INDIAN-PRENEURS

AGAM PANDEY | HARDIK CHAWLA | KRISH SHARMA

Global trends of Li-ion Battery manufacturing and environmental impact of in-efficient disposal.

Lithium ion battery Global demand is increasing, driven largely by the imperative to reduce climate change through **electrification of mobility** and the broader **energy transition**

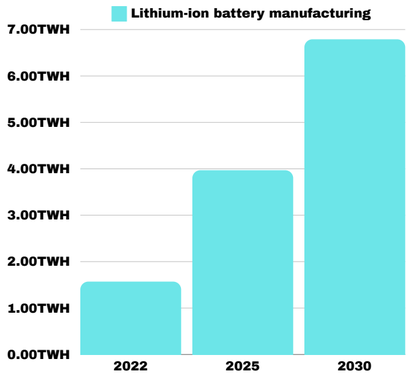
Despite the eco-friendliness, challenges still lie ahead:

- Supply-Demand Imbalance
- Inefficient Recycling
- Resources Drainage
- Forced Labor & Exploitations

The Li-ion battery **value chain** involves steps ranging from **mining to recycling**, forming a circular economy.

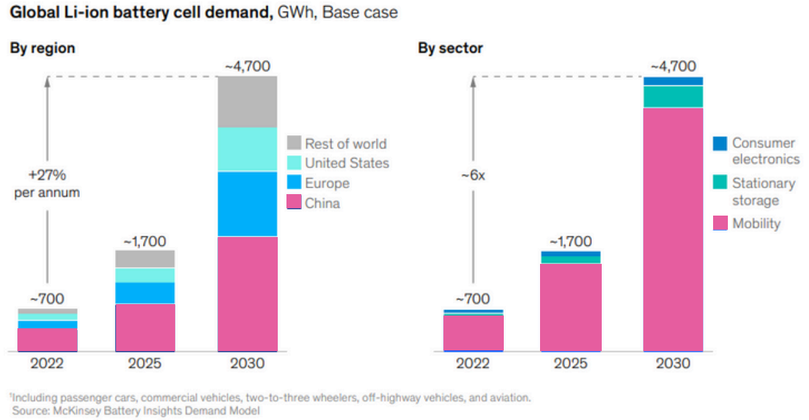
Solving problems in any step of the value chain involving solving either SDGs will create profound impact

Global Lithium Battery manufacturing trends



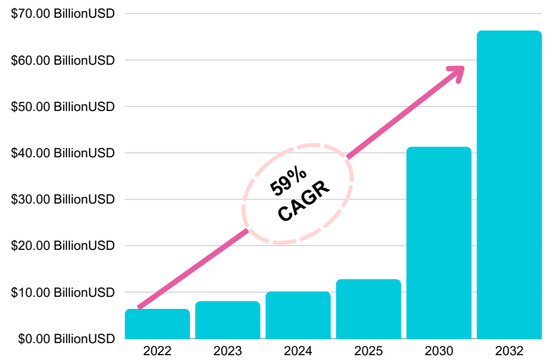
Lithium battery **manufacturing** is set to increase by **7x by 2030**.
TWh refers to TerraWatt hours

Region wise and Sector wise Li-ion battery demand projection by 2030.



The demand for lithium battery has also increased with sectors like **Consumer electronics**, **ESS** (Electronic Storage Systems) and **Electric Vehicles** gaining 6x boost from 2022 to 2030 (projection).
There has been demand supply disparity for batteries, with supply not coping up with demands

Global market for Li-ion battery recycling



The YoY growth of the Recycling Market Cap of Li-ion battery shows, with increase in the demand and usage of Li battery on global scale has shown a 7x increase indicating huge market to be tapped.

Global trends of Li-ion Battery manufacturing and environmental impact of in-efficient disposal.

Lithium ion battery Global demand is increasing, driven largely by the imperative to reduce climate change through **electrification of mobility** and the broader **energy transition**

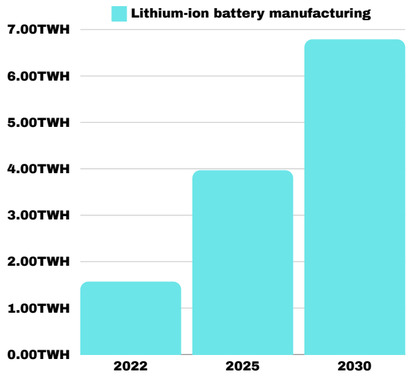
Despite the eco-friendliness, challenges still lie ahead:

- Supply-Demand Imbalance
- Inefficient Recycling
- Resources Drainage
- Forced Labor & Exploitations

The Li-ion battery **value chain** involves steps ranging from **mining to recycling**, forming a circular economy.

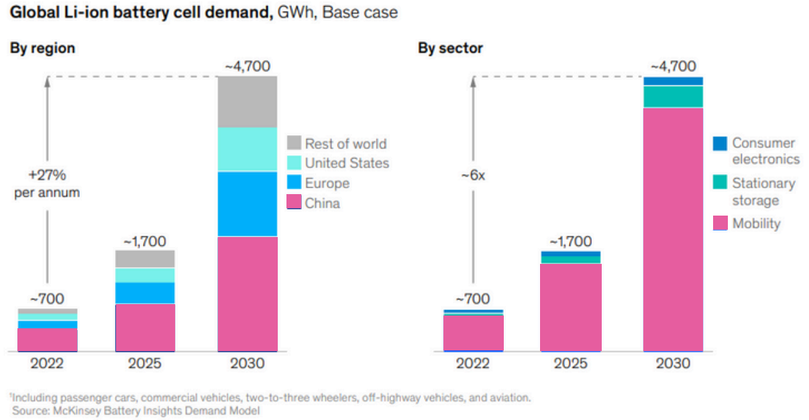
Solving problems in any step of the value chain involving solving either SDGs will create profound impact

Global Lithium Battery manufacturing trends



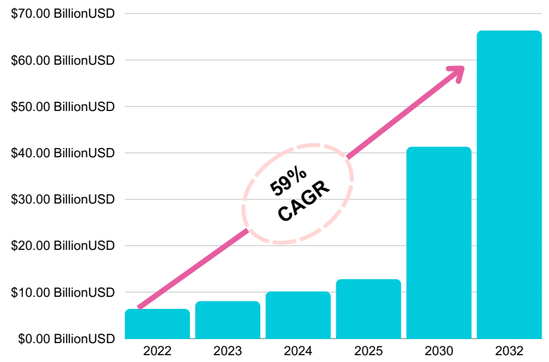
Lithium battery **manufacturing** is set to increase by **7x by 2030**.
TWh refers to TerraWatt hours

Region wise and Sector wise Li-ion battery demand projection by 2030.



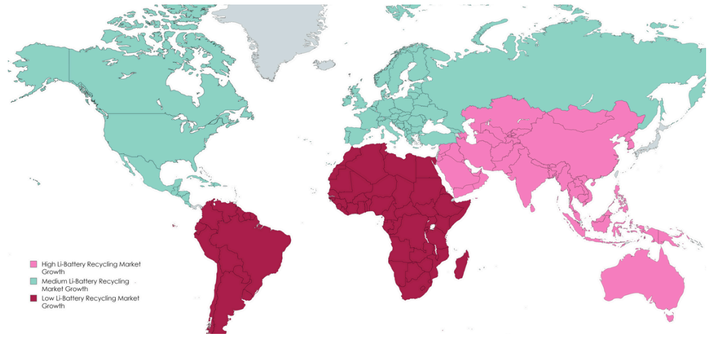
The demand for lithium battery has also increased with sectors like **Consumer electronics**, **ESS** (Electronic Storage Systems) and **Electric Vehicles** gaining 6x boost from 2022 to 2030 (projection).
There has been demand supply disparity for batteries, with supply not coping up with demands

Global market for Li-ion battery recycling



The YoY growth of the Recycling Market Cap of Li-ion battery shows, with increase in the demand and usage of Li battery on global scale has shown a 7x increase indicating huge market to be tapped.

The Indian Battery market is diverse and expected to grow at a 10.56% CAGR with recycling industry growing with CAGR of 38.95% by FY 2030.

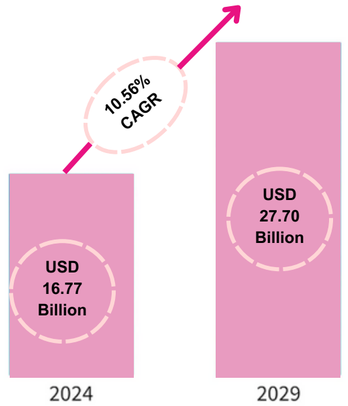


Asian regions have a high Li-ion battery recycling market growth rate. Thus, rationalizing our choice of India as the startup market for Li-ion battery recycling

Indian battery industry overview

Electric vehicles and battery **energy storage systems(ESS)** for different applications and the growing usage of automotive batteries in electric vehicles, will likely drive the Indian battery market during the forecast period.

The increase in demand for Li-ion battery in India creates void for battery disposal and recycling.



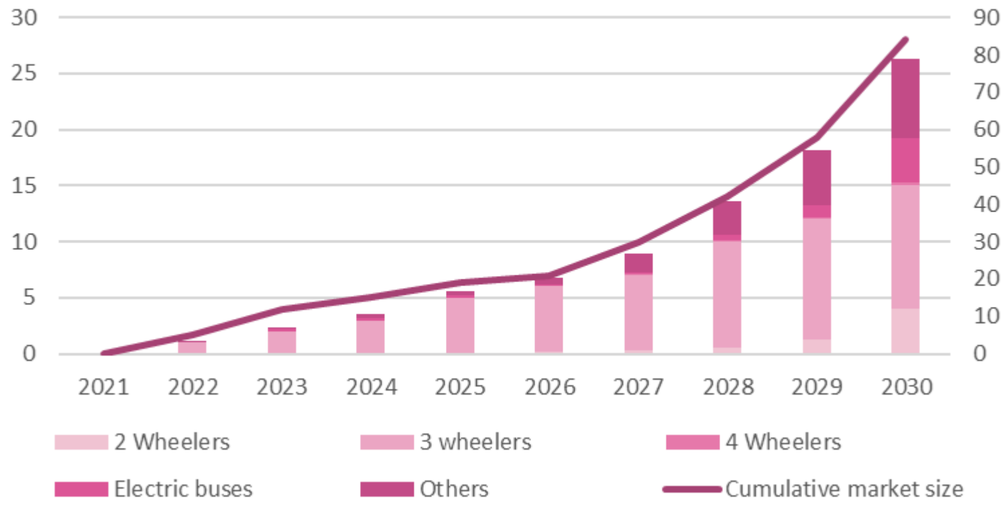
The Indian battery market is expected to grow in 5years

Li-ion battery recycling problems in India

India, in 2024 **doesn't have many of the minerals required for battery cell manufacturing**. Hence, **recycling is the need of the hour to address supply-side issues** and also to realise India's ambitious targets of **reducing its carbon emissions by 30 per cent and increasing its non-fossil energy capacity to 500 gigawatt (GW) by 2030**

~50 per cent of the cost of an EV is the cost of a battery, out of which 45 per cent is the cost of the raw materials that make up the battery, which include **cobalt, lithium, nickel, manganese, and graphite**. Each of these **critical battery materials has significant ESG** (environmental social issues)

Around **90% of India's used batteries** (most of which as not even li-ion but lead acid units) are either **processed by the unorganised sector**, or they **end up in landfills and garbage dumps**.



The growth of battery recycle industry in India with 39.95% CAGR in 8-9 years

Our primary objective is to mitigate adverse environmental impacts caused by unrecycled lithium-ion batteries by identifying their chemical components and providing a monetizable disposal solution.

Air Pollution

Green-House Gas Emmisions

Water Pollution

Land Pollution

Radioactive Pollution

Resource Drainage

Deforestation, Land degradation

Environmental Drawbacks of Lithium-ion Battery

Lithium ends up in a landfill without being recycled , It can cause leaching carrying lithium into the soil affecting the plant life .

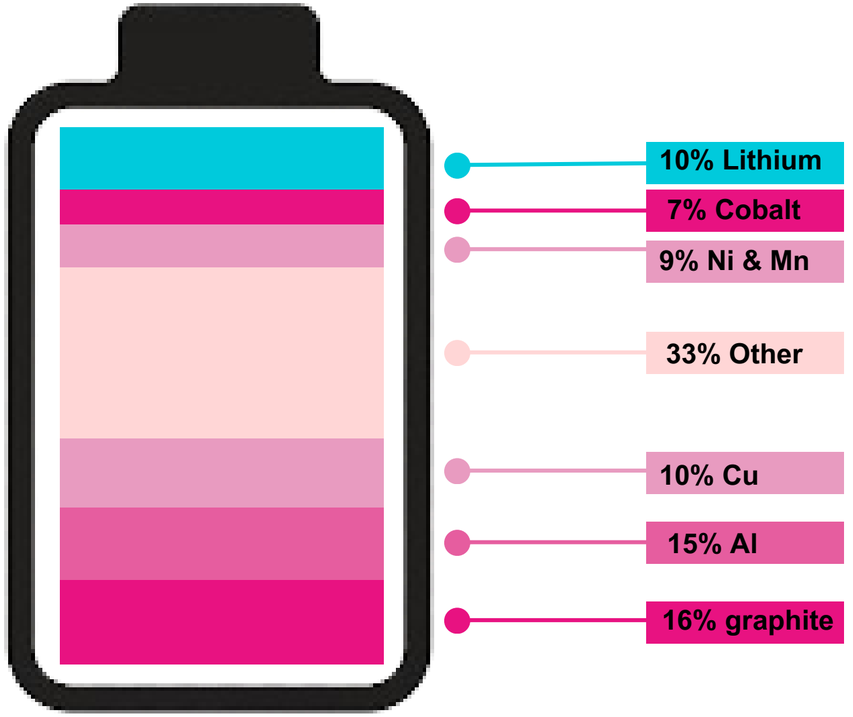
Deforestation, habitat destruction, and water pollution are among the environmental problems linked to **cobalt** mining.

When improperly managed, **nickel** in particular can have negative effects on the environment and human health.

Copper is usually in the form of foils for the electrodes. Extracting copper from raw materials is an energy-intensive process.

Carbon dioxide (CO_2) and other greenhouse gases are released during the main **aluminum production** process.

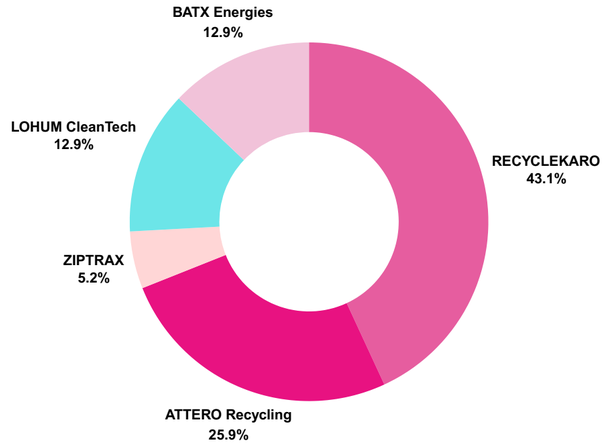
When **graphite**-containing materials break down in landfills or are incinerated, there is a potential for the release of pollutants into the air, contributing to air pollution.



The proposed solution for the recycling challenge to be tackled by 3-steps approach, *Collection-Treatment-Monetization* by-products (CTM) strategy

Competitive Analysis

Recycling Capacities of competitors in India (in tonnes)

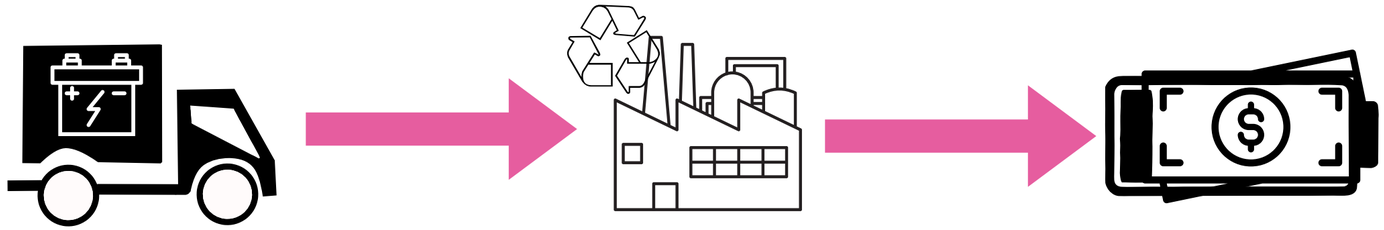


- Companies focus on **R&D** wing for **optimizing Lithium extracts and collaboration with OEMs**
- Use of **Deep Learning techniques to extend lithium battery life** of recycled products by **segregating** them
- *Indian recycling companies are focusing on 4 main steps*

Cell Auditing **Refabrication** **Sales & Swapping**

Regrouping

The Battery recycling process divided into 3 main steps of operation



1 Battery Collection Phase

- Collecting discarded batteries from various sources.
- Indian small retail shops, "*kabari walas*" collect batteries which can be tapped strategically.
- EV batteries, Consumer and Industrial Electronic devices to be collected

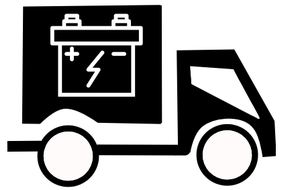
2 Recycling Phase at industry

- Recycling Li batteries include either mechanical, pyrometallurgical or hydro approach.
- Selecting best extraction approach
- Deciding the by-product we want to go with for monetizing

3 Monetizing By-products & Circular economy establishment

- Deciding the by-product to sell
- Industry that would buy extracts
- How do we contribute more for building a circular economy?

Indian Li-Battery Collection: Sourcing, Incentivizing Retail collection, Partnering with Auto and ESS



1 Battery Collection Phase

Discarded/used and damaged batteries collection is the primary aim of this phase

Indian market Lithium waste can be divided into various sources and usage:

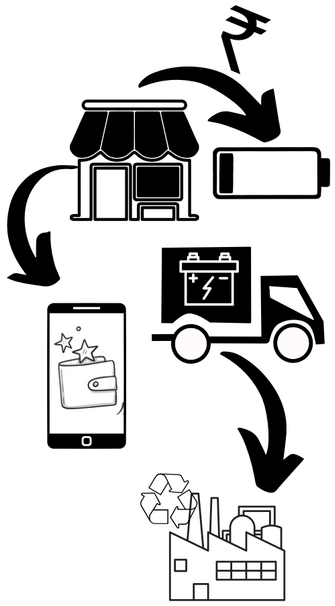
Consumer Electronic Devices

Devices with lithium-ion batteries, such as **Laptops** , and **smartphones .**

These batteries are sent to service centers and repair shops.

Why will shop owners give us the collected batteries instead?

- **Incentivising** the repair shop owners and collaborating with companies for collecting the used batteries .
- Cashback credits to shop owners for each kg of battery sent to us.
- Cashback credits can be used for ordering electronic items from partnered electronic distributors in different Indian states.



Electronic Storage Systems (ESS)

Energy storage batteries that are used in **homes , offices , hospitals** etc .
Establish partnerships with **businesses, municipalities, waste management companies**, and other organizations to facilitate the collection of ESS batteries.

Setting up convenient collection points at hotspot locations with more Battery waste
Similar platform for ESS batteries acquisition with shop owners and distributors

Automobiles (EVs)

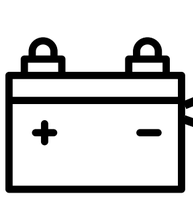
Partnering with the **car dealers and the service centers** for the collection of the batteries .

Collaborating with swapping station companies for leveraging **Battery Swapping to acquire used batteries of electric vehicles** .

Government Incentives for the battery Swapping

- India has implemented several supporting initiatives, including **FAME I** and **II**, **PLI** for **NPACC**, and state-level policies to boost indigenous battery manufacturing capacity

Batteries reaching the Industry will be segregated, and treated at different levels to extract by-products using advanced technologies.



Battery Segregation

Direct Recycling

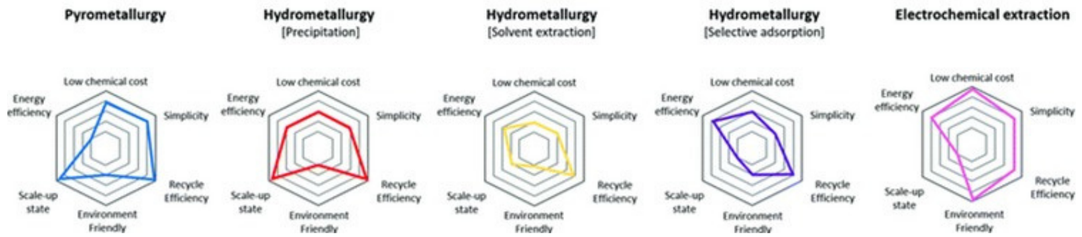
Used for refabrecation

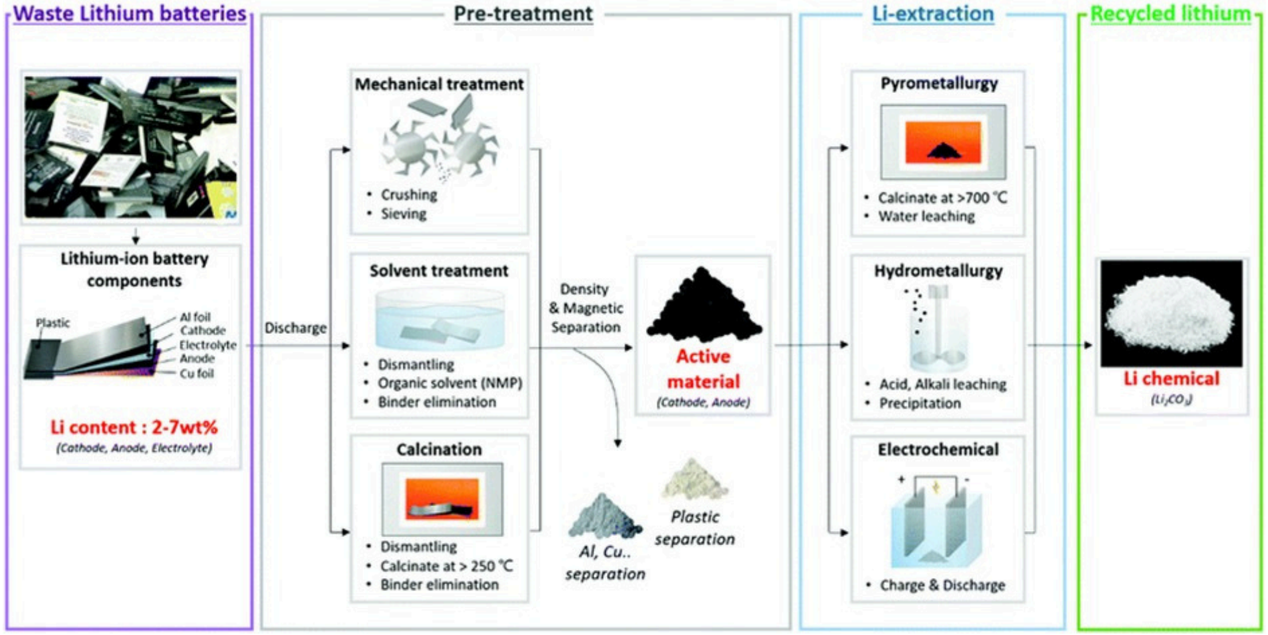
Battery Recycling & treatment

2 Recycling Phase at industry

Recycling Technology- Separating Li from the packed battery

- Discarded battery is subjected to a pre-treatment process to separate the cathode-anode from plastics and polymers.
- Chemical separation using **pyrometallurgy, hydrometallurgy,** and **electrochemical extraction** method for deposition of Li chemical .
- The pyrometallurgy method has the maximum efficiency (80-98.9%) and maximum purity (98- 99.95%) .





Currently we are seeking to work on the patented technology with IIT Roorkee's chemistry and physics department to:

- Give **more efficiency** for Li extraction and pre-chemicals with higher quality
- Leveraging **Deep Learning technology** to **identify industries to resale batteries,**
- **Extending battery life for reuse in Automobile service industry & ESSs**

Monetizing discarded batteries by selling treatment by products to different industries

3 Monetizing By-products & Circular economy establishment

Sale of Products Post- treatment

Cobalt, Nickel, Copper, Aluminum: These metals can be sold to industries involved in **metal manufacturing and production .**

The recovered metals (Co, Ni, Cu, Al) can be used in metal, chemical, EV-Automobile and ESS industries

Metal Industry
Al: Can be used to create new Al castings, sheets, and extrusions for various structural and fabrication applications within the metal industry itself
Co & Ni: Depending on the achieved purity, can be used in the production of stainless steel, magnets, and other metal alloys

EV-Automobile Industry
Li: Can be used in e-rickshaws and as a replacement batteries in local service centers
Al: Can be used in components in e-rickshaws like main panel, frames and wheels.

Chemical Industry
Li: Can be used in lubricants, greases and polymers as Lithium carbonate or lithium hydorxide.

ESS Industry
Li: In smaller off-grid systems as second-life battery applications
Al: In components and inside of ESSs.

Our Customer Companies

CMR Technologies - is a metal recycling company which buys scrap metals such as lithium , aluminium , copper etc.

Harshprit Impex LLP - is a Aluminium ingots manufacturing and recycling firm in INDIA which can buy the Aluminium scrap.

Websites like ScrapMonster, Scrap Metal Prices, and Alibaba provide avenues for selling bulk quantities of scrap metals to buyers worldwide.

Companies involved in the production and distribution of batteries can purchase recycled metals for use in their products.

Also , the refabricated batteries can be sold to the E-Rick companies such as **Atul Auto , Piaagaio vehicle , Kinetic Green** etc .

We estimate an initial investment of ₹ 6cr with a 6 ton/day Li-battery supply, daily profit of ₹ 3.25 lakh/day and achieving breakeven after 7 months.

Cost Breakdown

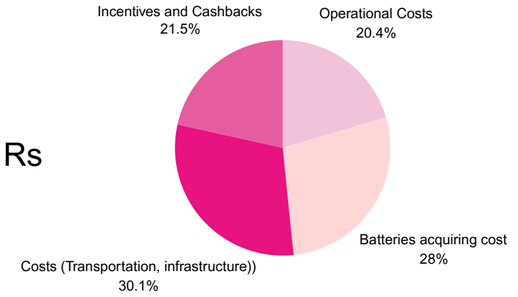
- Initially, we plan to establish a **facility housing 2 units of recycling machinery**, including a Shredder, Granulator, Pyrolysis System, and Separator.
- Each machine costs approximately 1.5 Crs and can recycle up to 500 Kg/hr.
- The total land required will be three times the area needed for two machines (15m * 6.5m * 2 * 3).
- Assuming the plant is located in Roorkee, the land cost there is Rs. 30,000 per square meter. Additional expenses will encompass raw material and labor costs.

Total machineries cost = 1.5 * 2 = 3 Crs
Land cost = 30,000 * 585 Sq. m = 1.75 Crs
Miscellaneous costs = 1.25 Crs

Total cost for setting up the plant = 6 Crs with a capacity of 600 kg/hr.
Daily revenue generated by the plant = 864 Rs. * 600 = 5 Lakhs/day

Revenue Breakdown

- Operational cost per kg = 90 - 100 Rs./kg
- Price of old batteries = 130 Rs. /Kg
- Price of Black Mass = 1000 Rs. /Kg
- Price of Black Mass present per Kg = 600 Rs
- Price of Copper per kg = 733 Rs./kg
- Cost of Copper present in 1 Kg = 220 Rs
- Cost of Aluminium present in 1 Kg = 44Rs



Running cost/day

INPUT	Quantity Assumed	Price (₹)	Cost incurred (₹)	Total Cost (₹)
Scarp Lithium Battery	6 Ton/day	13,000/T	78,000/day	
Power Consumption	DY-500 model - 185kwh x 2	6.5/ kwh	25,000/day (assuming 10hrs running)	**1.25 lakhs+ 50,000= 1.75 lakh/day**
Labor Cost	10-15	1,200/ day	20,000/day	

Revenue /day

Output	Quantity Assumed	Price (₹)	Revenue	Total Revenue (₹)
Refabricated Battery to industries	10%= 60kg/day	350/kg (assuming 10kg Li battery)	30,000/day	**4.5 lakhs/day (roughly)**
Chemicals powders (Cu, Al, Li, Black Mass)	5 ton/day	86,400/T	4,32,00/day	

Profit estimated/day= 4.5-1.75=2.75lakh/day

Break-Even analysis

We expect to reach breakeven point after **7 months** approximately based on assumption supply and revenue