
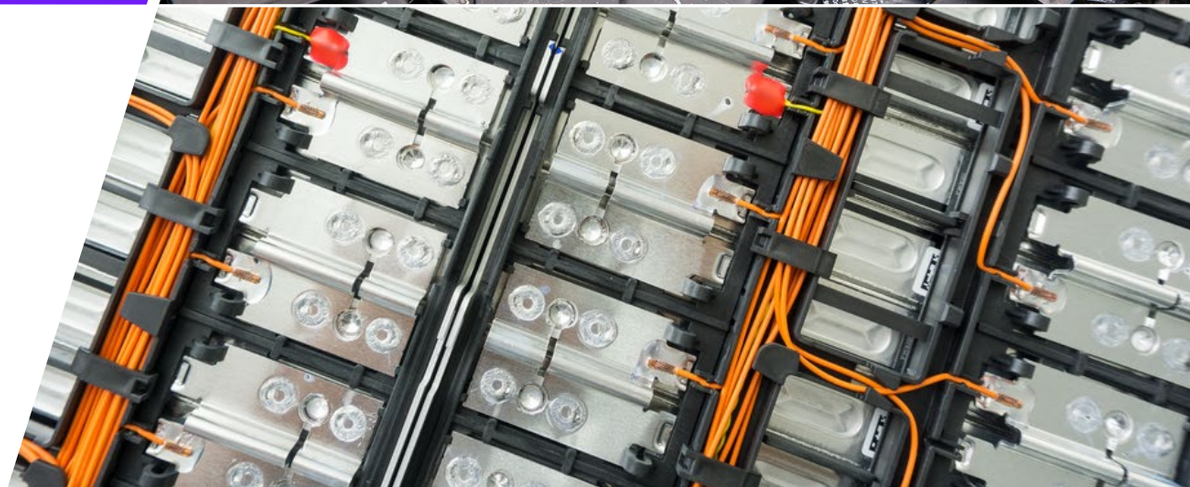

# ACE Green Recycling

CASE STUDY – GREEN BATTERY RECYCLING FOR THE CIRCULAR ECONOMY

Delhi, India | November 2022

ACE Green Recycling

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# Do you think that all recycling is Eco-friendly ?

# State of Battery Recycling

- **High Green House Gas emissions** as fossil fuels are used to heat up the smelting furnace to > 1000$^{o}$ C
- **High Toxic emissions** of heavy metals like lead
- **Lead rich slag - a hazardous solid waste product of smelting –** is dumped into landfills

**Developed Countries**: Smelters are facing ever tightening regulations and higher compliance costs

**Developing Countries**: Lax regulations leads to extreme pollution and pathetic workplace conditions

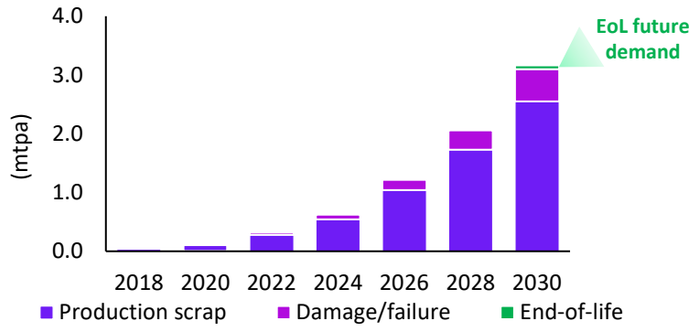
# Lithium-ion battery recycling is another economic and ecological imperative

*Electric vehicles penetration will exceed* **50% by 2030**

## Challenge 1

**Simultaneous escalation of battery waste**

**Battery recycling demand**




Startup of new plants expected to produce significant pre-consumer scraps

End-of-life (EoL) scraps to create sustained recycling demand longer term

## Challenge 2

**Existing waste management solutions are ineffective and potentially dangerous**

### Smelting process

- High air pollution
- Toxic solid waste
- Unsafe work environment

### Waste disposal

- Toxic liquids and solid and air pollution
- Explosion hazards in transportation and shredding
- Opportunity cost

## Challenge 3

**Increasing constraint impact battery raw materials sourcing**

- High environmental impact of mining and refining activities
- Increased requirements for localization of supply chains in the EV industry
- Expected material supply shortages from primary mining
- Supply chain transparency requirements

ACE Green Recycling

Source: Broker Research

# Problem cannot be solved in silos. We need to have an ecosystem approach

| | Technology | Process efficiency | Safe and sustainable operation | | | Supply chain management | Recovery rates |
|---|---|---|---|---|---|---|---|
| | | Extraction | Temperature | Solid wastes efficient | Emissions | | |
| **ACE Green** | **Mechanical preprocessing/ Hydrometallurgy** | **Single step recovery and leaching** | **~75C** | **No toxic solid waste** | **Zero[1]** | **Decades of global battery trading experience** | **98%** |
| **Mature Western Hydro based Tier 1 & 2 Players** | Mechanical preprocessing / Hydrometallurgy | Multi-step leaching | ~100C | Toxic solid waste | Zero | Upstream: OEMs partnership Downstream: Limited prior experience | 95% |
| **Mature Western Hydro + Pyro based Tier 1 & 2 Players** | Thermal preprocessing / Hydrometallurgy | Multi-step leaching | ~100-300C | Toxic solid waste | Emitting pyro-processing | Upstream: OEMs partnership Downstream: Limited prior experience | 95% |
| **Tier 3 players** | Thermal preprocessing / pyrometallurgy | Multi-step pyrolysis and smelting | ~300-1,400C | Toxic slag byproducts | High air pollution | Localized supply chain expertise only | 90-95% |



Note:
1. ACE's process is designed for zero Scope 1 emissions and the facilities are envisioned to be zero Scope 2 emissions as well

# Drawing synergies & expertise between Lead Acid Batteries & Lithium-ion Batteries markets

# ACE Green: Solutions across the battery recycling value chain

**Scrap batteries** → **Pre-processing** → **Intermediates** → **Extraction & material recovery** → **Precursors & intermediate products**

Can treat LFP, NCM, LCO etc

**Dismantling**

**Discharging**

**Crushing**

**Black mass**

ACE tech is not dependent on receiving clean black powder and can treat variety of black mass

Pure **Al** and **Cu** recovered

**Leaching**

**Extraction**

**Crystallization**

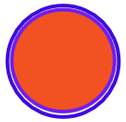
**Plastic & Steel** recovered

Graphite

Copper

Lithium carbonate

Cobalt Salts



MHP

Nickel Salts

Aluminum sulphate

Sodium sulphate

Iron phosphate

Precursor

Flexible technology design allows to manufacture precursors and various metal salts (Sulfates/ Carbonates/ Hydroxides) & their combinations as per customer requirements

Economic End-products

**Pre-processing IP**

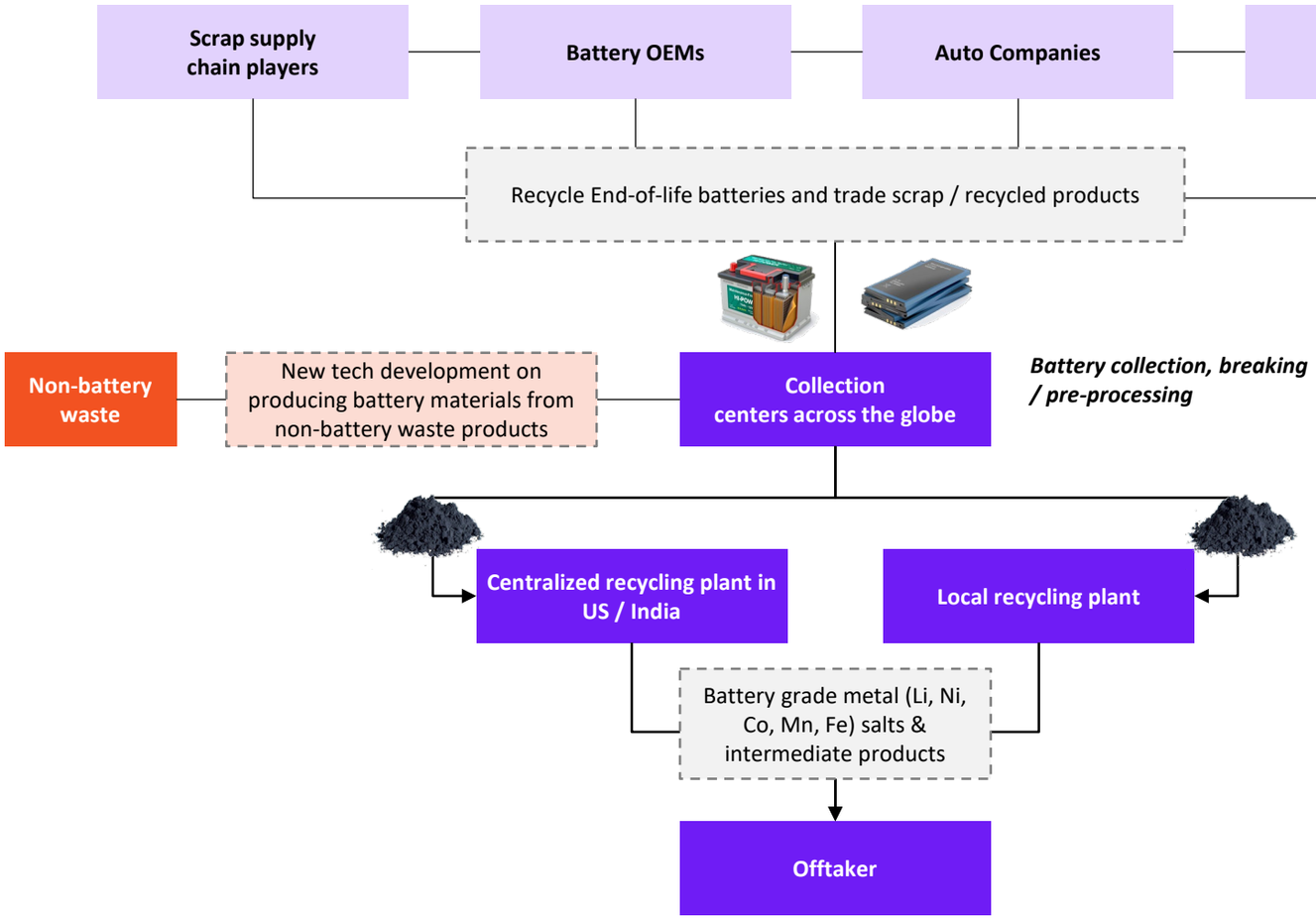
- Robotization of discharging and dismantling
- In-house processing of Al and Cu

**Hydrometallurgical IP**

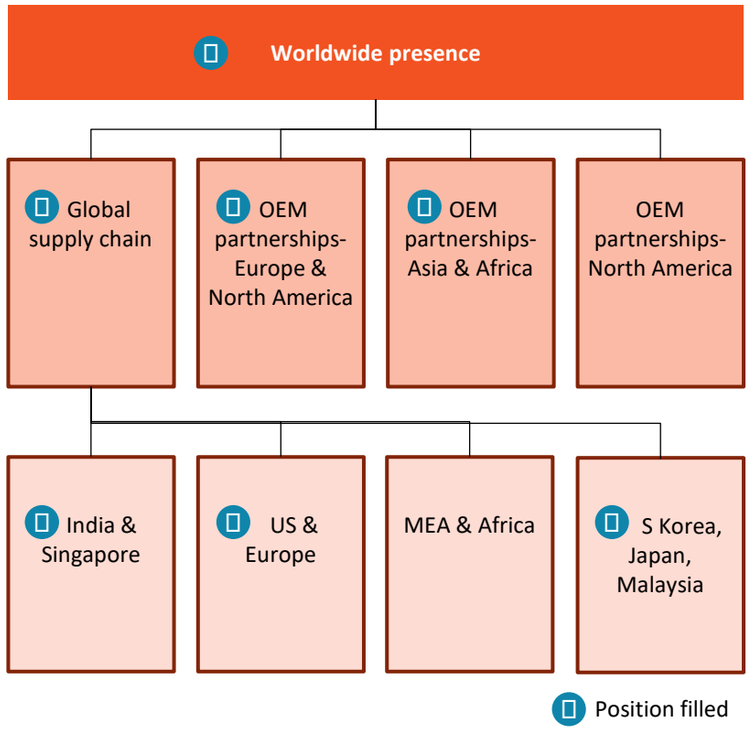
- Proprietary leaching technology & equipment design
- Proprietary additives for enhanced recoveries

# World-class supply chain management

## Cost efficient and scalable supply chain model




## Highly experienced and dedicated supply chain management team

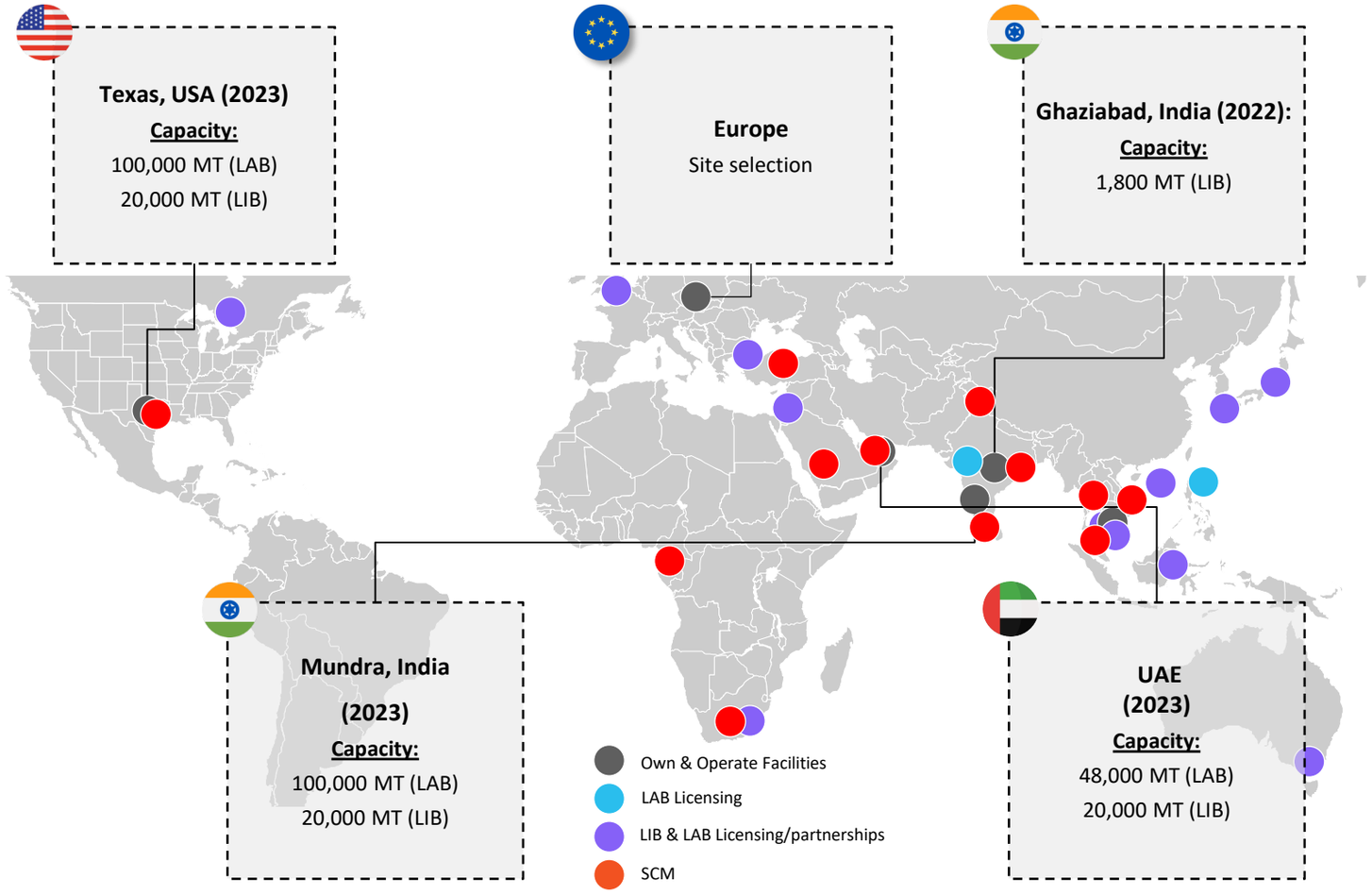



**Active SCM & BD network**

| 14 | 42 | 83 |
|---|---|---|
| Americas | EMEA | Asia |

# ACE is pursuing projects in diverse geographies

## Well-articulated global roadmap




ACE Green Recycling is also setting up ***Lithium-ion collection centers*** in emerging markets by ***leveraging its rich supply chain management experience,*** which allows low-cost and low-risk scaleup in those geographics



Source: Company information

# ACE Green Recycling – India Focus

### Expansion Plans

- ✓ We aim to setup a combined battery recycling park in Mundra, India in 2023
- ✓ Planned capacity of 100,000 MT (LAB) and 20,000 MT (LIB) battery processing in phases
- ✓ R&D and Collaborations with leading institutes

### Li-ion Recycling Technology

- ✓ ACE's Li-ion Battery Recycling facility is under commissioning, expected to be operational in Q4 2022
- ✓ Plant capacity for 1,800 MT Battery Processing

### Lead Acid Battery Recycling (Licensing)

- ✓ Delivering on agreement with Pondy Oxides & Chemical Ltd., with commissioning underway.

# Seasoned management and business development teams

**Nishchay Chadha**

*CEO*

- 16 years in **recycling, global trading, mining, supply chain**
- Asia Pacific & Middle East **head for Lead/zinc** & India/MENA for **scrap metals at Trafigura**
- **Senior global positions** in **Vedanta** & 2 **startups**
- B. Tech. in Mining Engineering from **IIT (ISM) Dhanbad** and MBA in Finance and Strategy from **ISB, Hyderabad**

**Teodoro Alban**

*CFO*

- 25 years professional experience in **finance & treasury** with broad experience in M&A and business development
- **Held CFO position** at RDT Inc (Subsidiary of Tubos Reunidos) and Quantum Offshore Energy Services
- B.Sc in Mechanical Engineering from Brown University and Master of Finance from London Business School

**Vipin Tyagi**

*CTO*

- 11 years in **Battery materials cleantech recycling**
- **PhD in Mechanical Engineering** from **Texas A&M University** and B. Tech. in Mechanical Engineering from **IIT Bombay**
- Co-authored several peer reviewed journal and conference publications
- Ex **Merrill Lynch** Trader, USA

**Sumit Sachdeva**

*CEO – India*

- 17 years in experience in **Corporate and Investment Banking** handling fund raising- both debt and equity
- Last worked as Executive Vice President and **Coverage Head** for Indian Conglomerates for Kotak Mahindra Bank, India
- MBA in Finance and Strategy from **ISB, Hyderabad**, graduated with Dean's list. Executive Program in Finance from **IIM, Calcutta**

**Siddharth Roy**

*Business Director*

- 13 years **in Base & Precious Metals, Recycling, International Trading, Logistics**
- Hindustan Zinc manager APAC
- Startups – global head of Lead & zinc

**Farid Ahmed**

*VP – Business Development*

- 30+ years in the **metals sector** with deep ties to industry players across the globe
- Recognized as a global thought Leader in commercial intelligence for **battery materials, energy, metals, and mining**

**Aaron Wee**

*VP Strategy & Investments*

- 10+ years in **investments, M&A, and consulting**
- Extensive VC experience in digital technology, web infrastructure, and blockchain

**Meredith Matthews**

*VP Global Communications*

- 20+ years experience in **corporate, crisis, non-profit, community and employee communications**
- Worked as PR Lead, U.S. Gulf Coast, Communications Advisor at LyondellBasell
- Former journalist and award-winning communications professional with senior-level experience in communications

# Thank You.

We welcome enquiries on our continuing journey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