



# coulomb

TECHNOLOGY

**“Unlock electrification through breakthrough chemistry”**

Tim Vosburgh – Founder & CEO – September 2024

# Why Now?

Energy demand expected to double by 2050\*

Per DOE lithium demand will outstrip supply by 2030\*\*

Renewable energy supply is intermittent and requires more storage

New tariffs on imported batteries drive domestic demand

Energy demand is cyclical and requires storage to reduce costs

Current battery technologies are not up to the challenge

\*Energy Live News - 2024

\*\*Per Imre Guyk – Chief Scientist, Energy Storage Research, U.S. Dept. of Energy

# CURRENT BATTERY MARKET IS RIPE FOR DISRUPTION

Lead acid and Lithium have significant issues and the addressable markets are large



## Lead Acid



## Lithium Iron Phosphate

\$45B	Market Size	\$55B
Back-up Power & Starting Motors	Uses	E-Mobility & Grid Storage
<ul style="list-style-type: none"> <li>▶ Low Cycle Life</li> <li>▶ Very Low Energy Density</li> <li>▶ Uses toxic lead</li> </ul>	Issues	<ul style="list-style-type: none"> <li>▶ High Cost</li> <li>▶ Earth-Scarce Materials / Environmental Impact</li> <li>▶ Poor economics &gt;4 hours of storage</li> <li>▶ Safety / Fire Risk</li> </ul>

**Last year in New York  
alone there were 175  
lithium e-bike fires  
killing 14 people and  
injuring 96 others.**



\*New York Times - 2023

## OUR BREAKTHROUGH TECHNOLOGY – PATENT-PENDING

Rechargeable Zinc-Ion Batteries have huge benefits but not yet commercially realized

### Common Roadblocks

Zinc dendrites cause short circuit risk and reduce life

Corrosion

Instability of cathode materials

Hydrogen gas generation



### Key Benefits

No fire / thermal runaway Issues

Fills the 4 to 20 hour storage gap

50% lower cost than US made lithium batteries

Uses earth-abundant materials

-20C to 60C operating temperature

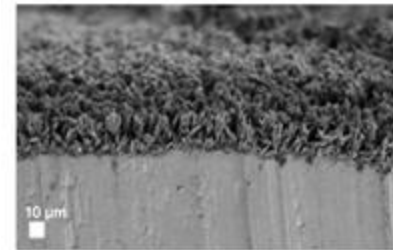
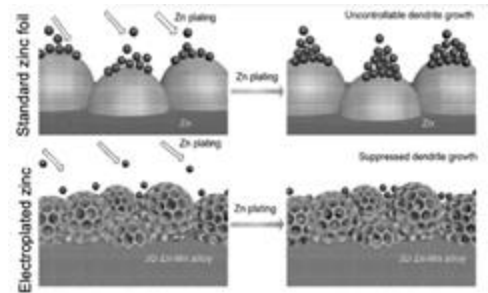
# COULOMB TECHNOLOGY REMOVED THE ROADBLOCKS

Aqueous Zinc-Ion Batteries that meet or beat current technologies are now possible

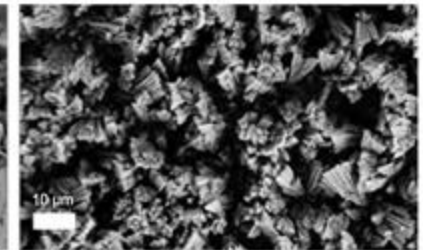
## Patent-Pending Technology

- ▶ Electroplated 3D anode solves dendrites & corrosion issues which increases battery life.
- ▶ Acidic operation which increases energy density.
- ▶ Specific cathode and electrolyte additives increases energy density & cycle life.

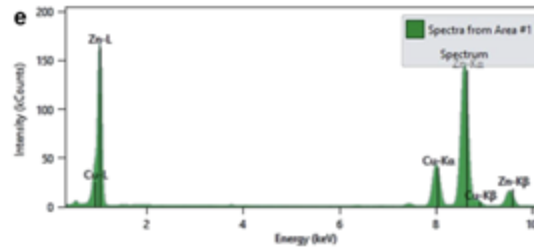
### Morphology of anode inhibits dendrites & corrosion



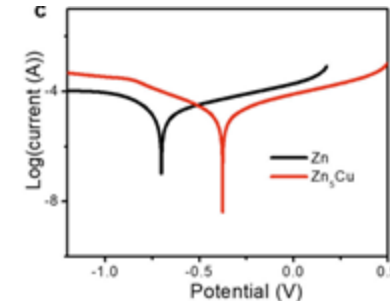
SEM of a cross-section of electroplated Zn-Cu anode



SEM of the surface of electroplated Zn-Cu anode




Successful formation of the zinc-copper alloy layer was confirmed through EDS




A shift to the right to more positive corrosion potentials of Zn-Cu compared to Zn reflects less corrosive tendencies of Zn<sub>5</sub>Cu

# COMPETITION: Patent-pending solution solves problems that others can't

Type	Energy Density	Safe?	Earth-Abundant?	Cycle Life	RTE	Self-Discharge	Cell Cost
<b>LFP</b> – CATL, BYD, etc	180 Wh/kg	No	No	3k+	90%+	0.07%/day	\$55/kWh*
<b>Na-Ion</b> – Natron, CATL, Faradion, etc	70 to 140Wh/kg	No	Yes	3k+	88%+	0.07%/day	>\$80/kWh
<b>Ni-Zn</b> – Zinc5, ZAF	60 Wh/kg	Yes	Yes	800	80%	0.1%/day	>\$150/kWh
<b>Zi-Mn</b> – UEP, Salient	100 Wh/kg	Yes	Yes	1k	86%	0.01%/day	\$100/kWh
<b>Zn-Br</b> - EOS	35 Wh/kg	No	Yes	5k+	80%	2%/day	\$160/kWh
<b>Zn-Air</b> – E-Zinc	50 Wh/kg	Yes	Yes	800	55%	0.07%/day	>\$100/kWh
<b>coulomb TECHNOLOGY</b>	140 Wh/kg	Yes	Yes	2k+	86%	0.01%/day	<\$50/kWh

 \*Batteries from China before tariffs

 Ni-Zn batteries are optimized for high-power and not energy density

# HUGE POTENTIAL WITH \$100B TAM / \$1B SOM

## Key Markets

### E-Mobility



Replace Lead-Acid in SLI (Starting, Lighting, and Ignition) - **\$45B**



Replace LFP in E-Bikes, Scooters, Golf Carts, Marine, etc - **\$12B**

### Energy Storage



Grid, Residential, Commercial, & Industrial - **\$43B**



## Key Drivers of Future Value



Different size batteries address multiple market segments



Profitability **~20%** EBITDA margins



Gov. aid to support ramp-up

- **\$35/kWh** Production subsidies
- **~70%** factory CapEx via low-cost gov. loan

Source:

- Lead acid - <https://straitresearch.com/report/lead-acid-battery-market#:~:text=Market%20Overview,USD%2048.3%20billion%20in%202022.>
- E-mobility - <https://www.mordorintelligence.com/industry-reports/e-bike-battery-pack-market/market-size>
- Stationary Storage- <https://www.insightaceanalytic.com/report/stationary-energy-storage-market/1668#:~:text=The%20Global%20Stationary%20Energy%20Storage,forecast%20period%20for%202024%2D2031.>



# STRATEGIC PARTNERS

## Our Development Partners



ORNL battery team with Ilias and Parans through the Innovation Crossroads program

\$400k of funding over 2 years, starting Aug 12, 2024

Approved to put **two Coulomb scientists** in ORNL Battery Lab starting ~ mid Sept, 2024.



Cradle to Commerce (C2C) program

\$50k of funding over 1 year, starting Sep 13, 2024



In conversations to partner as a CM



New Jersey Lab in collaboration with NEI corporation



\$40k use their SEM, XRD, etc to provide nanoscale images and material properties.



Modeling with Columbia University – Alan West’s group



Working with NREL to develop a good proposal for grant 40209



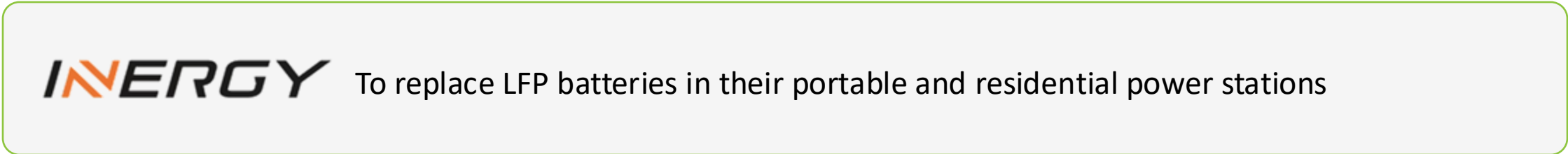
Co-Development partnerships in place

# PILOT CUSTOMERS

**Status** - These customers are waiting for samples to test which are expected early 2025.



**LOI's** – We have LOI's signed with this customer



**Go-to-market plan** – We will utilize a direct B2B sales model, channel partners, and eventually retail.

# BUSINESS MODEL

## Goal



To reduce our costs, reduce ownership of factories, material, etc.



To provide great customer service

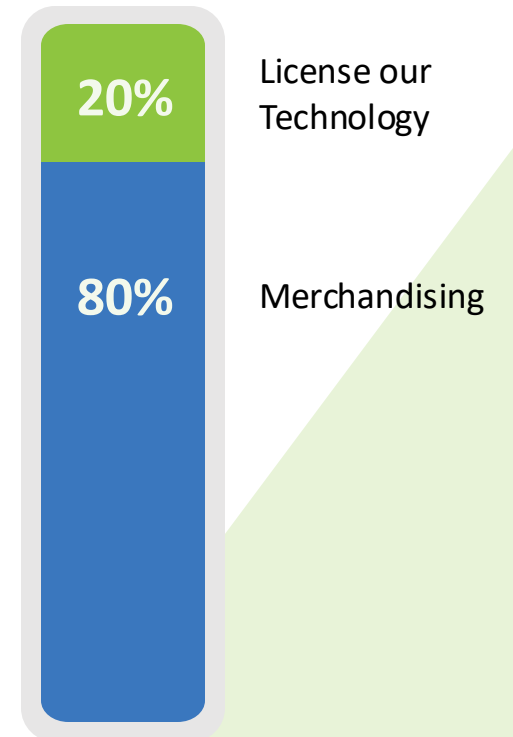


Own the customer for life

## How

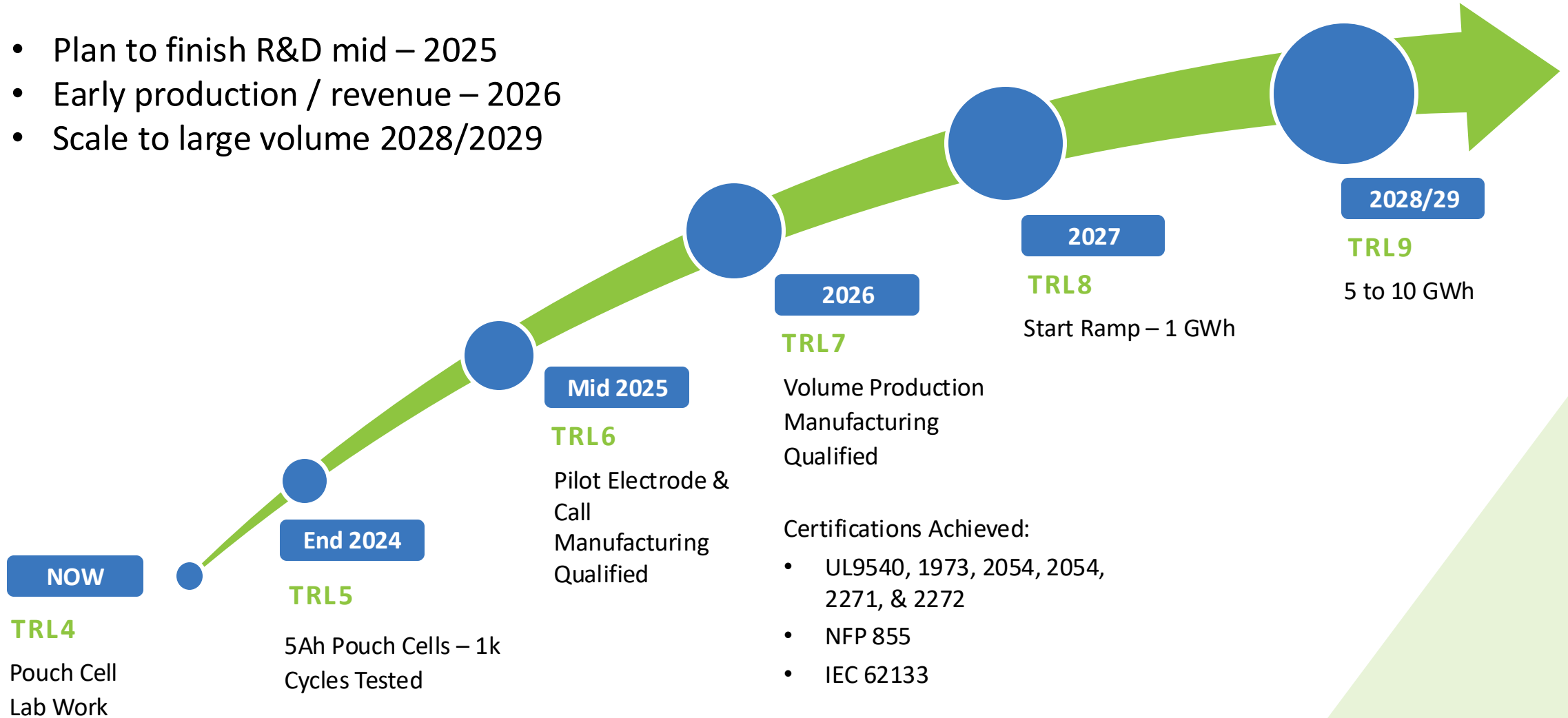
- ✓ Own no factories and use contract manufacturers.
- ✓ Work with supplier to retrofit existing lithium-ion and lead-acid factories to build our batteries.
- Offer drop-in replacements with no modification needed by customer
- ✓ Provide a subscription or rental model to solar installers, etc.
- Offer battery replacements and recycling as a service. Use a franchise model that is set up by region.

## Two Revenue Streams

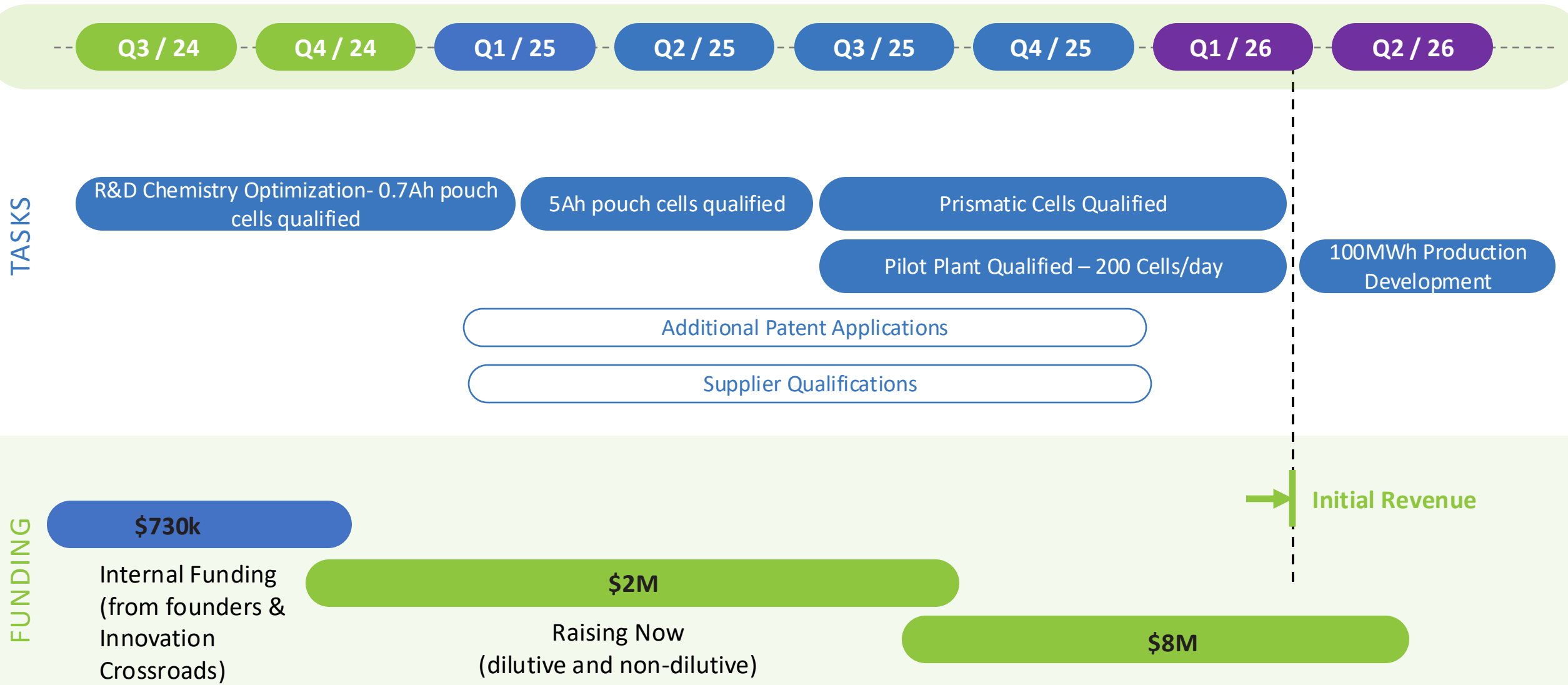


# RAMP PLAN

- Plan to finish R&D mid – 2025
- Early production / revenue – 2026
- Scale to large volume 2028/2029



# FUNDING MILESTONES



TASKS

FUNDING

## Our Lab Qualifies for New Jersey New Business Incentives (Available to any investor located anywhere world-wide)

### Angel Tax Credit Program –

Any investor eligible for **20% tax credit** up to **\$500k** per investor.

### Investment Insurance –

Guaranteed payment **up to 80%** of investment to **max \$400k** for 1 year

### Innovation Evergreen Fund –

**Match up to \$6.25M** if VC join program

### Net Operating Loss Offset –

Start-up can sell **10% of losses** per year

### SBIR Grant Match –

Up to **\$25k**

# LEADERSHIP TEAM

Combined 71 Years of Energy / Battery Experience



**Tim Vosburgh**

Founder & CEO - MBA

30 years exp - high volume contract mfg / semi equipment 2<sup>nd</sup> battery startup



**Matthew Kim**

PhD – Scientist

6 years of MnO<sub>2</sub> battery development experience



**Thanh Le**

Sr. Scientist

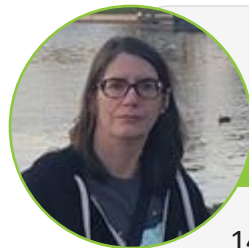
PhD Battery Chemistry and DFT modeling, acidic zinc-MnO<sub>2</sub> chemistry



**Xiaoran Yang**

PhD – Scientist

5 years of battery development experience.



**Stefanie Goldman**

PhD – Consulting Scientist

14+ years of zinc battery development experience. Successful zinc battery exit



**Amir Chamaani**

PhD – Scientist

7 years in battery development, including aqueous MnO<sub>2</sub>



# OUR LAB





## SUMMARY

# Aqueous Zinc-Ion Rechargeable Battery Technology

Enormous market (\$100B TAM, \$1B SOM) ripe for disruption.

Breakthrough,  
patent-pending technology.

Experienced & committed  
development team & development  
partners.

Balance sheet light business model.

Raising \$2M to finish R&D and start  
prismatic cell development.



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## TECHNOLOGY

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[Christine@coulombtechnology.com](mailto:Christine@coulombtechnology.com)

917-570-7024



In Process

In Process

# Backup

# KEY ADVISORS & 2 MORE TEAM MEMBERS



**Ilias Balharouak**

Corporate Fellow

Head of Electrification Section  
Distinguished scientists  
24 years science research



**Parans Paranthaman**

Corporate Fellow

Fellow National Academy of Inventors &  
Materials Research Society  
39 years science research



**Sanja Tepavcevik**

Chemistry Scientist

23 years science research  
Acidic zinc-MnO<sub>2</sub> patent



**Kevin Huang**

Professor Electrochemistry

19 years science research  
Acidic zinc-MnO<sub>2</sub> development



**Nathan Neisius**

Sr. Scientist

PhD Inorganic chemistry, recent  
grad, battery research



**Confidential**

Sr. Cell Engineer

45 years in aqueous zinc battery  
development.  
Successful zinc battery exit



# BUSINESS MODEL CANVAS – E-MOBILITY MARKET

<p><b>8. Key Partners</b></p> <ul style="list-style-type: none"> <li>• Grant and Investor partners so we can hire more scientists</li> <li>• low-cost lab partnerships to finish our development</li> <li>• pilot manufacturing partners to make our initial 20Ah cells</li> <li>• Close with early adopters. / teacher customer</li> </ul>	<p><b>7. Key Activities</b></p> <ul style="list-style-type: none"> <li>• Perform R&amp;D - Customer samples with 5Ah pouch cell at 150Wh/kg and 200 cycles</li> <li>• Perform customer evaluation</li> <li>• Developing manufacturing partnerships</li> </ul>	<p><b>2. Value Propositions</b></p> <ul style="list-style-type: none"> <li>• We are replacing lead-acid and LFP (lithium) batteries with safer, lower-cost (50% less), earth-abundant zinc-ion batteries</li> <li>• Our long-term goal is \$25/kWh where our zinc competitors are &gt;\$100/kWh now.</li> <li>• Drop in replacement</li> <li>• Be the battery provider for life</li> <li>• lower LCOS via less up-front costs, less thermal management equipment, and lower insurance costs.</li> </ul>	<p><b>4. Customer Relationships</b></p> <ul style="list-style-type: none"> <li>• Develop deep direct relationships with each targeted customer</li> <li>• Build trust and maintain excellent customer support</li> </ul>	<p><b>1. Customer Segments</b></p> <p><i>E-mobility customers</i></p> <ul style="list-style-type: none"> <li>• Golf carts - Club car, EZGo, Yamaha, AMC, Garia, Polaris, Cushman</li> <li>• Bass Boats - Skeeter &amp; Triton, Bass Pro Shop / Cabellas</li> <li>• Mining - CAT, Joy Mfg</li> <li>• Powersport Companies - Honda, Yamaha, Polaris, BRP, Kawasaki</li> </ul> <p><i>Decision makers:</i></p> <ul style="list-style-type: none"> <li>• Start w engineers</li> <li>• Then procurement and supply chain</li> <li>• Then CTO</li> <li>• Channel partners</li> <li>• Retail partners</li> </ul>
<p><b>9. Cost structure</b></p> <ul style="list-style-type: none"> <li>• R&amp;D costs</li> <li>• Contract Manufacturers</li> <li>• Material</li> <li>• SG&amp;A</li> <li>• 15% net margin goal (includes 48C tax rebate)</li> </ul>		<p><b>5. Revenue Streams</b></p> <p><i>We have a direct sales and channel partner model. Additional revenue from subscription.. We expect recurring orders from our customers</i></p>		

# BUSINESS MODEL CANVAS – ENERGY STORAGE MARKET

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