



**Battery Technology & Analyst Day**  
May 17<sup>th</sup>, 2023



**Toronto Stock Exchange (TSX:ELVA) & (OTCQB:EFLVD)**

# Disclaimer

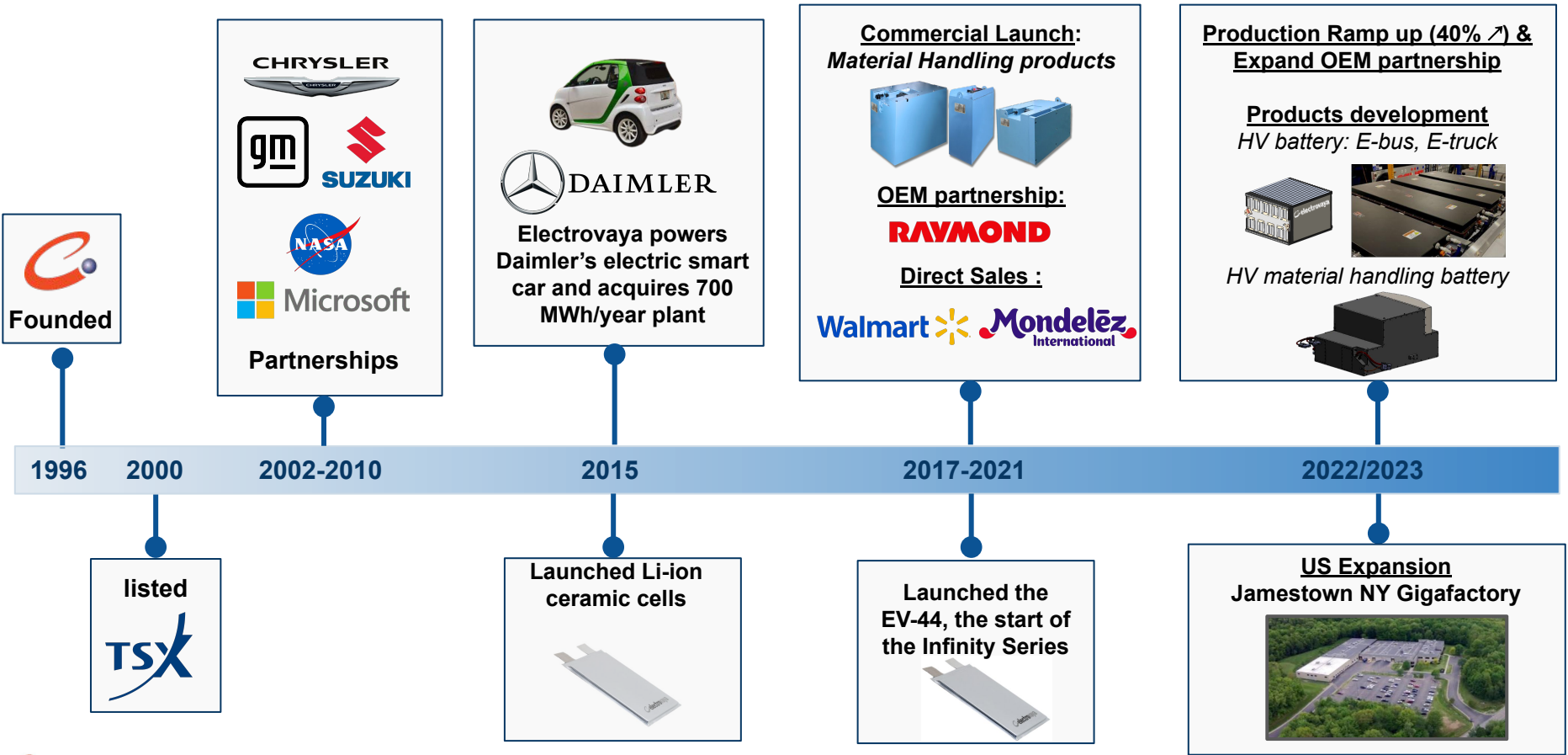
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# **Our Mission**

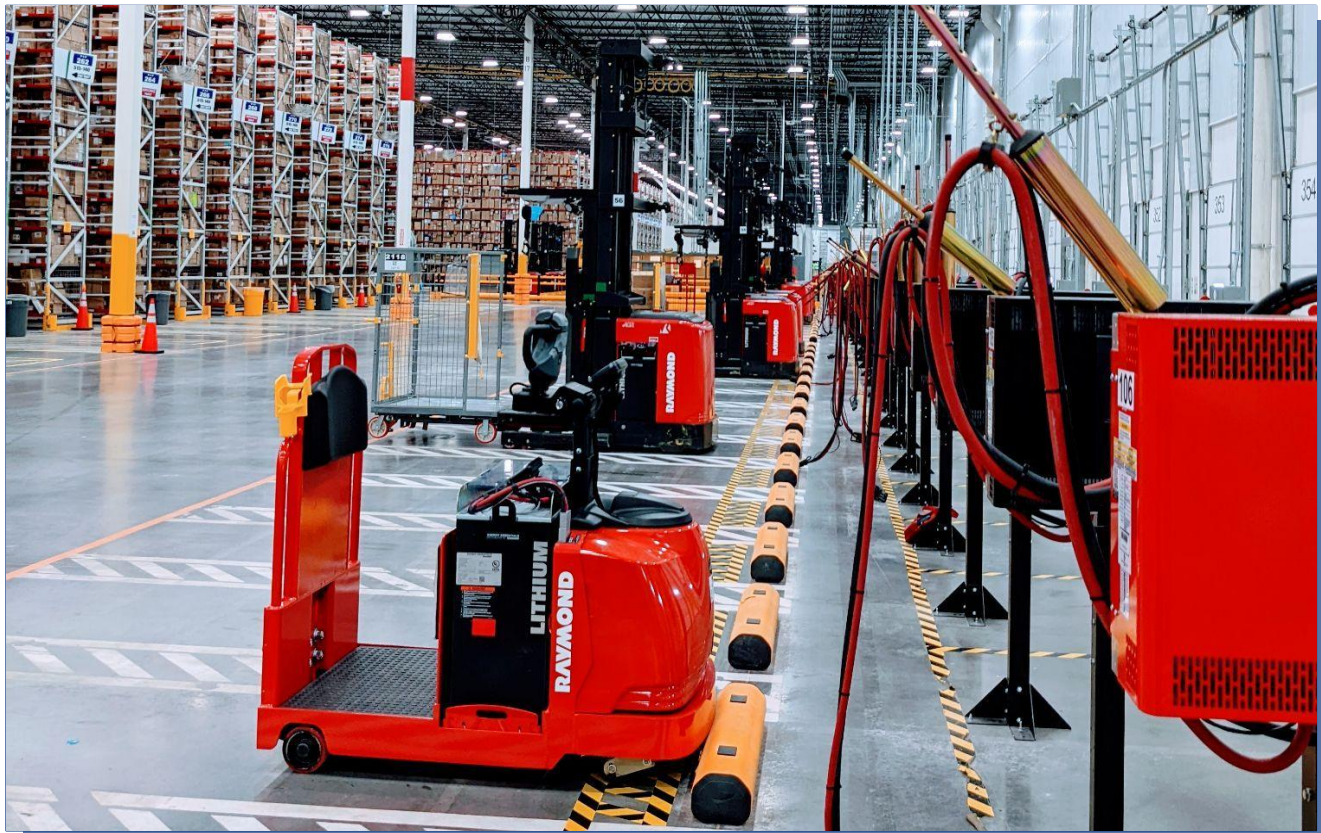
**To accelerate the energy transition with safer and better batteries through technology advancement**

# Electrovaya at a Glance





# Electrovaya: Success based on innovation



Electrovaya batteries powering vehicles at a Fortune 100 customer site



**Industry Leader**  
Providing the safest multi-million-mile batteries



**Top-tier Customer Base**  
Fortune 100 customers and leading OEMs



**Unparalleled Experience**  
25+ years of experience and 100+ Patents ; team of ~95 & 30+ engineers



**High Revenue Growth**  
>4x since 2019 with projected 100% growth in FY2023

# Electrovaya Capabilities

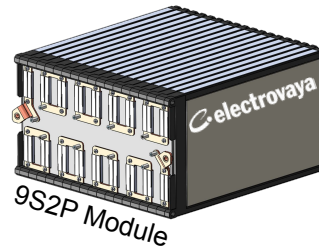
Electrovaya expertise and capabilities includes designing and manufacturing lithium ion batteries cells / Modules / Packs / Battery systems and other battery-related products (BMS)



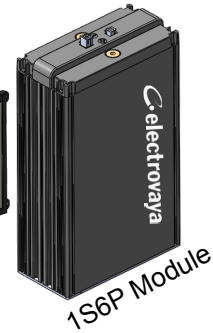
Cell

Module

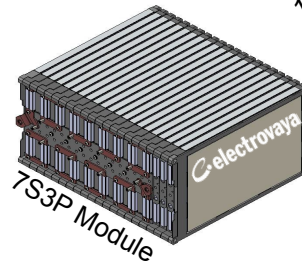
Pack



9S2P Module



1S6P Module

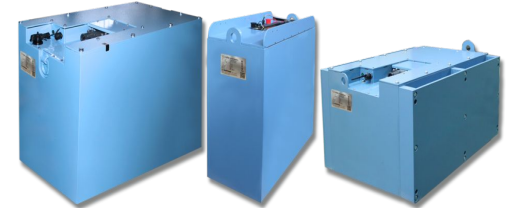


7S3P Module

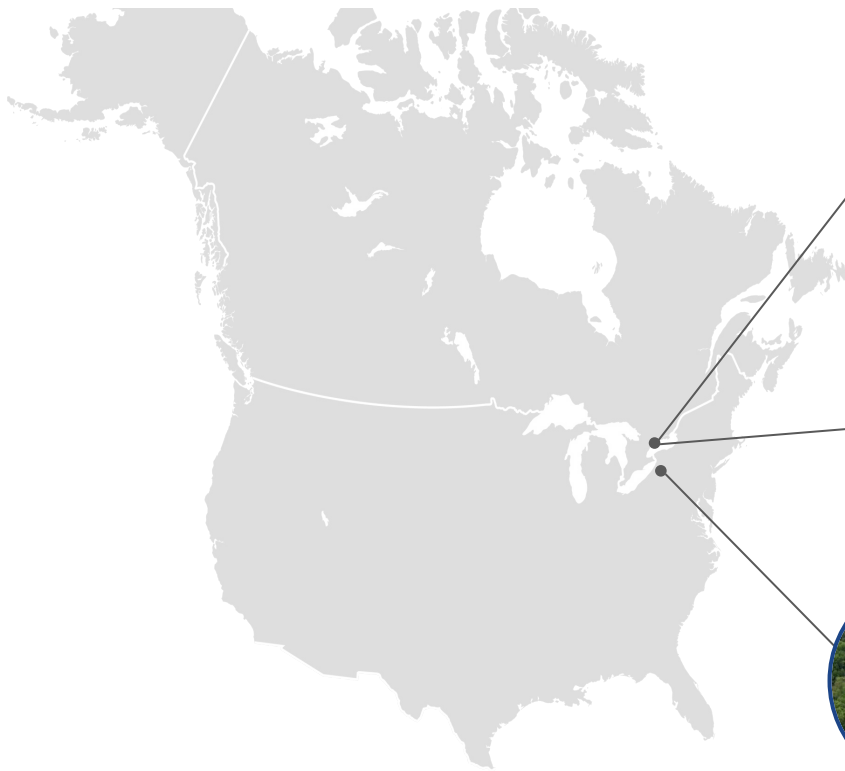
High Voltage battery systems



Material handling battery systems



# About Electrovaya: Our locations



- ❖ Canadian Headquarters: 63,000 Sq feet Facility in Mississauga, ON
- ❖ Module & Pack assembly & engineering development



- ❖ Electrovaya Labs: 25,000 Sq feet facility in Mississauga, ON
- ❖ Cell technology development & scale up



- ❖ US Headquarters: 130,000 sq feet and 52 acres facility in Jamestown, NY
- ❖ Cell, module & pack assembly
- ❖ Planned overall capacity >1 GWh/yr
- ❖ Powered by low cost hydro energy (~\$0.05/kWh)

# Expansion: Jamestown Gigafactory Update



The Gigafactory Plant in Jamestown, NY will allow Electrovaya to onshore manufacturing and streamline supply chains to support increased battery demands

**130,000 sqft**

Industrial Facility

**100%**

Renewable Energy

**\$0.05/kWh**

Energy Cost

**< 3 hours**

Travel to HQ and Key Customer Bases

## Update

**2022**

- \* Site Acquired in Jamestown, NY state
- \* Term sheet received from a NY State consortium lenders covering 80% of stage 1 costs

**2023**

- \* Hiring drive started
- \* LV pack assembly will go live in Jamestown in Q4-2023

**2024**

- \* HV/LV module and HV pack assembly will go live in Jamestown in Q3-2024

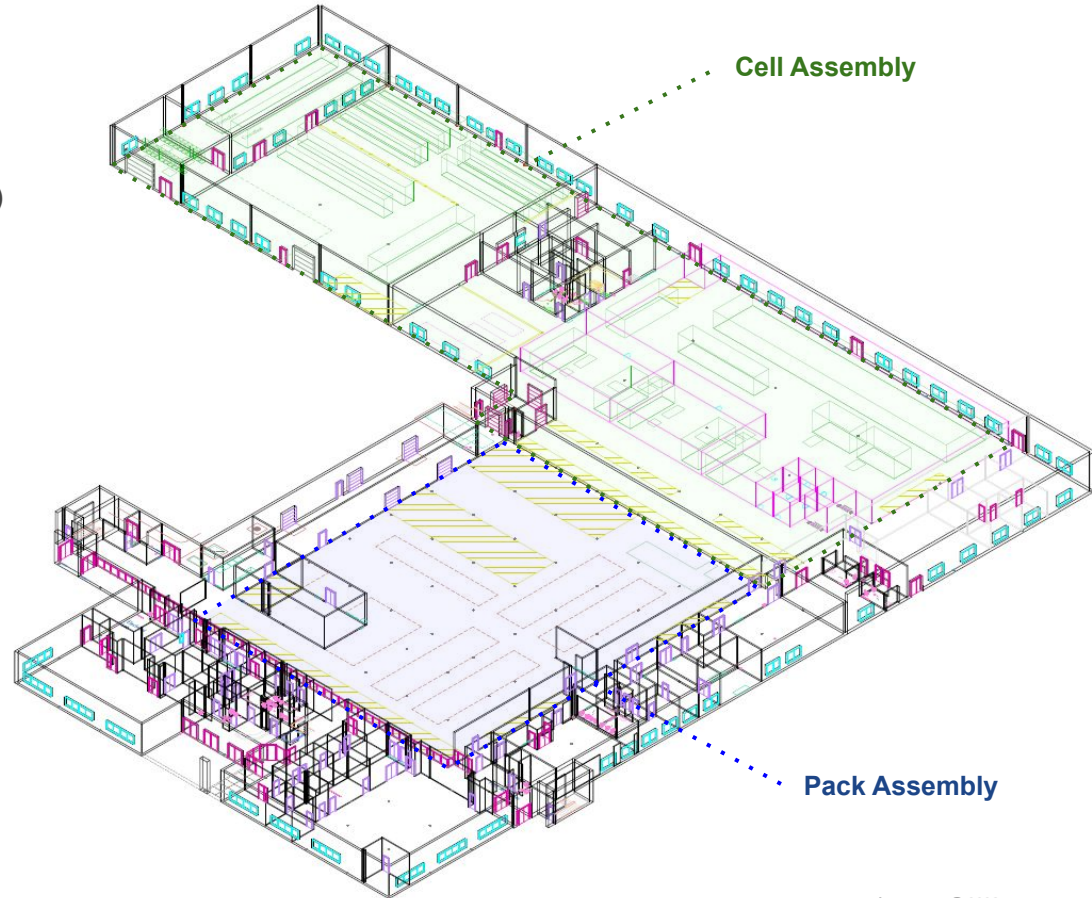
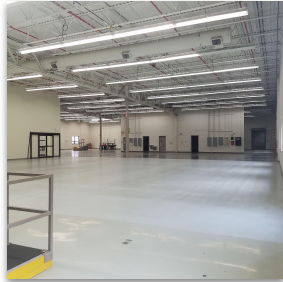
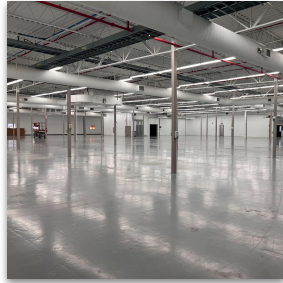
**2025**

- \* Cell assembly will go live in Q1-2025



# Jamestown Gigafactory: Planned Layout Phase-1

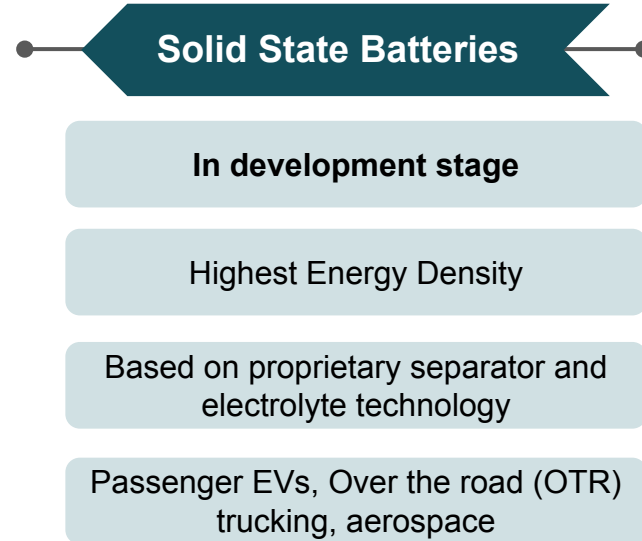
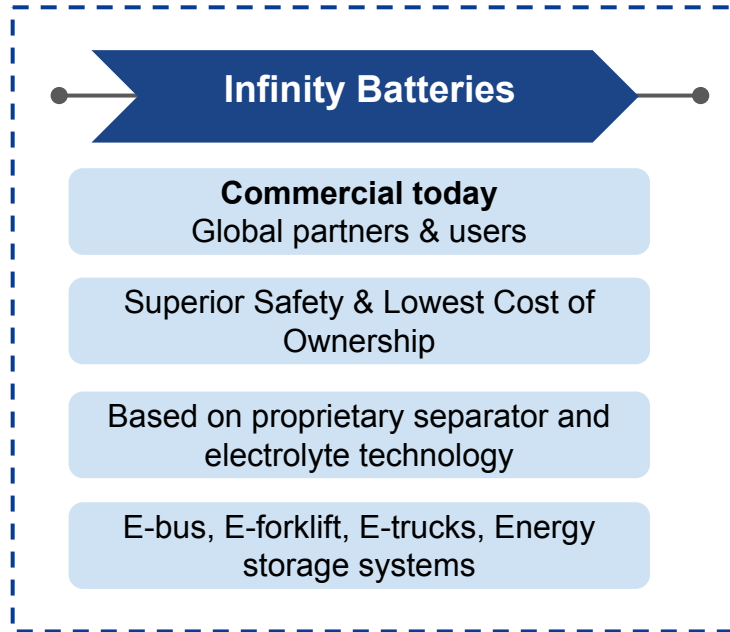
- ❖ US Manufacturing Hub: 130,000 sq feet and 52 acres facility in Jamestown, NY
- ❖ Cell, module, and pack assembly
- ❖ Phase-1 planned capacity of 300 MWh/yr
- ❖ Powered by low cost hydro energy (~\$0.05/kWh)








# Technology Solutions

Electrovaya complementary technologies targeting the various EV applications.  
Infinity batteries provides industry leading longevity and SSBs provides industry leading energy density



# Market Opportunity Summary: Infinity Platform

APPLICATION	USAGE	MARKET SIZE
 E-Buses E-Delivery Trucks	12-20 hrs/day	~ \$9.6 Billion Addressable Market*
 E-Forklifts/ Warehousing	20-24 hrs/day	~ \$4.5 Billion Addressable Market*
 Stationary energy storage	12-20 hrs/day	~ \$4.2 Billion Addressable Market*

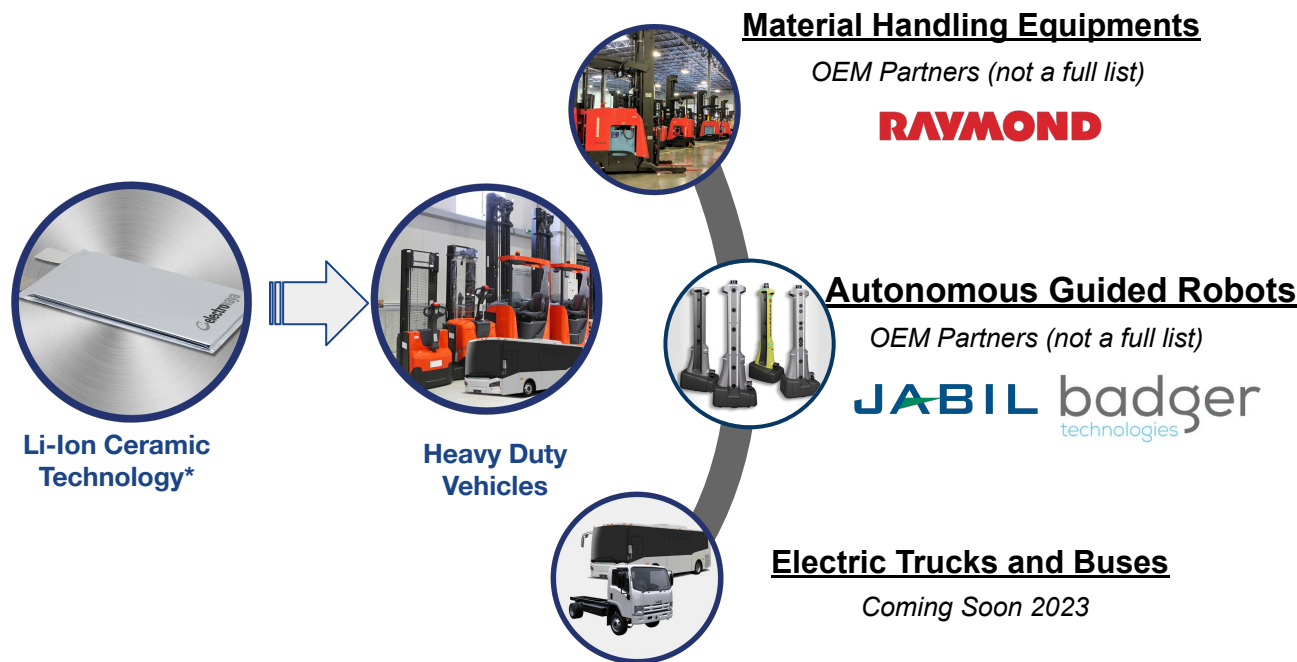


**Battery Requirements:** Efficiency, Lifetime, Safety & Cost of Ownership

\*Data Numbers Obtained Through MarketWatch

# Infinity Batteries: Proven technology

Lithium-ion ceramic cells with highest cycle life and safety setting the industry standards.



**High Cycle Life**  
Lowest Cost of Ownership

**Safety**  
Zero Fire Incidents

**High Reliability**  
Performance in 24/7 applications

\*An earlier iteration of our lithium-ion ceramic technology has also been used in ~20,000 Daimler Smart cars (no active cooling).

\*There have been no known battery safety incidents in these vehicle or the 5000+ Material Handling/AGV battery systems



# Infinity Batteries: Commercial Ecosystem

**OEM Customers**  
(not a complete list)



RAYMOND

JABIL

## End Users Examples (not a complete list)

Retail & eCommerce

FORTUNE **100** \*Confidential User



Walmart

THE HOME DEPOT

Ashley HOMESTORE

LOWE'S

Food distribution



MARS incorporated

Unilever

MAPLE LEAF

Mondelez International

Manufacturing



P&G

PVH

PHILLIPS-VAN HEUSEN CORPORATION

Logistics



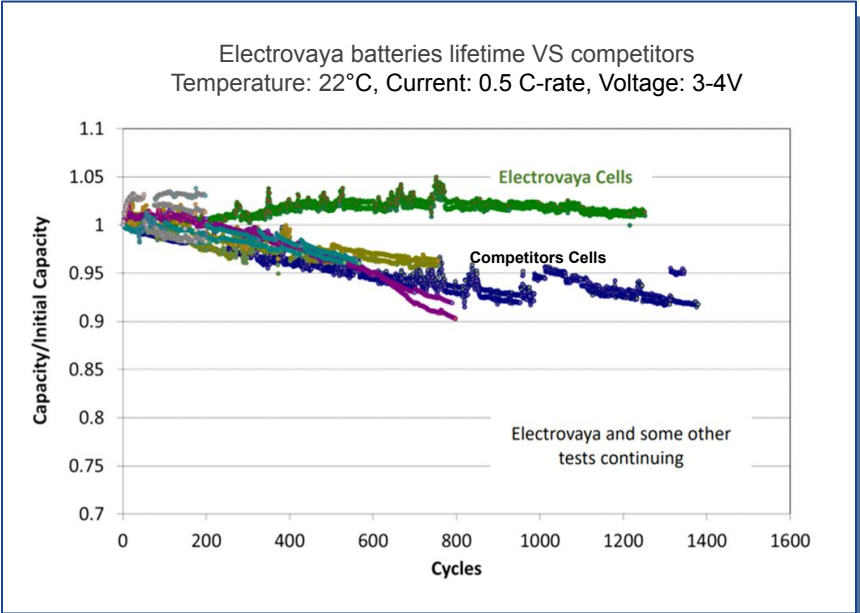
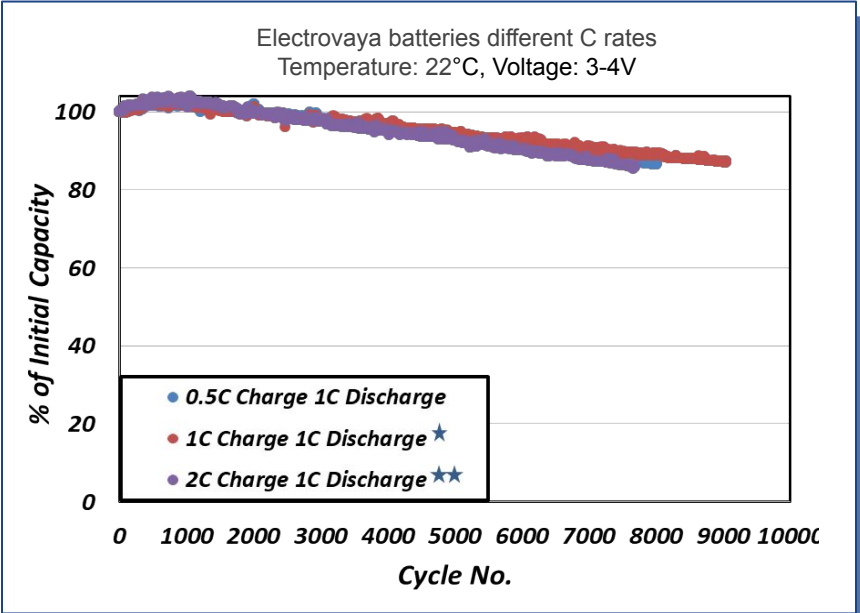
CEVA LOGISTICS

interstate warehousing  
a Tippmann Group Company

# Multi-Million-Mile Batteries- In a Class of Its Own (1/2)

Electrovaya Patented Technology provides the longest Cycle life in Industry: Electrovaya batteries can operate for ~14,000 cycles equivalent to >25 years with 1 cycle/day

### Third party testing



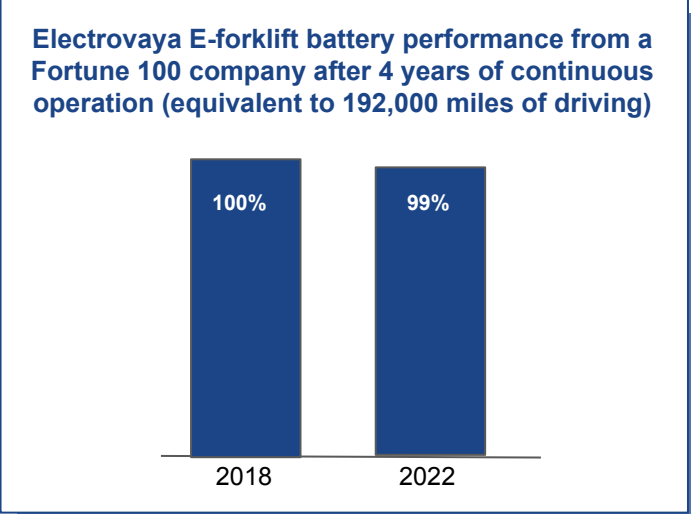
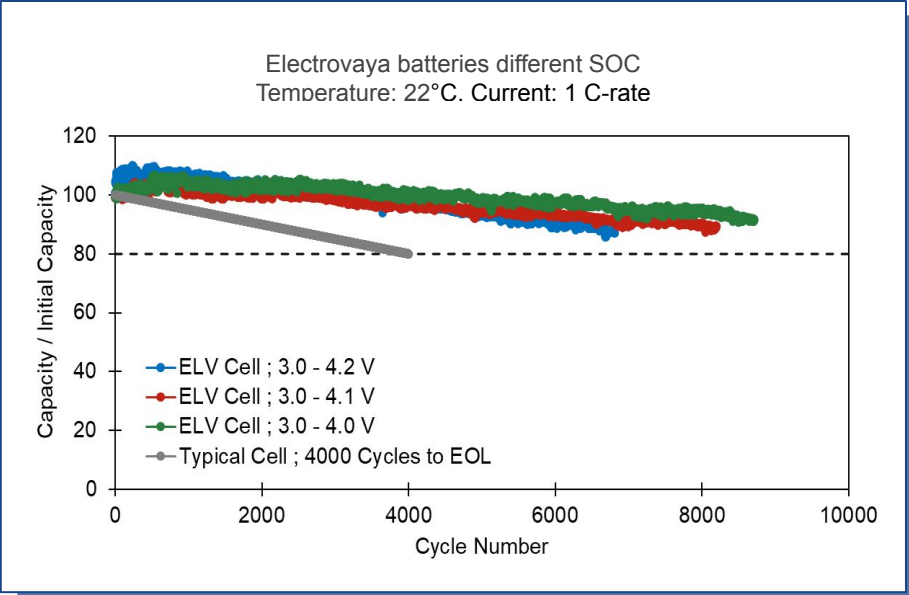
★ Charge rate changed from 0.5C to 1C after 3025 cycles  
★★ Charge rate changed from 1C to 2C after 1762 cycles



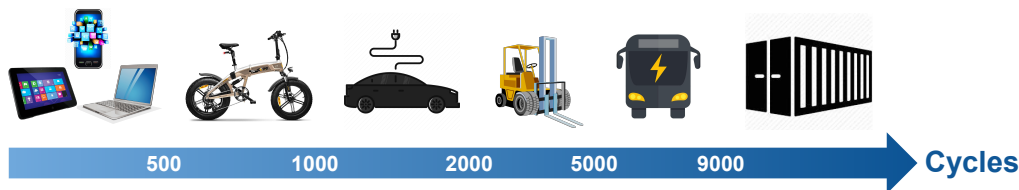
# Multi-Million-Mile Batteries- In a Class of Its Own (2/2)

Electrovaya Patented Technology provides the longest Cycle life in Industry: Electrovaya batteries can operate for ~14,000 cycles equivalent to >25 years with 1 cycle/day

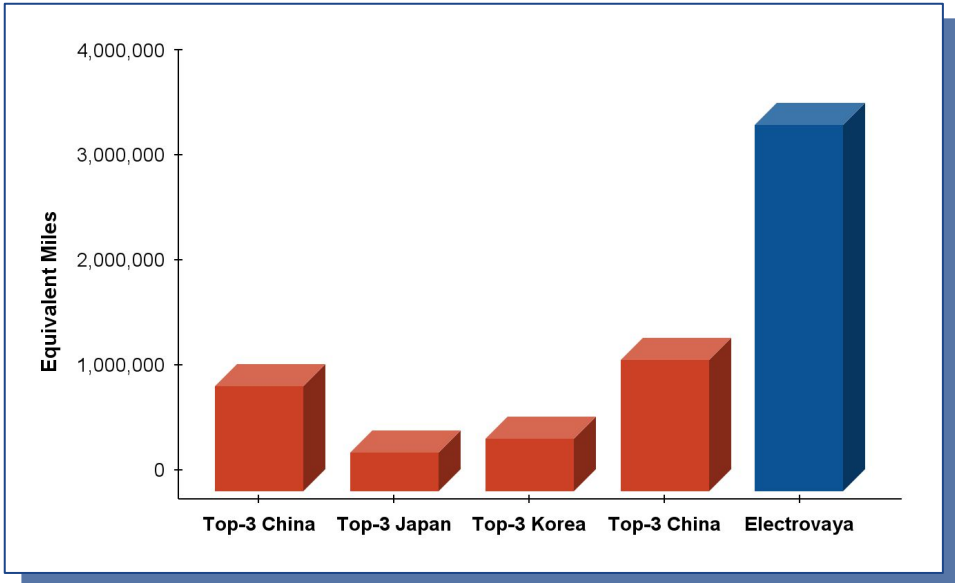
### Internal testing



# Multi-Million-Mile Batteries



*\*Cycle equivalent:  
14,000 cycles is equivalent to 3,500,000 miles for 250-mile range car with 1 charging cycle per day*

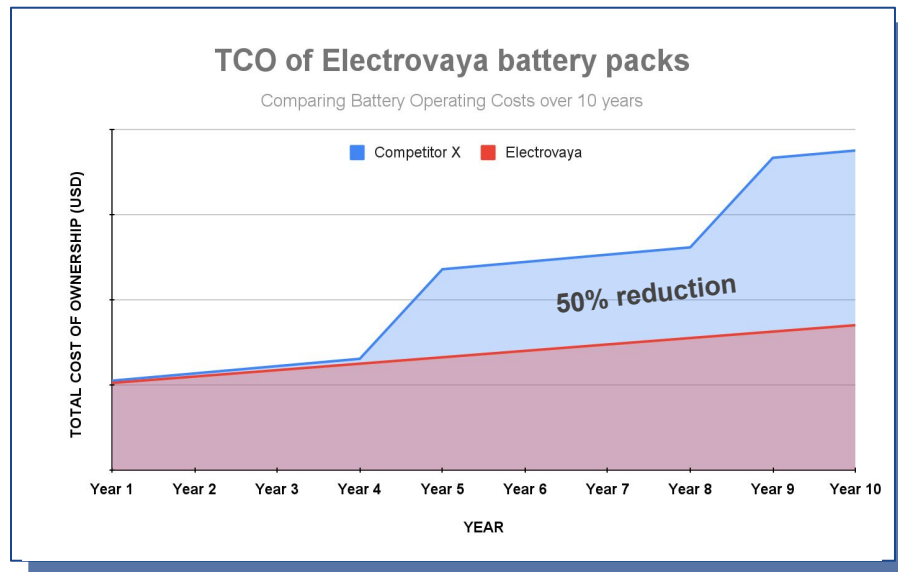


# Lowest Cost of Ownership

Electrovaya's batteries have best cycle life in the industry, providing the lowest total cost of ownership when compared to other lithium ion batteries, fuel cells and lead acid batteries.



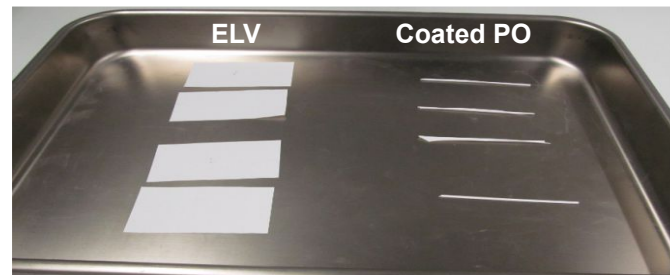
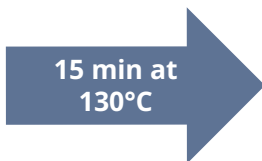
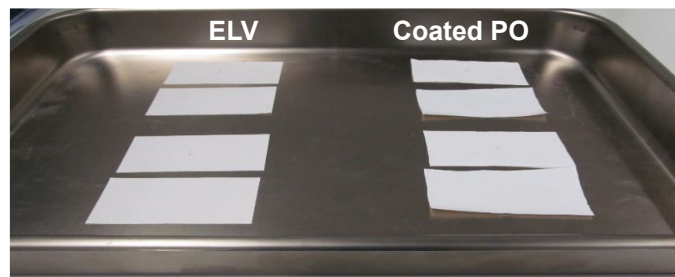
Heavy Duty Vehicles (HDV) Operate at ~2 cycles per day  
→ Battery replacement needed every 6 years



# Superior Safety

Multi-level cell and system safety technology with end result being a non-propagating battery design

## Electrovaya Ceramic vs Coated PO Separator



## Third Party fire propagation test

An Electrovaya 24V battery AFTER fire propagation testing for UL

- ❖ Individual cell in fully charged battery pack was forcibly heated to +200°C
- ❖ No internal propagation, the fire was contained within the faulted sub-module
- ❖ No flames escaped the battery enclosure

*Test conducted by UL in early 2020, UL comment about the fire propagation test results: "best results seen in lithium ion battery regardless of the chemistry"*



# BMS Technology

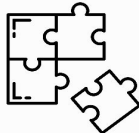
5th generation advanced battery management system developed in house (hardware & Software)

*Robust design that withstood years of difficult applications with no failures or safety incidents*



## Advanced architecture

- ❖ Isolated high speed monitoring of individual cells (voltage & temp.)
- ❖ Communicates: allowable power limits, available energy, passive balancing & SOC



## Modular Hardware Design

- ❖ New HW design reducing possible points of failure
- ❖ Easy implementation of different battery voltage requirements



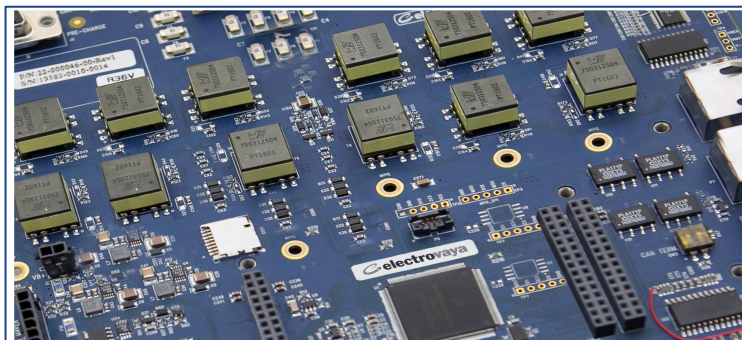
## Improved safety controls

- ❖ Multiple Redundant safety control mechanism including:
  - Positive & negative contactors
  - global safety fuse



## Connection & Communication

- ❖ Dual port battery connection to the Charger and the EV
- ❖ WIFI and CAN bus capability with advanced battery analytic monitoring (EVISION)



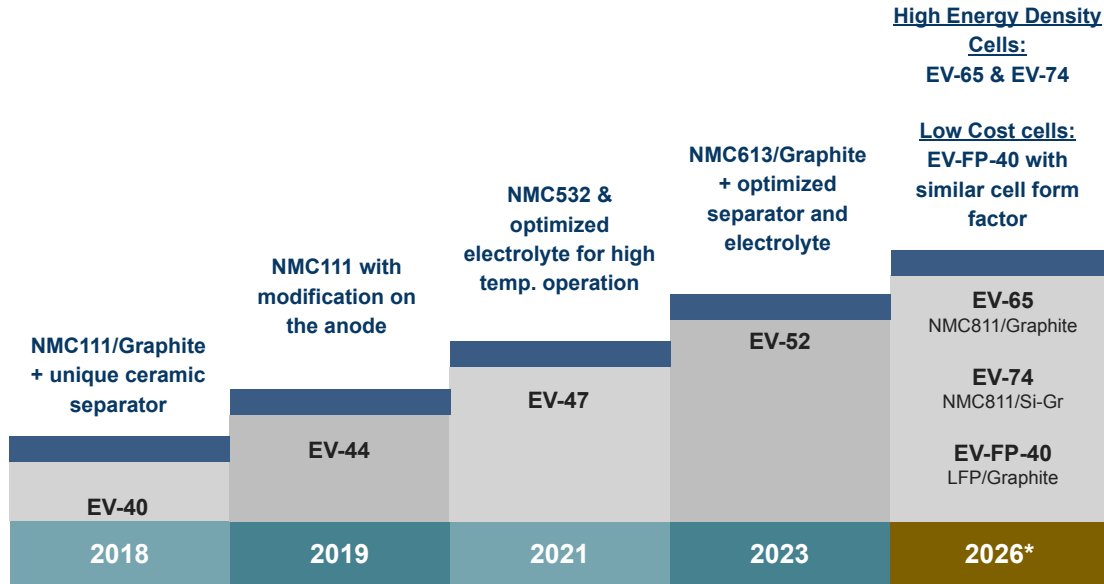
UL1991 and UL1998 Recognition



# EV-infinity cell series: Road Map



Over 7 years of R&D, EV infinity series cells witnessed ~30% increase in capacity from 40Ah to 52Ah without compromising the superior safety and longevity of the current generation cell.



High Energy Density Cells:  
EV-65 & EV-74

Low Cost cells:  
EV-FP-40 with similar cell form factor

\*Targeted Launch

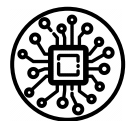
# Summary: Infinity Batteries



EV-infinity series cells with higher energy density (52Ah) received UL2580 & UN38.3 certifications (*highest safety standard*)



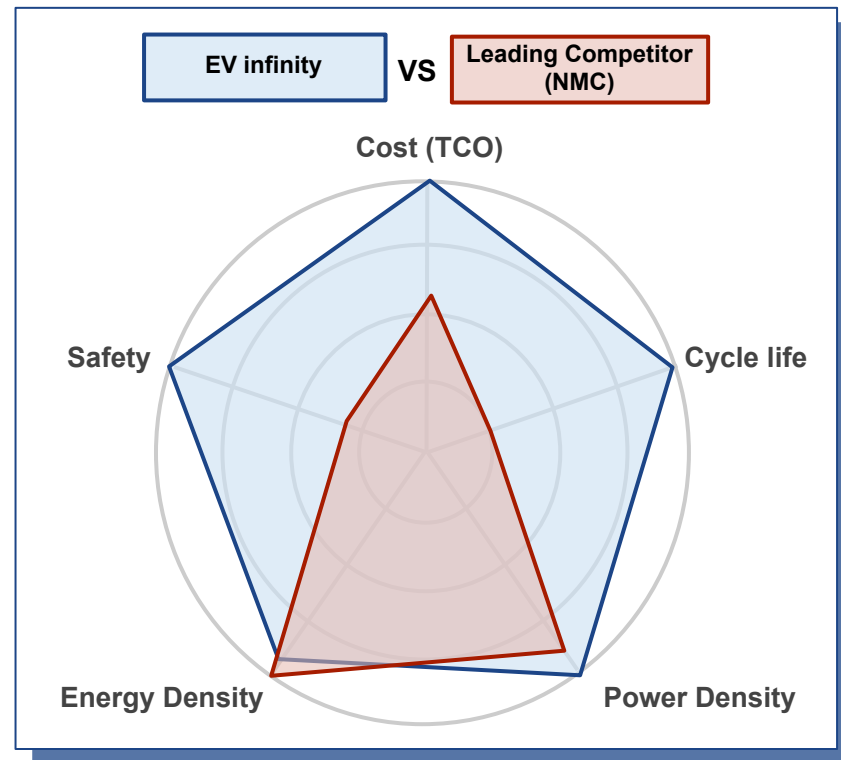
Infinity cells demonstrated Industry-Leading Cycle Life at Third Party Test Lab  
(*Batteries completed more than 9,000 charge/discharge cycles with ~87% capacity retention*)



GEN-V BMS system with advanced HW/SW design and improved safety control mechanisms



Commissioning of advanced automated assembly line at the canadian HQ to accelerate new products development for infinity platform

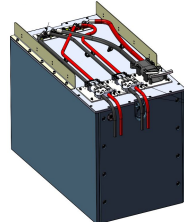


# Product landscape: Infinity Batteries

24V, 36V, 48V Forklifts (~40 Battery Models)



Gen 2 Forklift Batteries



AGV



AGVs



Walkie Pallet Jacks

E-bus



E-trucks



Stationary ESS

Hybrid Fuel Cells

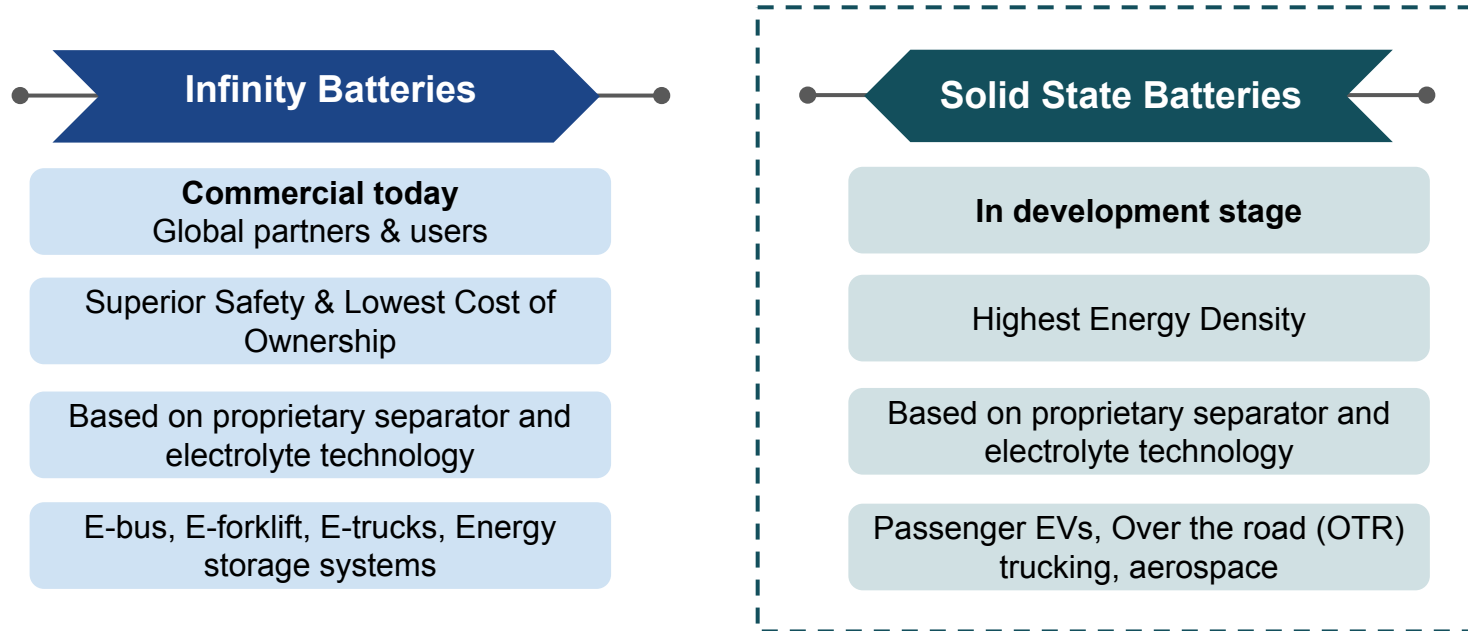


2023

2024

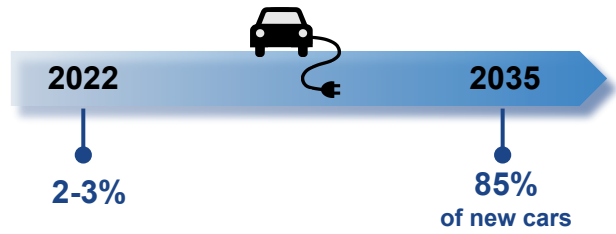
# Technology Solutions

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Infinity batteries provides industry leading longevity and SSBs provides industry leading energy density



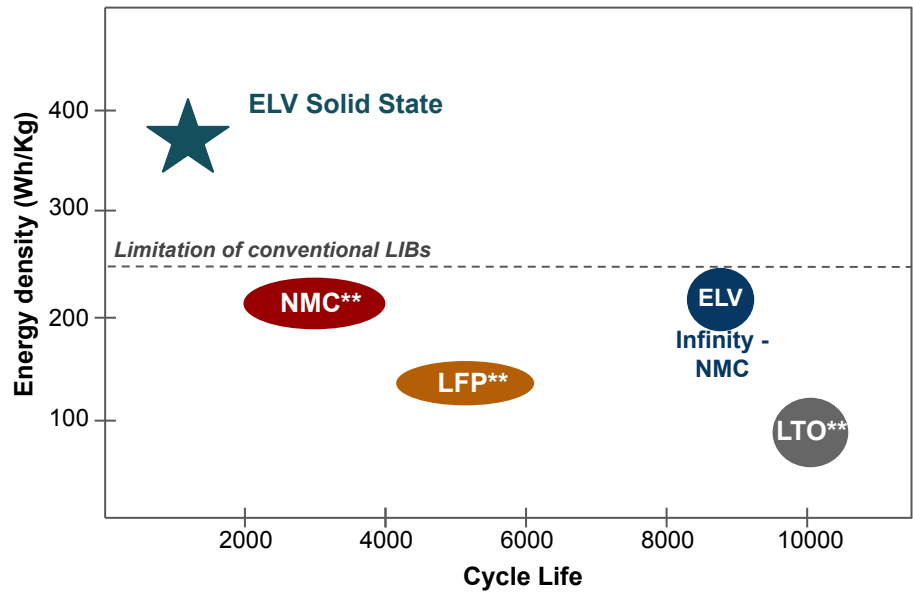
# Next Gen-Solid State batteries

## EV penetration in the global vehicle market



### Battery Requirements for E-cars adoption

- Energy Density > 350 Wh/Kg (>750 Wh/L)
- >10 years lifetime
- Superior Safety
- Cost < 100 \$/Kwh for cells



\*\* Competitor data sheets/estimates



# Solid-State Batteries: Value proposition



## Energy dense electrodes

Enables the use of Lithium metal anodes with 10x higher specific capacity than conventional graphite  
⇒ 20%-40% increased energy density



## Solid Electrolyte

High decomposition voltage (larger operating voltage window)  
Use of liquid electrolytes minimized or eliminated



## Low Cycle Life

Formation of lithium dendrites during repeated charge/discharge  
Poor electrode-electrolyte interfacial contact

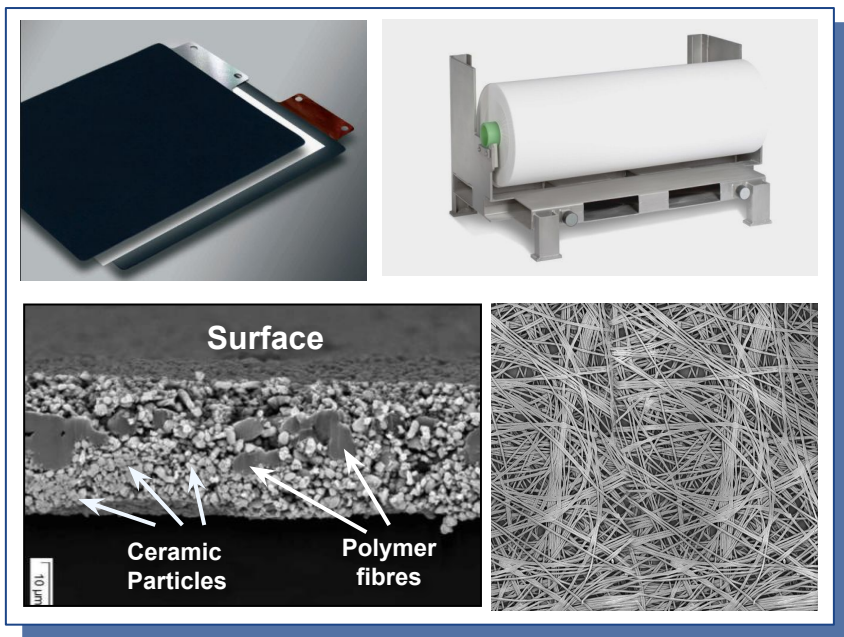


## Complex Scaled Manufacturing

Production of high-quality lithium metal batteries at scale remains unachieved in the global battery market

# Ceramic separators: Unparalleled Experience

The transition to Lithium Metal based batteries is almost certainly going to require the use of ionic conducting ceramic based electrolyte materials



## Electrovaya Strength



Patented unique ceramic separator offers unparalleled safety. (36 patents)



Substantial experience and know-how in the manufacturing of ceramic separators.



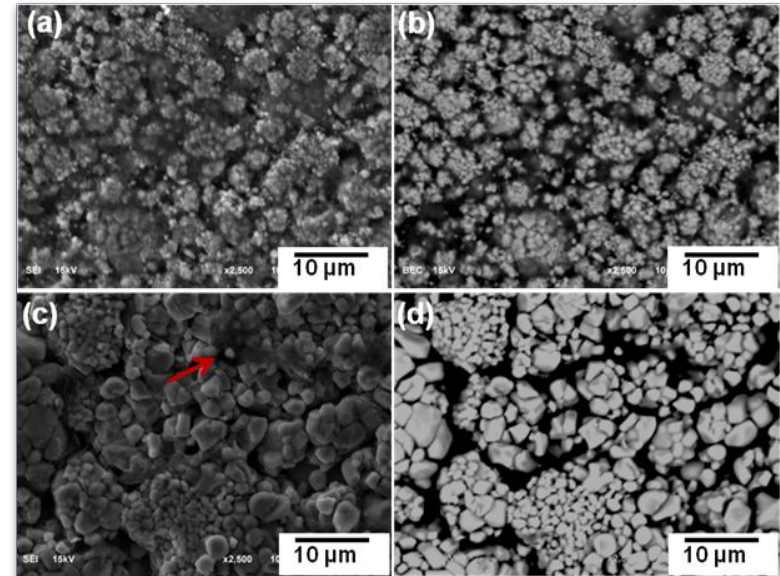
The only company who has commercialized the use of ceramic separator for LIB (Z-fold assembly)

# Solid-State Batteries: Proprietary coating technology

## Non-Toxic electrode coating process with lower Capex and Opex

Patent #: US20190267616A1

- ❖ Conventional electrode processes use toxic NMP solvents.
- ❖ Electrovaya disruptive technology uses solvent-free coating that allows thicker cathode coating at lower cost.
- ❖ Responsible manufacturing embraces the sustainability goals of our clients while saving on the operation and capital costs.
- ❖ Combined with separator/electrolyte technology to provide the world's leading and most manufacturable solid state battery technology.

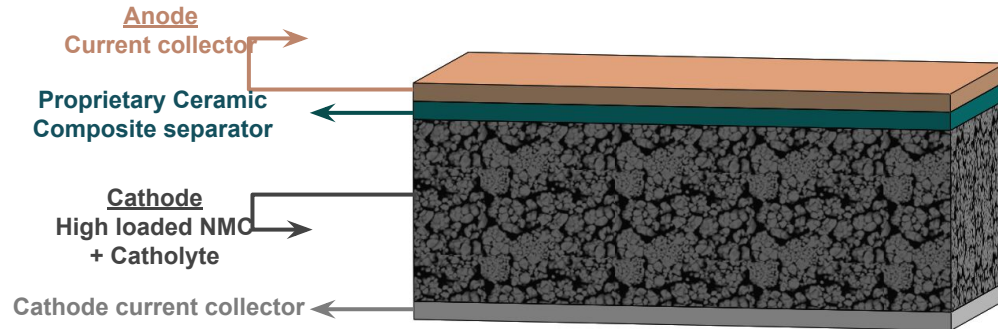


# Solid-State Batteries: Electrovaya's Approach

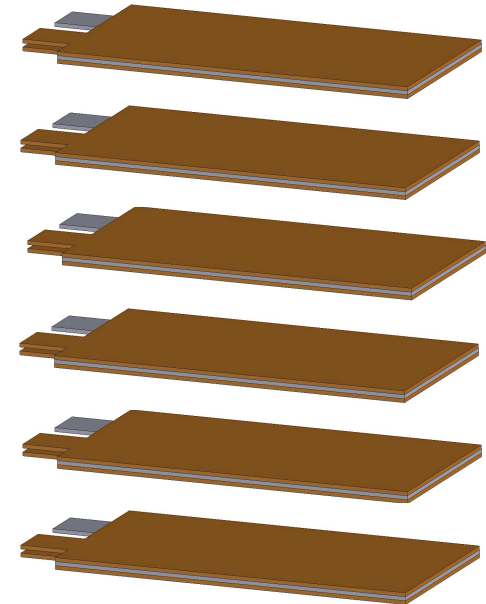
Solid State battery platform with versatile proprietary technology

*Four Solid State Battery Related Patents Filed*

Single layer Pouch stack



Multi-layer Pouch stack



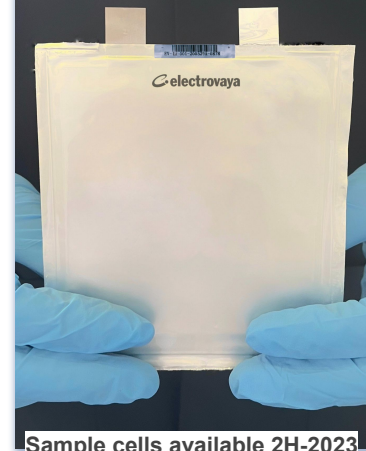
# Solid-State Batteries: Update

Proprietary Synthesized  
Ceramic powder



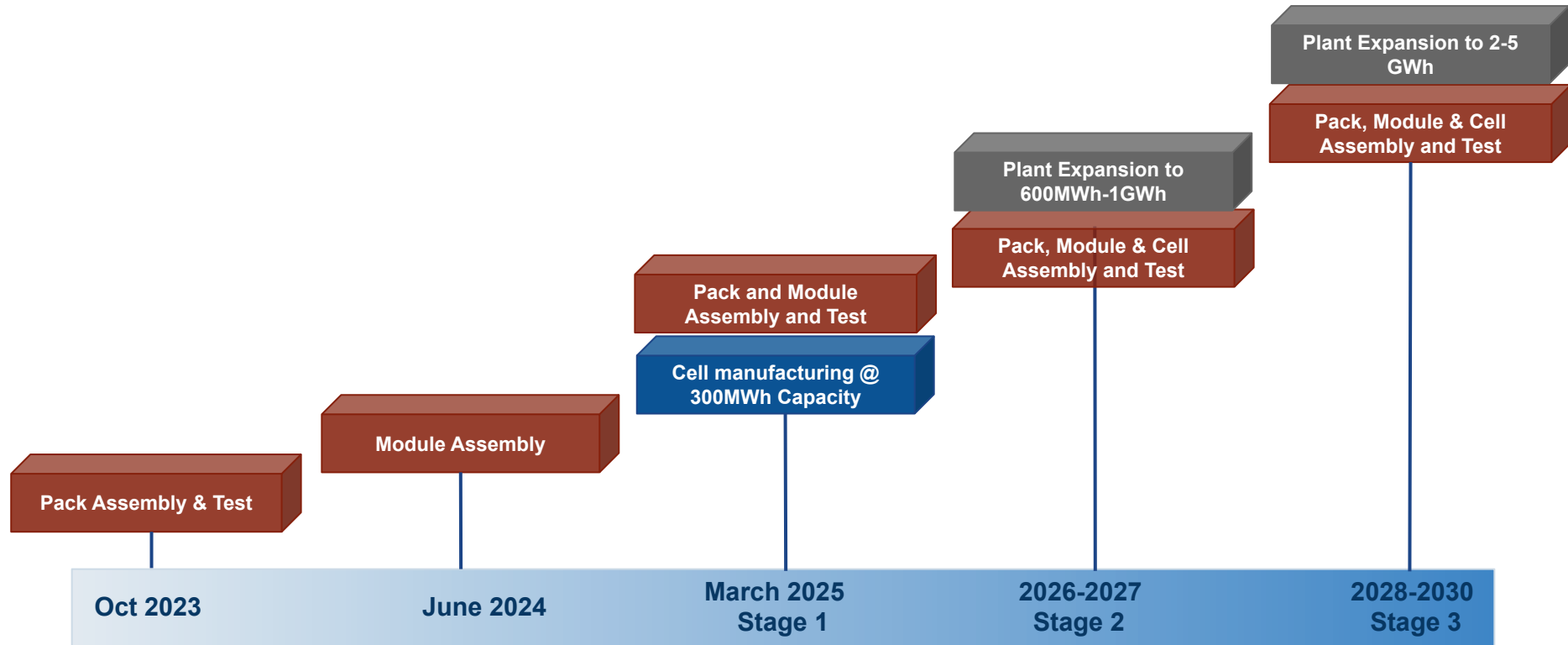
- ❖ In-house production of critical ion conducting ceramic materials using cost-effective and scalable processes
- ❖ Manufacturable approach for the preparation of ceramic composite separator
- ❖ Single layers and multilayers anode-free pouches has been made using the prepared composite ceramic separator and NMP-free thick cathodes
- ❖ Testing in process, target volumetric energy density 1000-1500 Wh/l (~2X Li-Ion Technology today)

Solid State Pouch cell



Sample cells available 2H-2023

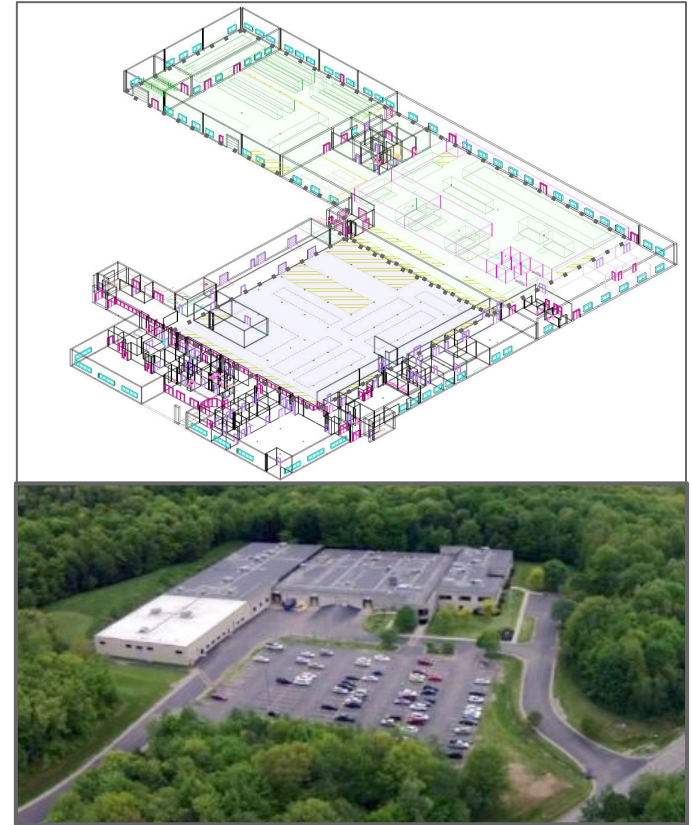
# Jamestown Gigafactory Roadmap (1/2)





# Jamestown Gigafactory Roadmap (2/2)

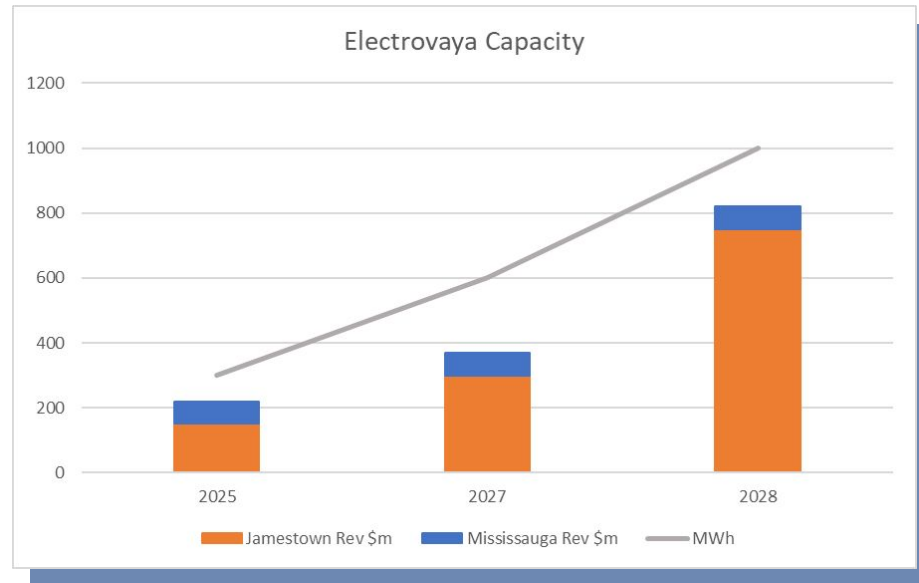
- ❖ **Initial operations** in Jamestown will mirror what is done in Mississauga
- ❖ Pack and Module assembly to **increase overall capacity**
- ❖ **Cell assembly** expected to go live in calendar **Q1 2025**
- ❖ **IRA** expected to provide \$10 per KWh for modules and \$35 per KWh for cells.
- ❖ If we operate at 100% capacity that would translate to **~\$13.5m in cash rebates**
- ❖ Reshoring of cell production expected to **increase gross margins** by 3-5%
- ❖ Increased capacity allows us to consider **alternate revenue streams** such as growing our rental fleet, E-Buses and Trucks, and EaaS offerings (where we are engaging in a feasibility study with Jupiter Power)
- ❖ Our goal is to remain flexible and **scale as demand increases**.



# Infinity Battery Scaleup Potential

As production capacity increases so does potential revenue supplementing max capacity from Mississauga of ~100MWh or ~\$70m

- ❖ Stage 1 - (Existing Site) 300MWh - ~\$150m-200m
- ❖ Stage 2 - 600MWh - 1GWh - ~\$450m-\$750m
- ❖ Stage 3 - 2-5GWh - >\$1bn



# Material Handling Adoption- Case Study

Expected Lithium Ion Battery adoption rates from market data

2023	5-10%
2024	12-15%
2025	~20%
2026	~30%
2027	~50%

Market opportunity for Electrovaya using one OEM production if their volume does not change

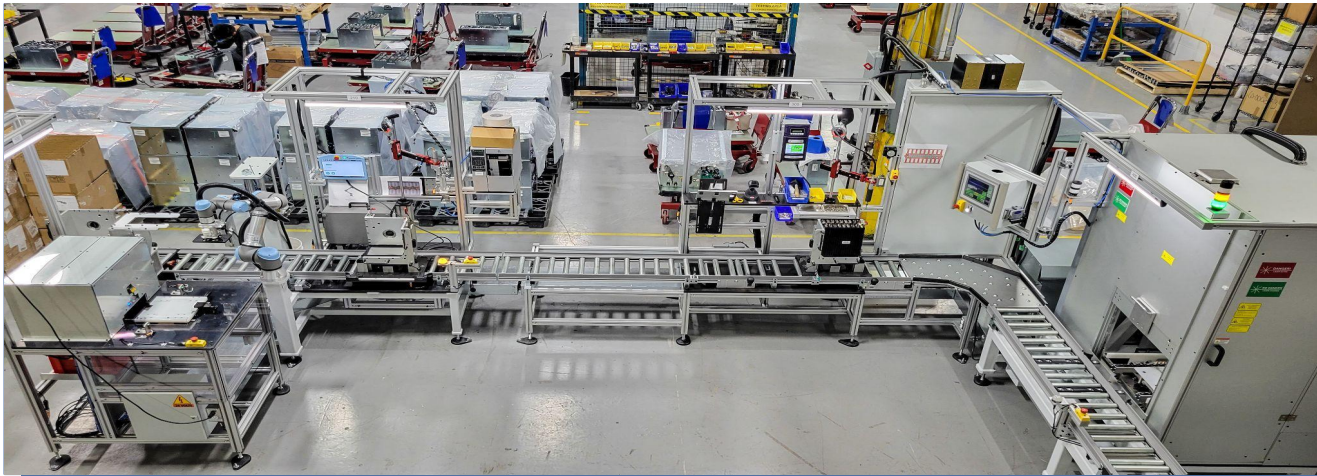
3,000 units	~\$50m
4,200 units	~\$70m
7,600 units	~\$130m
12,000 units	~\$200m
15,000 units	~\$250m

## Reasons for increasing adoption:

- ❖ Restrictions on gas powered industrial trucks
- ❖ Stricter emissions standards
- ❖ Greater understanding of safety and performance advantages
- ❖ Lower Life Cycle Costs compared to competing technologies

# High Voltage Offerings: EBus, ETruck & Energy Storage

- ❖ E-Buses - Currently only a ~15% adoption rate
- ❖ Manufacturers expect that to move to ~50% by 2025 with the incentives on offer both in Canada and the US.
- ❖ For a manufacturer producing 1,000 buses per year, the 500 e-buss produced would represent ~\$100m/annum in revenue for the battery supplier
- ❖ Currently in discussions with E-bus OEMs



Recently installed automated High Voltage assembly line at Electrovaya's Mississauga HQ

# Electrovaya Summary



## Pure Play Battery Tech/Manufacturing

Electrovaya is a Pure Play North American Lithium ion Battery Technology and Manufacturing company on track for Rapid Growth



## Leading Partners

Electrovaya has strong OEM relationships with some of the leading industrial vehicle manufacturers and numerous Fortune 100 and Blue Chip customers.



## Premium Performance

Infinity Technology Products offer significant competitive advantages which allow Electrovaya to sell products at higher gross margins than competitors



## Next Gen Technology

Electrovaya Solid State Battery Technology developments will be a game-changing technology



## North American Footprint

Plans to Reshore Production into the USA improves capacity, security and gross margins



## Growth and Route Profitability

70% increase in revenue from FY21, 115% increase forecast for FY23. EBITDA and Cash Flow positive for FY23 and beyond





**Investor & Media queries, please contact:**

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Email: [jroy@electrovaya.com](mailto:jroy@electrovaya.com) Web: [www.electrovaya.com](http://www.electrovaya.com)



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