurities.
- No use of organic solvents or acids!

Princeton NuEnergy's Direct Recycling

PNE's *Plasma-Based Direct Recycling* process is a faster, cleaner and more cost-effective alternative over competing technologies.

- **"Right Size"** site operations
- **Localize** the end-to-end process in one plant
- **Co-locate** to eliminate or minimize transport

- Reduce environmental impacts – **No VoC's**, **low energy use**
- Better control your **supply chain**!

Direct Recycling Advantages Over Traditional Recycling

PNE's *Plasma-Based Direct Recycling* process excels on all key metrics.

	Process	Product	Time	Product Value	Cost	GHG Emissions	Waste	Energy Consumption	Domestic Production
Cathode-to-Cathode PRINCETON NUENERGY	1. Separate materials 2. Remove impurities 3. Rejuvenate 4. Upcycle	Cathode	3 days	High	Low	Low	Low	Low	USA
Pyro/Hydro Hydro-to-Cathode	1. Reduce to critical minerals 2. Refine raw chemicals 3. Synthesis (planned) 4. Cathode Production (planned)	Cathode	> 2 months	High	High	High	High	High	USA
Hydro	1. Reduce to critical minerals 2. Refine raw chemicals 3. PCAM synthesis (overseas?) 4. Cathode production (overseas?)	Raw Chemicals	> 3 months	Low	High	High	High	High	?

Value Proposition

The PNE technology recovers ~95% of all constituent materials of LIBs, while achieving cost savings and providing unparalleled environmental benefits

Cost Savings

PNE's novel low-temperature plasma assisted separation ("LPAS") direct recycling process results in a **44% reduction in production cost** relative to mining

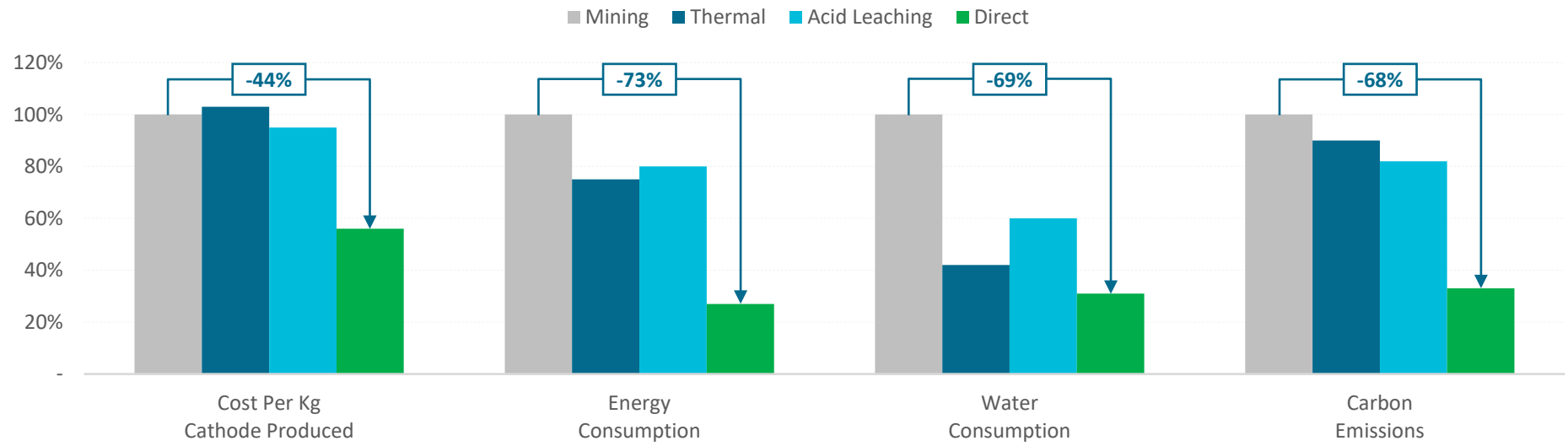
Environmental Benefits

PNE's LPAS technology results in **73% less energy usage, 69% less water usage,** and **68% less CO_2 emissions** relative to mining

Circular Economy

PNE's LPAS process can **recover up to 95% of all constituent materials** found in lithium-ion batteries, therefore **reducing the need for mining** of these materials to meet growing EV demand and helping **reduce landfill waste**

Benchmarking vs. Mining and Other LIB Recycling Technologies(1)



Source: Argonne National Lab ReCell Center

(1) Values of the thermal, acid leaching, and direct recycling processes are benchmarked to mining at 100%

Thank You

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