Æsir Technologies, Inc.

ÆSIR TECHNOLOGIES, INC.

*When **MISSION CRITICAL ENERGY STORAGE** is more than just a tag line.*

NAATBatt
SODIUM-ZINC
BATTERY WORKSHOP

ÆSIR TECHNOLOGIES BACKGROUND

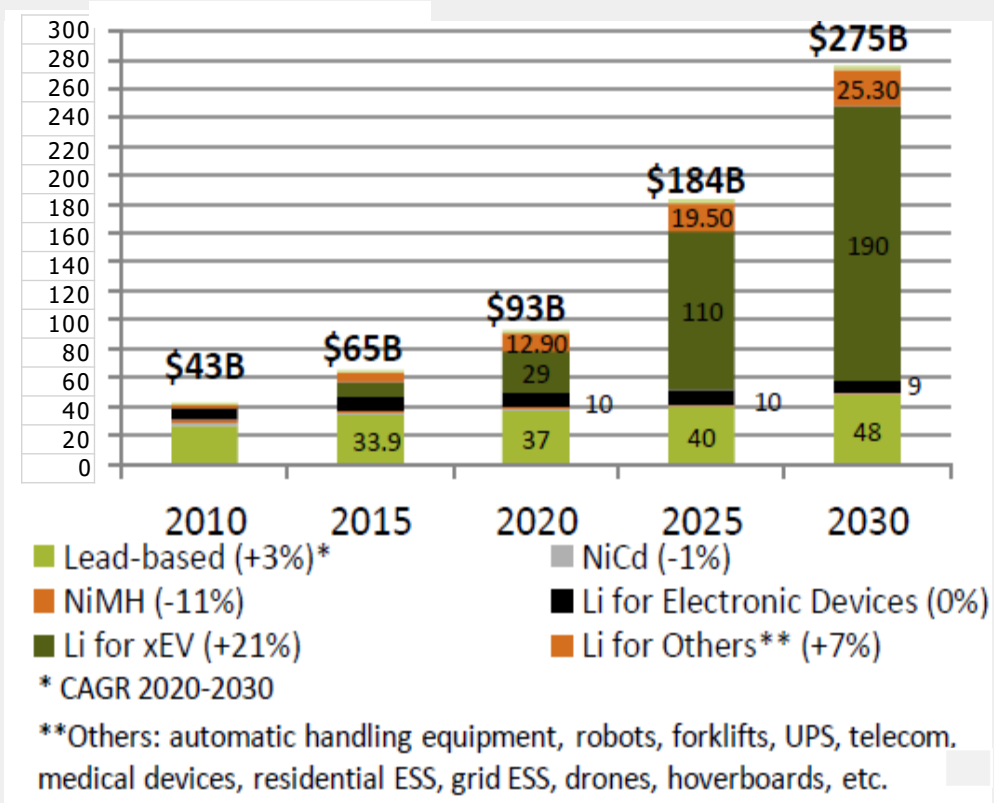
- Focused on the development of zinc-based electrochemistries including:
  - Nickel-Zinc (Ni-Zn)
  - Lithium-Zinc (Li-Zn)
  - Zinc-Air (Zn-Air)
- Targeting aerospace, defense, medical, and critical infrastructure
- 22 US patents and 38 in all stages of prosecution

ENERGY STORAGE

Strong growth market with high demand for improved battery technology: NiZn can disrupt entire lead-based and stationary li-ion

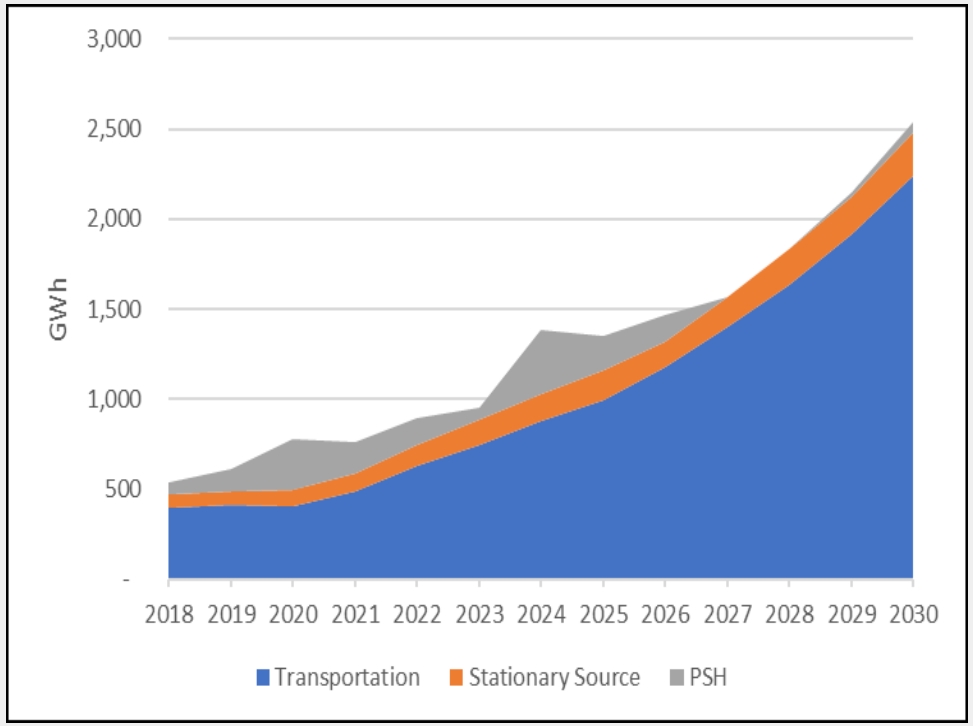
Future Growth in Market and Capacity Demand

Future CAGR in USD: 2021-2030, 10.4%



Source: Avicenne Energy, N. America Market Report, 2022

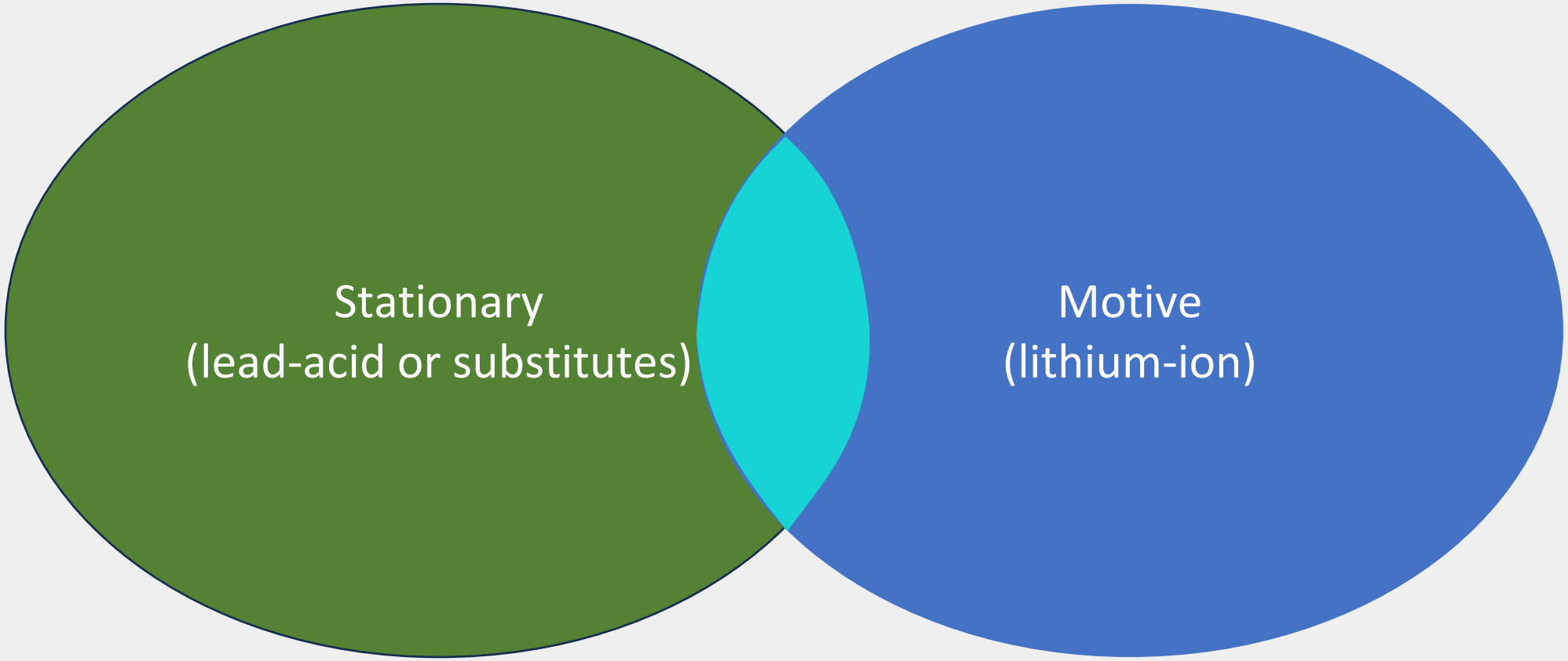
Future CAGR in GWh: 2021-2030, 14.5%



Source: US Dept of Energy, Energy Storage Grand Challenge: Energy Storage Market Report

Markets are Bifurcating into Motive and Stationary

- Mega-applications are Motive and Stationary Storage
- Current Technology is Predominantly Li-ion and Lead-acid



- Lead-acid Substitutes Gravitating toward Zinc and Sodium

ENERGY STORAGE

The Dilemma

Battery “Performance Gaps” exposed as technology evolves

Lead-acid Shortcomings

Capacity
Seeking longer run times in smaller packages

Power
More power required for commercial and industrial users

Life
Demand for longer cycle life and shelf life

Lithium-ion Problems

Safety
Customers in key markets place a premium on safety

Complexity
Operations require advanced electronics (BMS)

Cost
Widespread deployment of storage requires < $200/kWh

Total Market expected to reach

2.5 TWh by 2030

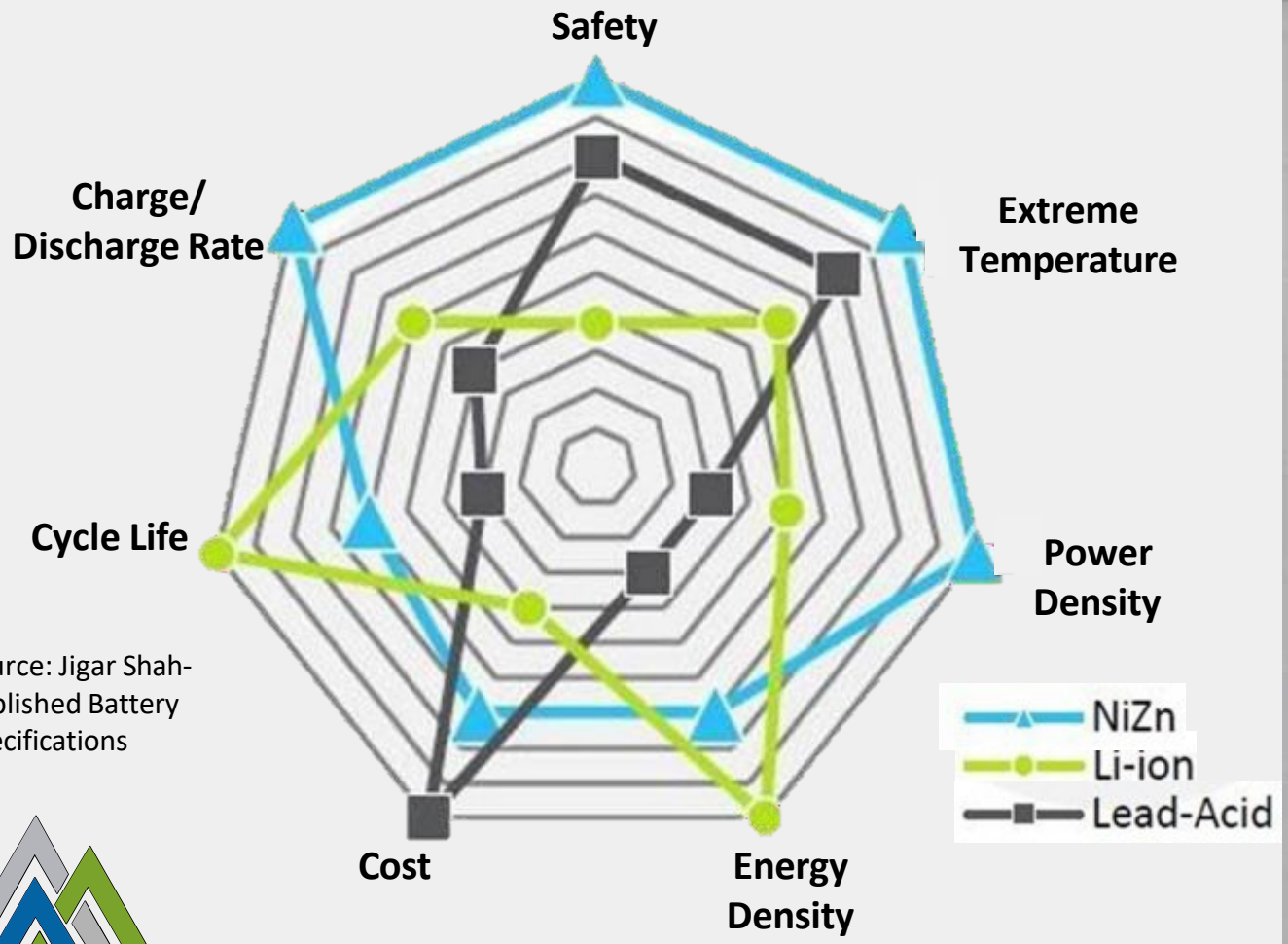
ÆSIR TECHNOLOGIES: ENERGY STORAGE SOLUTIONS FOR THE SPECIALTY MARKETS

Strong Traction in Mission Critical Energy Storage

- Aerospace & Defense, Medical, Critical Infrastructure
  - Lower Volumes
  - Higher Profits
  - Underserved Segments
  - Tight Customer/Supplier Relationships
  - Higher Barriers to Entry due to:
    - Performance Demand
    - Quality Requirements
    - Certification

THE PERFECT BATTERY

It Doesn't Exist – But NiZn is Closer



Source: Jigar Shah- Published Battery Specifications

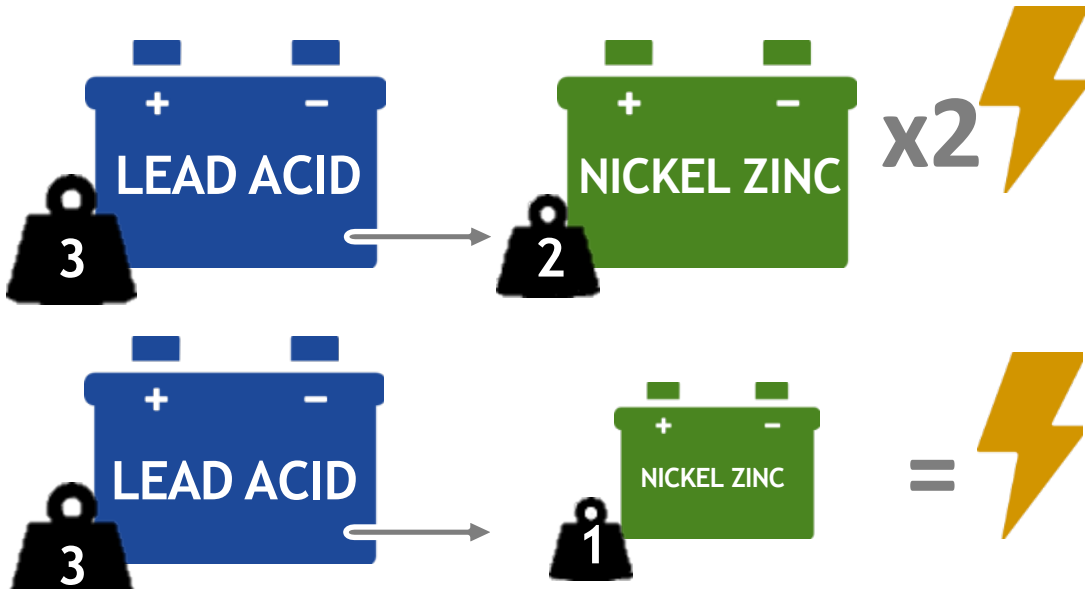
WHY NICKEL ZINC BATTERIES?

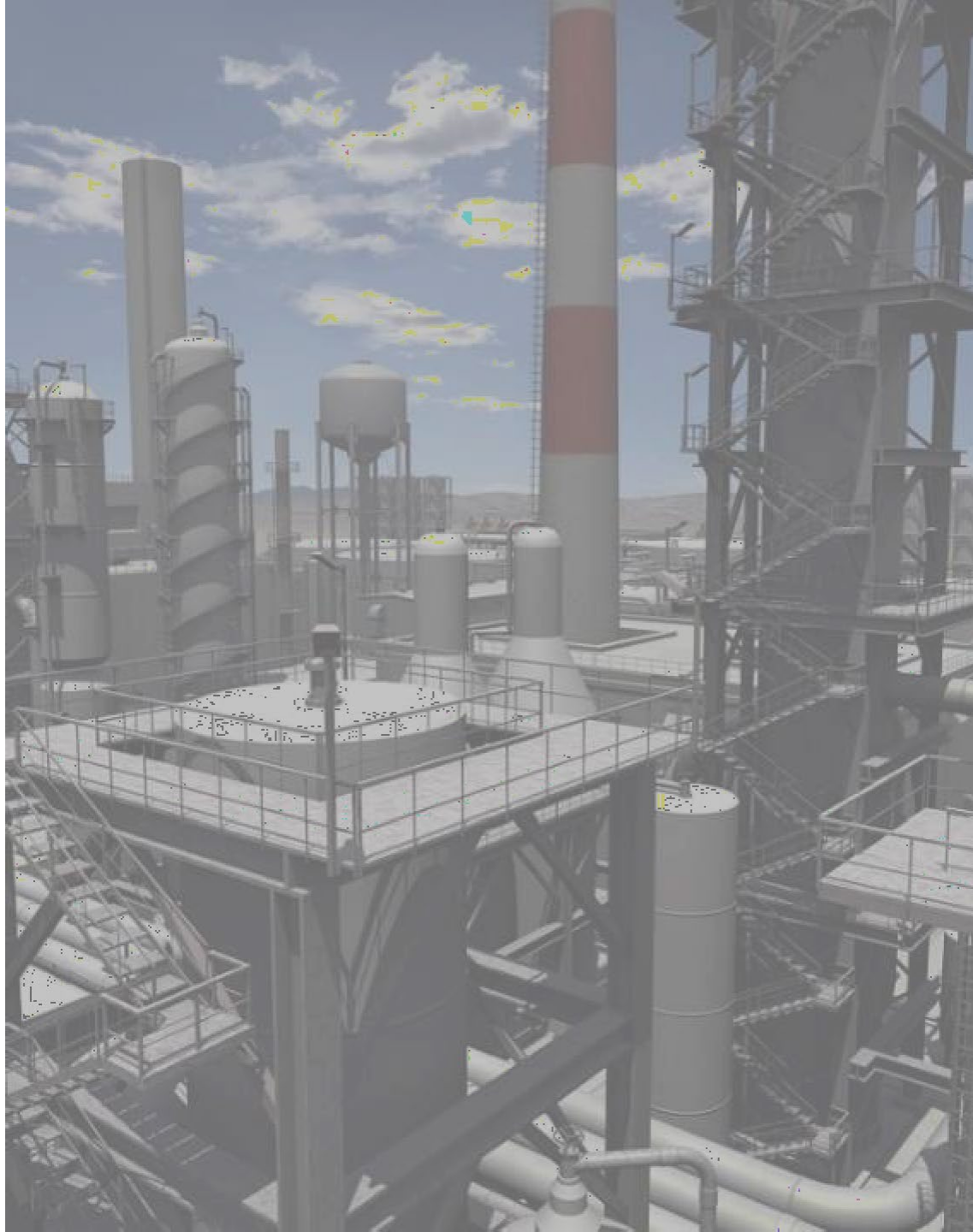
Why Æsir?

Æsir's nickel-zinc battery, based on decades of design and development at **Energy Research Corporation, Evercel, and ZAF Energy Systems**, solves historic problems.

✓ **Electrolyte dry out** ✓ **Dendrite growth** ✓ **Zinc migration**

A Nickel Zinc (NiZn) battery can give 2x performance in the same size, at two-thirds the weight, or the same performance as a Lead Acid battery in half the footprint at one-third the weight.







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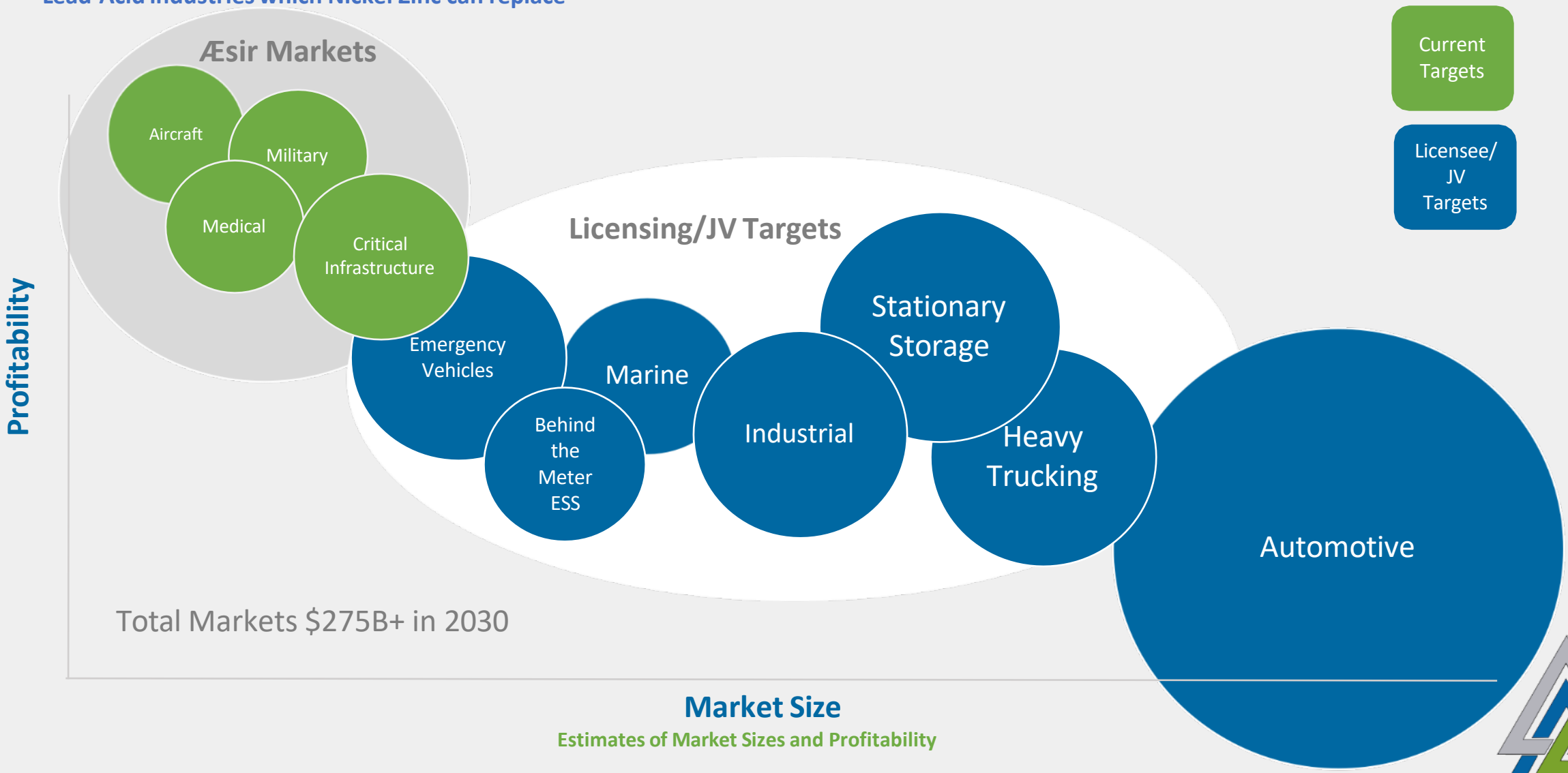
MARKETS

MARKETS

Lead-Acid industries which Nickel Zinc can replace



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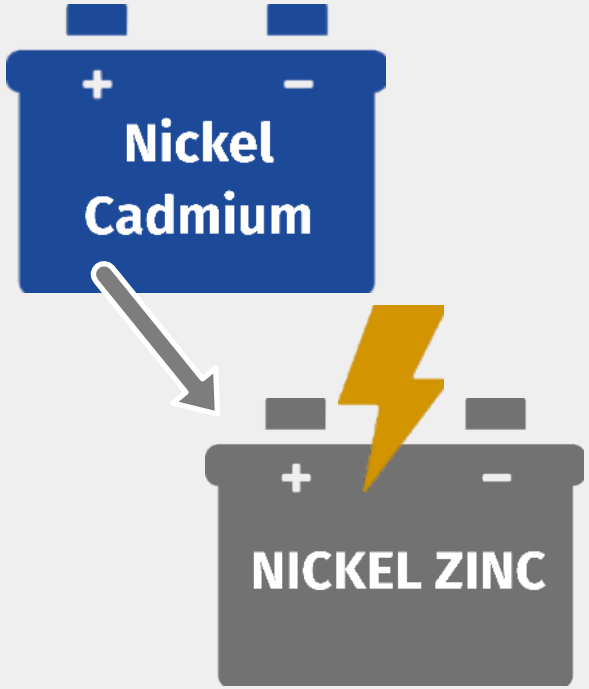
COMMERCIAL AEROSPACE

WHY NiZn FOR AIRCRAFT BATTERIES?

Over NiCd: Maintenance-Free OPEX Reduction Opportunity

Æsir's nickel-zinc battery design solves historic NiCd problems.

- **Memory effect -> inherently solved because the NiZn combination does not suffer the effect**
- **Electrolyte dry out -> solved through recombination device**
- **Environmental issues -> NiZn contains no cadmium, a heavy metal increasingly difficult to recycle and subject to governmental regulations banning hazardous substances**



Battery Data	NiCd	ZAF NiZn Capacity G31	Unit
Memory Effect	Yes	No	
Self Discharge	20%	5-7%	Per Month
100% DOD Life Cycles	500	600+	cycles
60% DOD* Life Cycles	1,100	1,900	A
specific energy*	40-60	87	Wh/kg
specific power	150	587	W/kg
energy density	50-120	180	Wh/L
power density	800-1000	1161	W/L

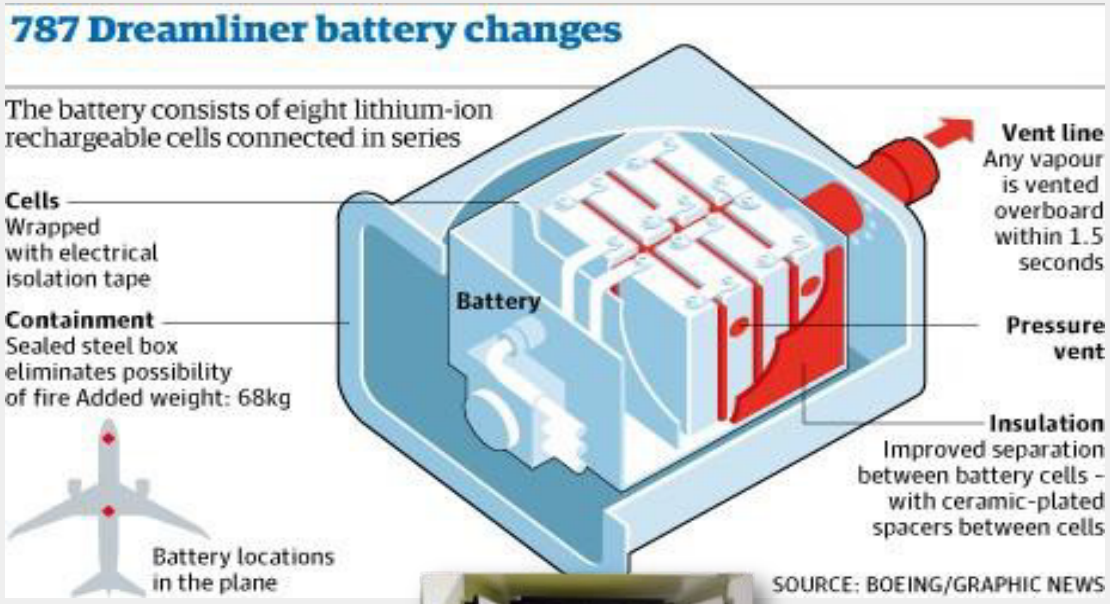
(* Depth of Discharge)

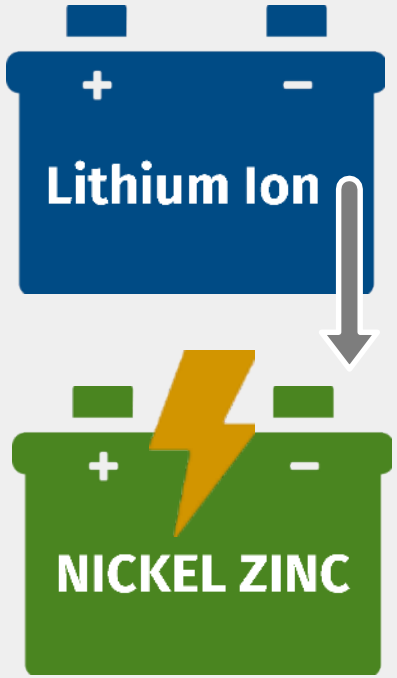
WHY NiZn FOR AIRCRAFT BATTERIES?

Over Li-ion: Safer Alternative

Æsir's nickel-zinc battery design solves emerging Li-ion problems.

- ✓ **Cost -> NiZn is considerably less expensive than Li-ion (no BMS, no DO-178, no DO-311)**
- ✓ **Safety -> NiZn is non-flammable**
- ✓ **Weight -> NiZnis lighter than FAA DO-311 compliant Li-ion**
- ✓ **Environmental issues -> NiZn is economically recyclable**





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CRITICAL INFRASTRUCTURE

PRIMARY COMMERCIAL TARGET MARKET – DATA CENTERS

CRITICAL INFRASTRUCTURE

2030 Data Centers - $3.9B / 2030 5G-Telecom $4.5B

Lowest cost solution over 20-year life

31% cost reduction over PbA and lithium NMC
26% cost reduction of lithium iron phosphate
52.5% fewer batteries consumed over lead acid over 20-year period..

Better performance

Operates at higher temperatures reducing air handling and safety requirements.

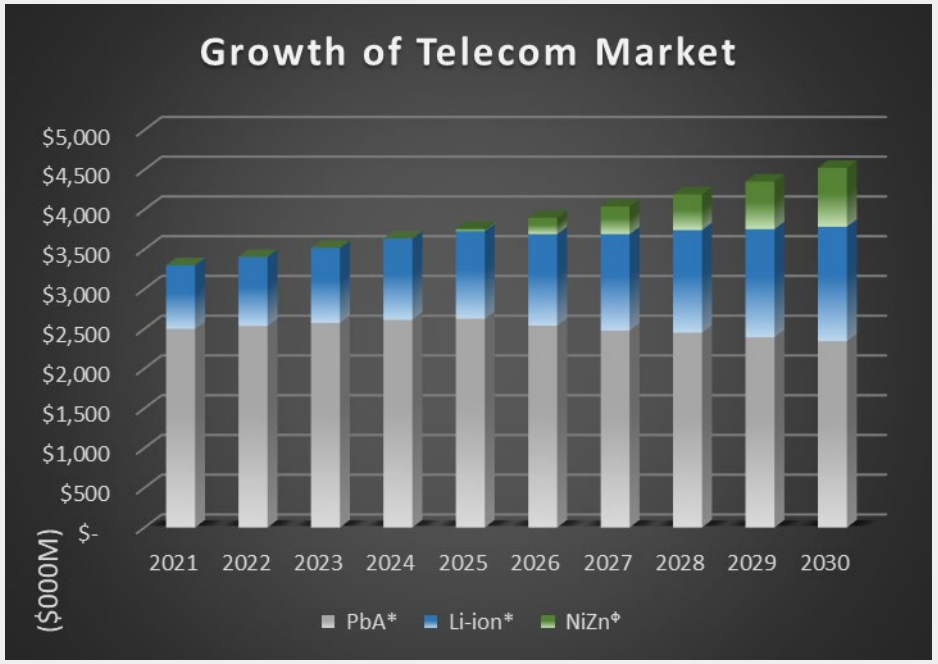
Reliable and safe

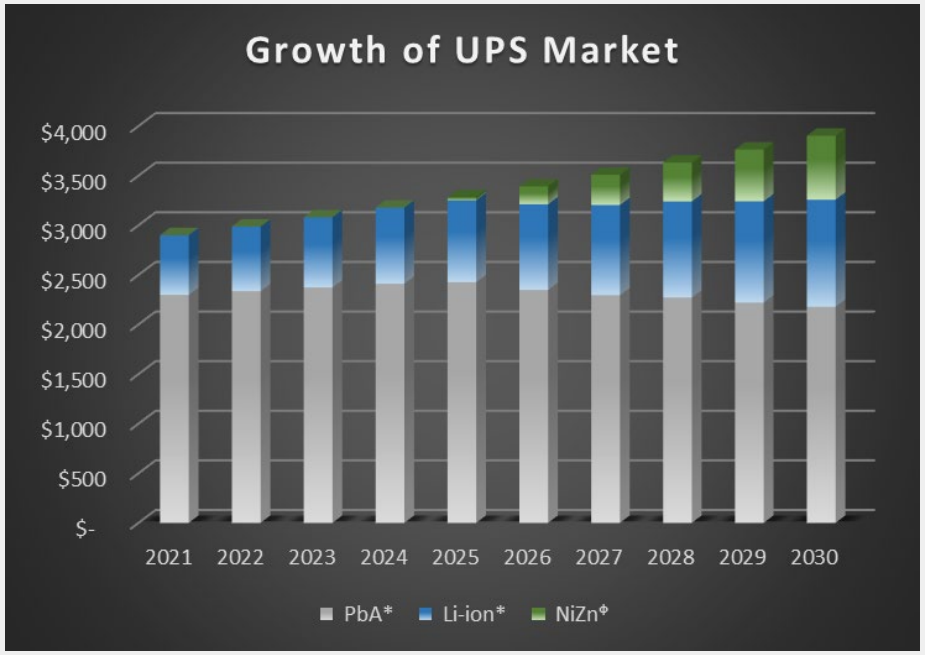
10-year warranty. Non-toxic, non-combustible, non-explosive, RoHS compliant, fully recyclable.

Highest IRR

Combination of performance, reliability and cost provides the best value.

Increased White Space Revenue.





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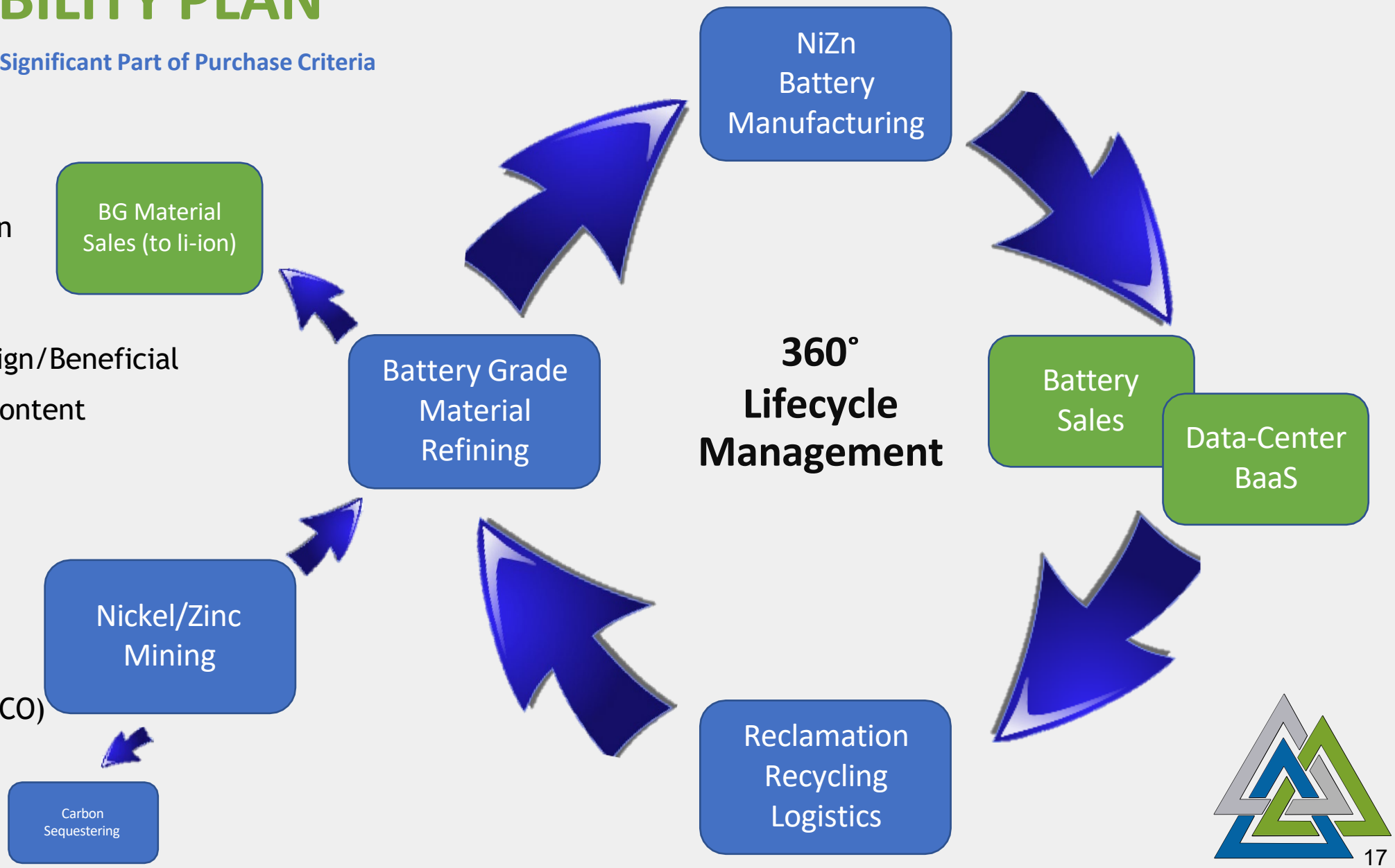
SUSTAINABILITY

COLD RECYCLING OF NIZN

SUSTAINABILITY PLAN

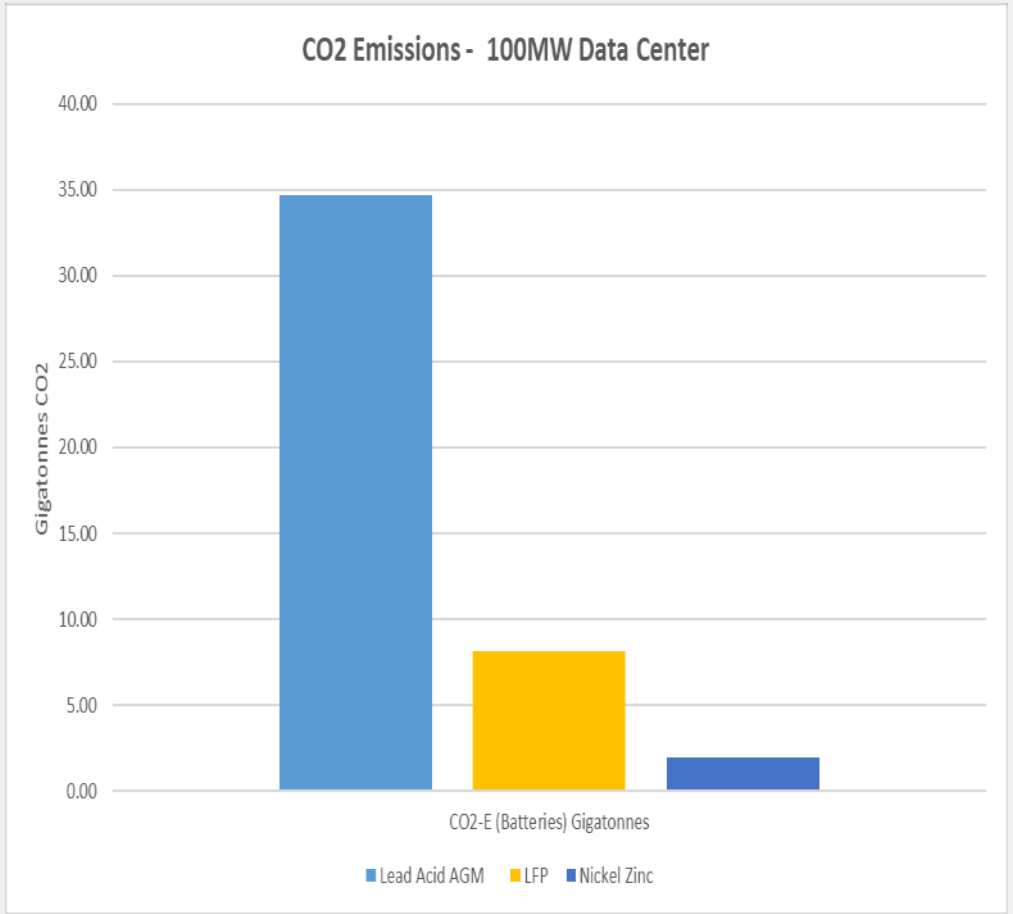
Customers are Making it a Significant Part of Purchase Criteria

- Based on Proven NiZn Battery Technology
- Operationally Stable
- Environmentally Benign/Beneficial
- No “Blood Battery” Content
- Sustainable
  - Safely Recyclable
  - Economically Recyclable
  - Environmentally Recyclable
- Lowest 10-year Total Cost of Ownership (TCO)



CO2 EMISSION COMPARISON

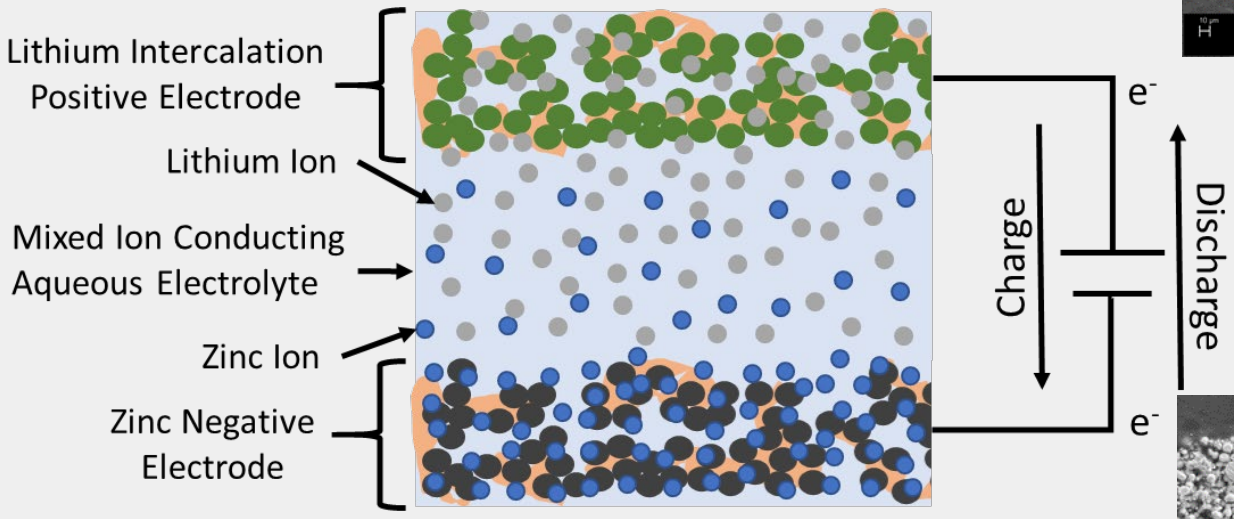
LARGE DATA CENTER

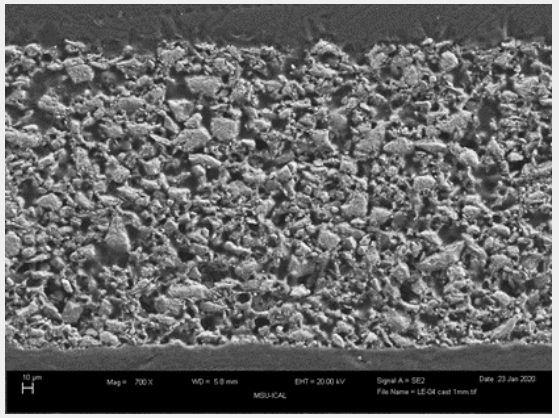


- Batteries do not reduce CO2 as much as people think.
  - Li-ion has an ESOI of 2 and lead-acid has an ESOI of 10.
  - That mean they emit twice, or ten times respectively, as much CO2 emission in their creation/recycling vs. energy storage they replace.
- Data Center operators are looking at this as part of their 360-degree environmental decision-making process.

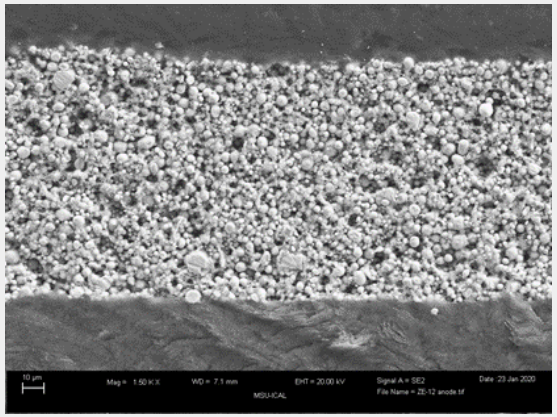
BEYOND ZINC: WHAT IS LITHIUM-ZINC?

The Li-Zn battery consists of an intercalation electrode, a zinc electrode, and an acidic aqueous electrolyte containing both zinc and lithium ions.





$$LiFe^{II}PO_4 \leftrightarrow Fe^{III}PO_4 + Li^+ + e^-$$



$$Zn \leftrightarrow Zn^{2+} + 2e^-$$

A slightly acidic electrolyte allows for a simple anode design that delivers long life at low cost. The water-based electrolyte is also highly conductive and nonflammable.

- National Science Foundation 24-month Phase II cooperative agreement was granted in May 2022
- Goal of Phase II is to achieve a TRL of 5 in a scaled prototype

Summary

Randy A. Moore
President & CEO
Æsir Technologies, Inc.

- New Energy Economy–Battery Markets Growing 3-5 Times GDP
- Lithium-Ion Will Dominate Motive
- Lead-Acid Currently Dominates Stationary
- Lead-Acid Weaknesses in Energy Density and Cycle Life Subject to Displacement
- Zinc- and Sodium-Based Batteries are Poised to be a Major Part of that Changeover

Æsir Technologies, Inc.

THANK YOU

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