Redefining clean energy storage world map....

$$E = MS^2$$

Energy for Mobility and Stationary Storage

Rechargion™

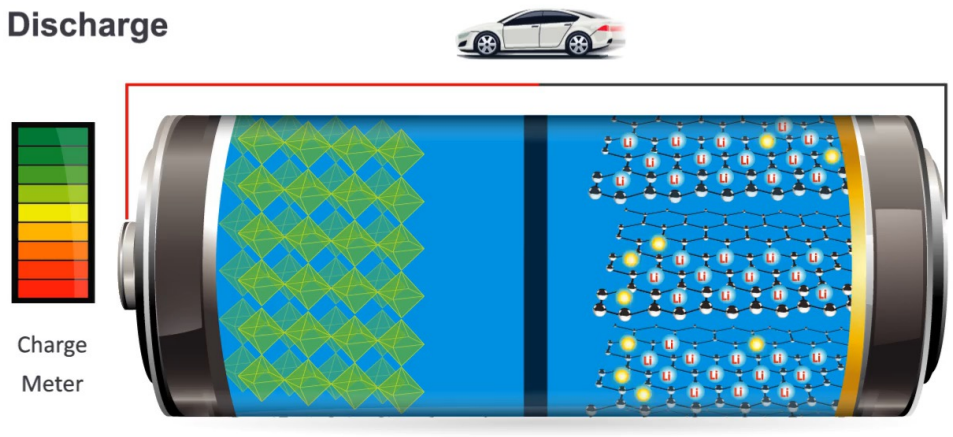
RECHARGION ENERGY Pvt. Ltd.,

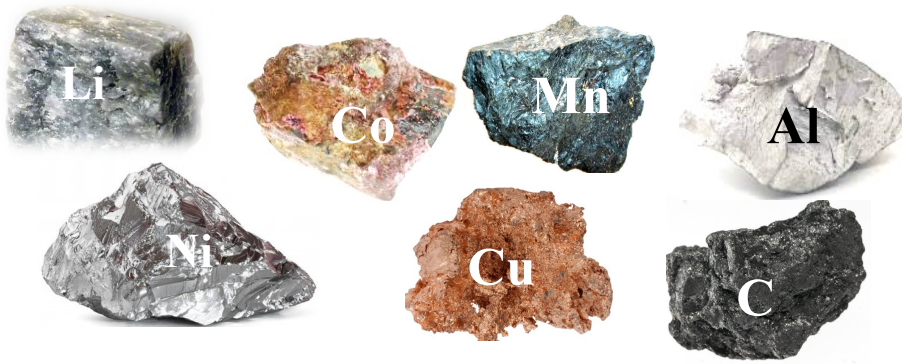
PUNE, INDIA

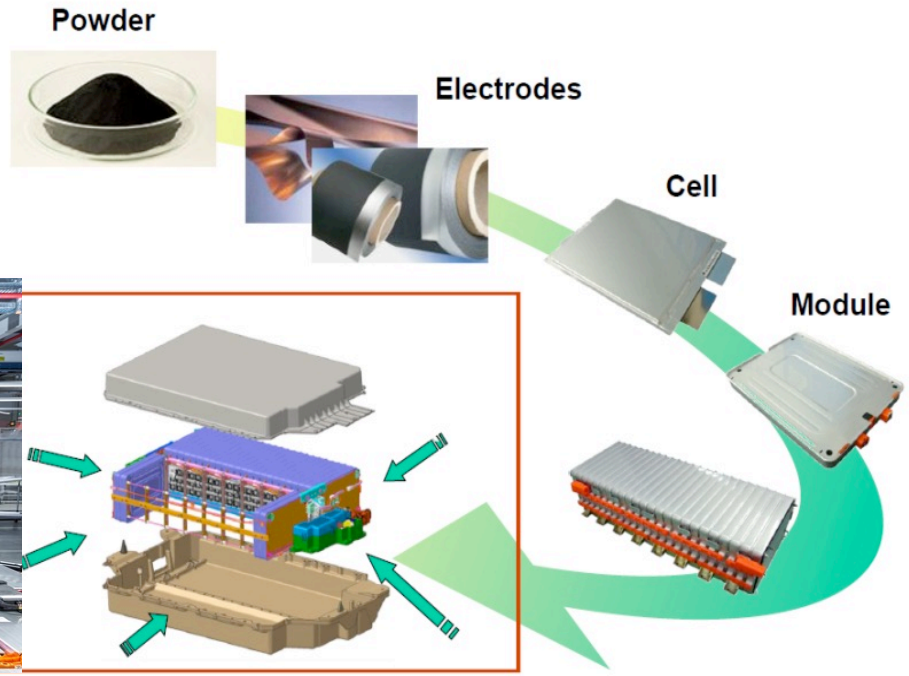
Supported/Mentored by-

National Chemical Laboratory · VENTURE CENTER · SOCIAL alpha · ARAI Progress through Research · NIDHI PRAYAS · सत्यमेव जयते Ministry of Heavy Industries Government of India · ARAI-AMTIF · USISTEF · UNIDO · Cummins

Battery Ecosystem

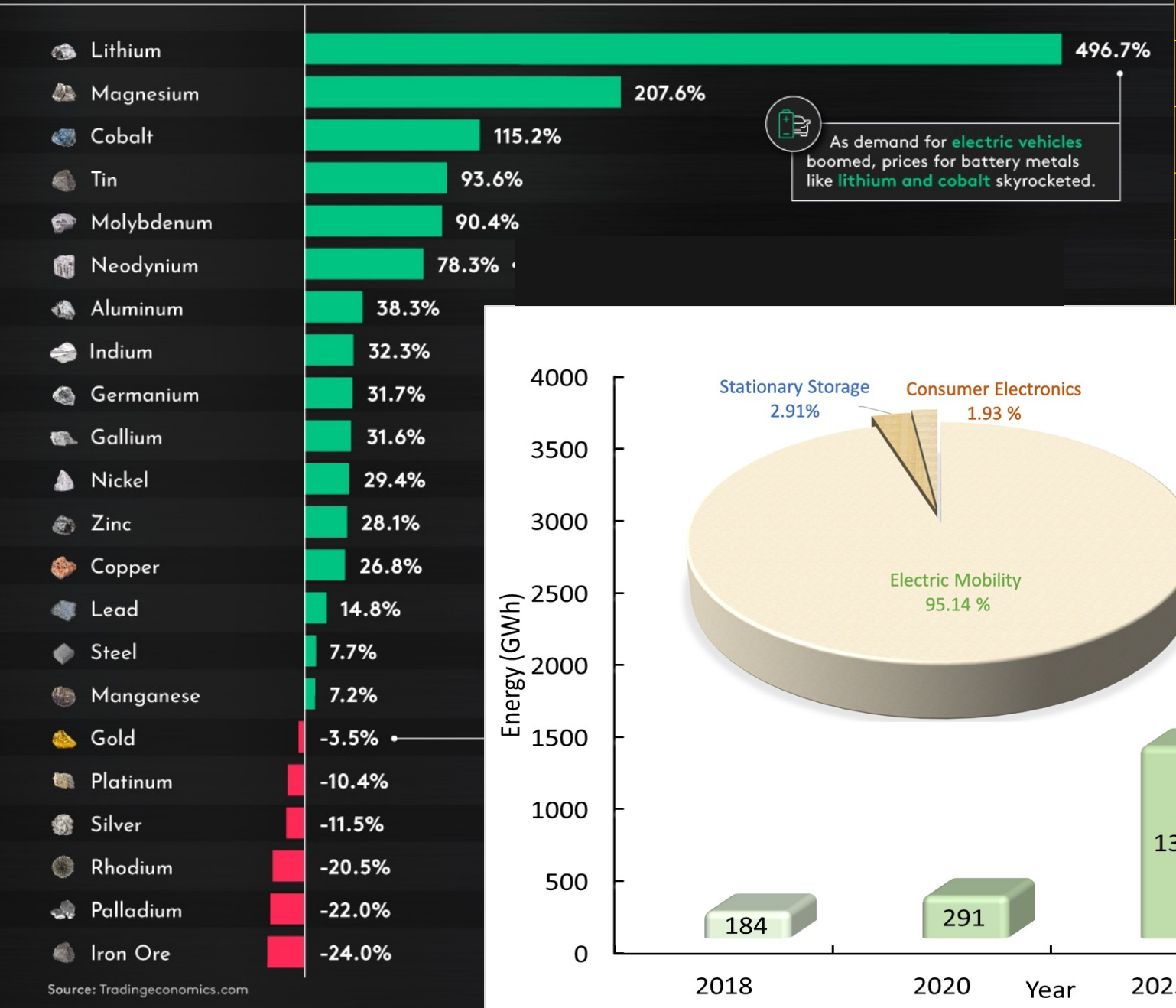






- Energy Density
- Cycle Life
- Safety
- Cost
- Sustainability
- Availability
- Eco-friendliness
- Recyclability

How Metals Prices Performed in 2021



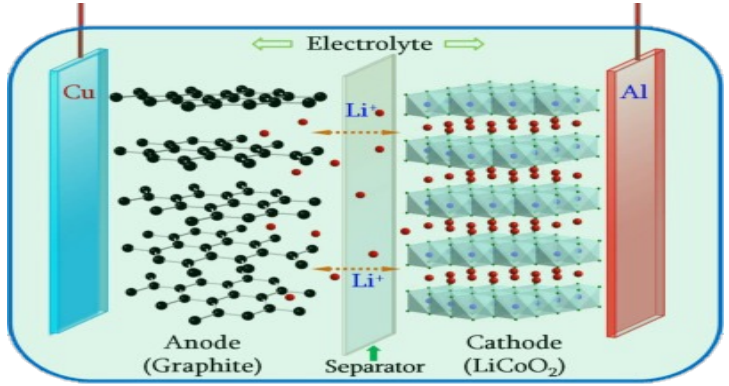
Material	Price per tonne
Lithium	$78,009
Cobalt	$46,902
Nickel	$26,751
Copper	$9,140
Manganese	$2,225

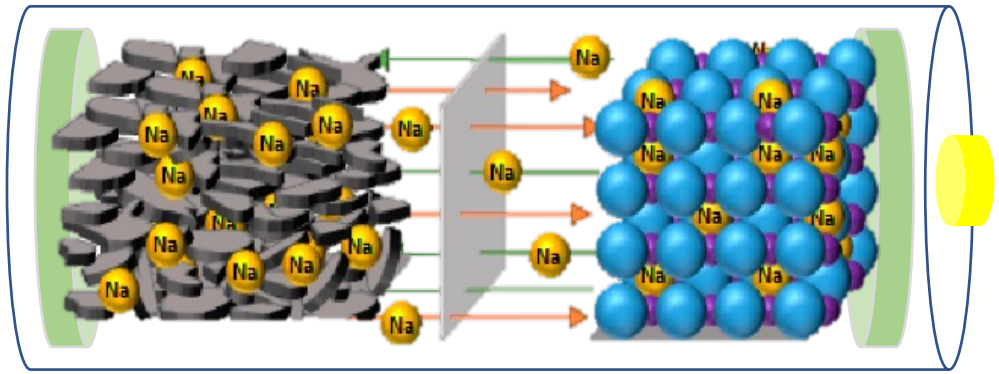
Wood Mackenzie 2021

Problems

Blood Batteries

Solution





	Commercial battery (Li-ion)	**Rechargion Battery (Na-ion)**
Anode	Graphite	Porous Carbon
Cathode	Lithium-Co/Ni/Mn/ Oxide	Sodium fluorophospate/Oxide
Electrolyte	$LiPF_6$	$NaPF_6$
Current collector	Copper/Aluminum	Aluminum
Casing	Coin/Pouch/Prismatic Cell	Pouch cell
Raw Materials	Mined outside India	**All domestic**
Safety	Low	Better
Cost	~ 170 $/kWh	< 100 $/kWh*

Key Performance Metrics

Six 'S' of Sodium

Sustainable

- ✓ Sodium is abundantly and proportionately available
- ✓ Li, Ni & Co-free cell chemistry

Safe

- ✓ Operating temperature range (-40 to 60 ^{0}C)
- ✓ Low thermal runaway
- ✓ 0 volt Storage and transportation

Suitable

- ✓ Surface derived raw materials
- ✓ Non-toxic materials
- ✓ Reduce Reuse Recycle

Scalable

- ✓ Energy density-150 Wh/kg
- ✓ Cycle life- 5000
- ✓ Voltage- 3.2 V
- ✓ Compatible for e-mobility/ stationary applications

Speed

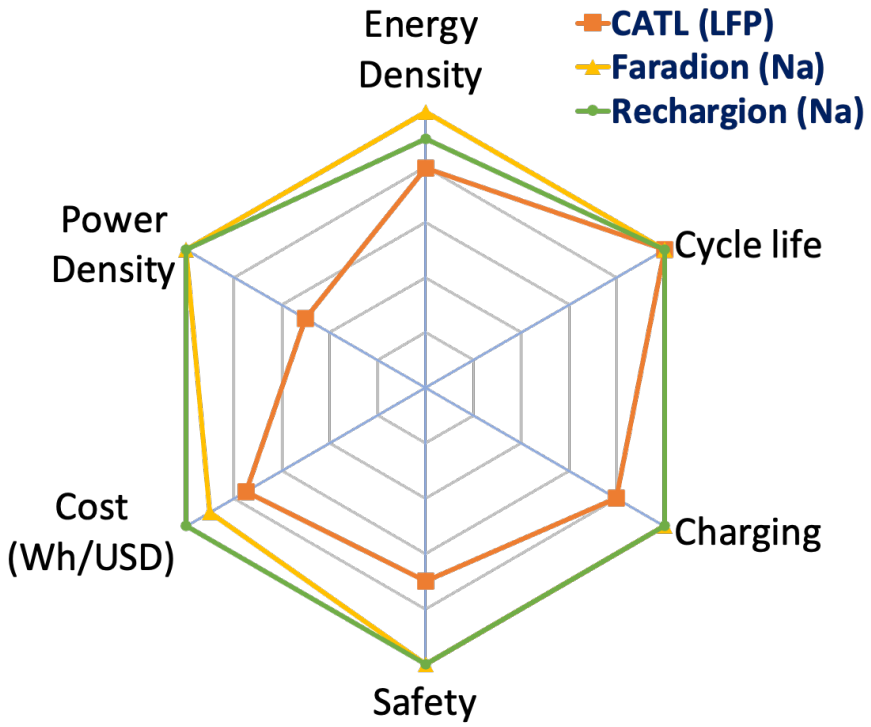
- ✓ Enhanced kinetics for charging speed (30 min)
- ✓ Up to 10 C charging/ discharging rate

Self-Reliant

- ✓ No import dependance
- ✓ Low capital and operating cost (~11 Rs/Wh)
- ✓ Domestic supply chain

Impact/Benefits

Na-ion battery is a Disruptive Technology

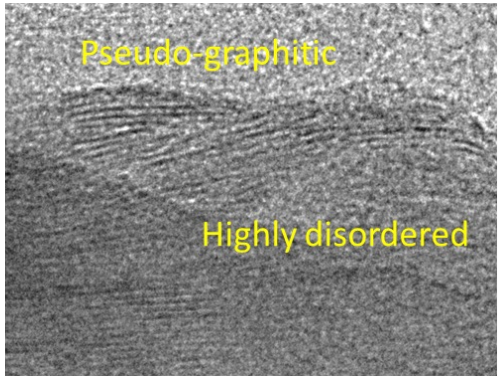


Current Status

Sodium-ion battery as an alternative for Li-ion battery

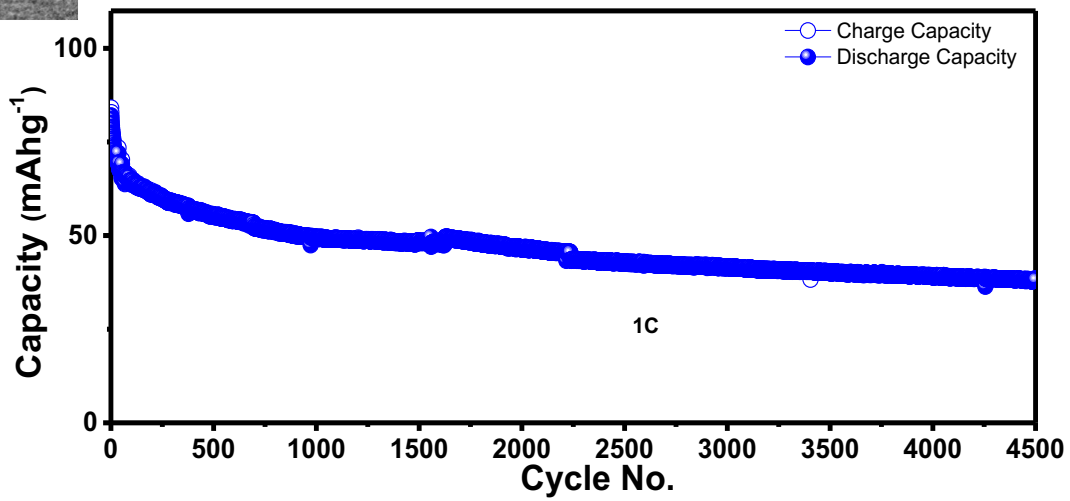
TRL 5: Lab-scale prototype is ready!

- **Proof of Concept:** Coin cell ~ 230 Wh/kg, 4500 cycles
- **Minimum Demoable Product:** Pouch cell 120 Wh kg^{-1}, 1000 cycles
- **Minimum Viable Product:** Pouch cell 150 Wh kg^{-1}, 5000 cycles

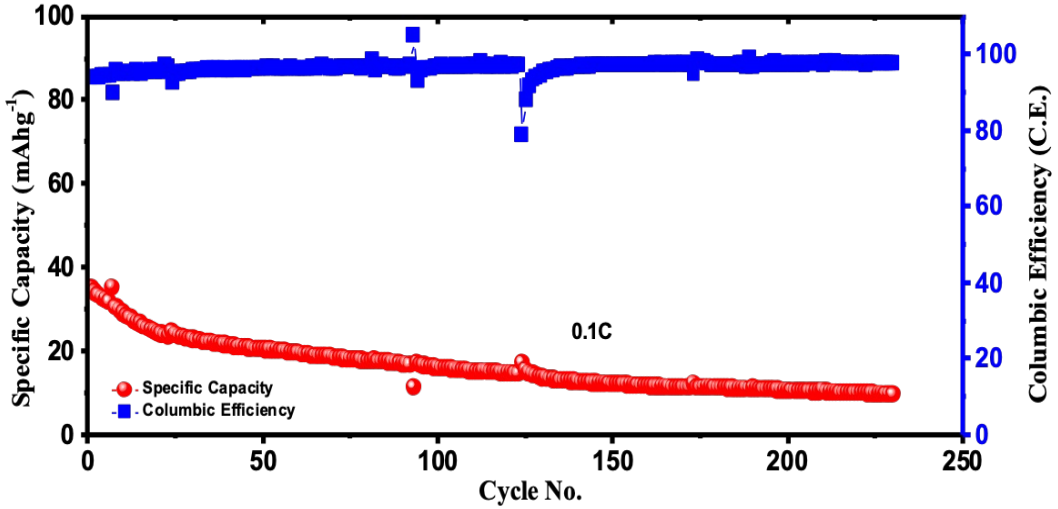


← Electrode material

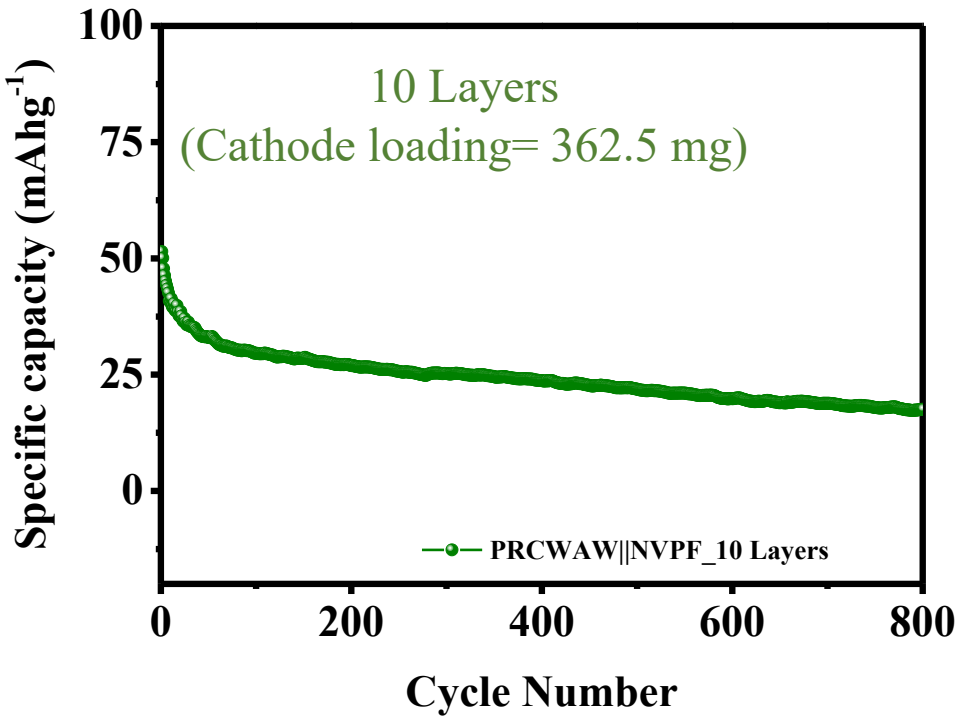
Coin cell performance

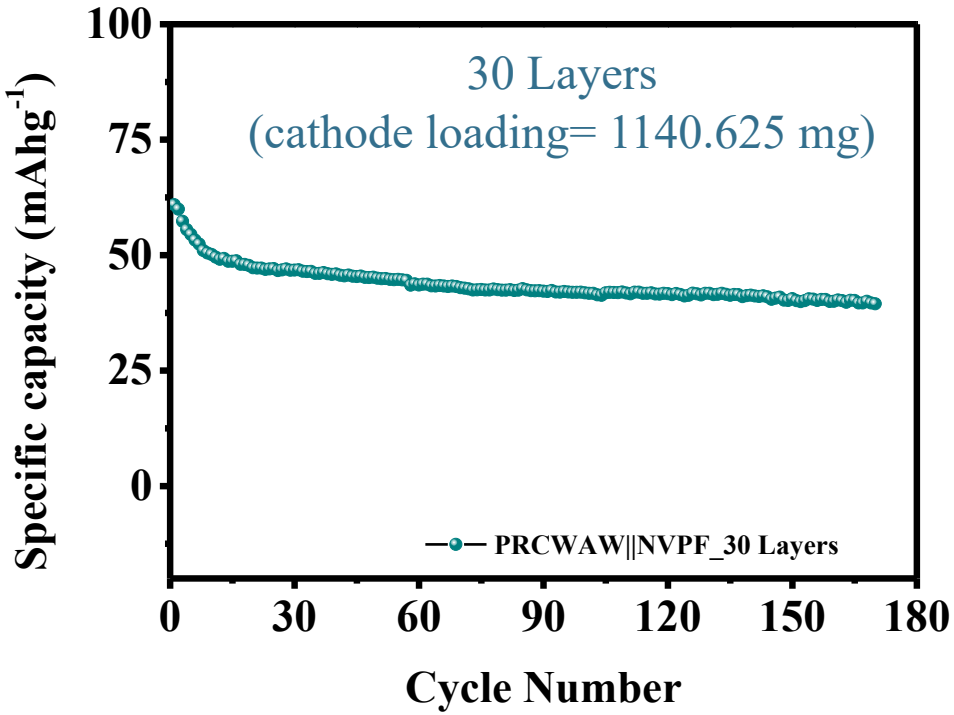


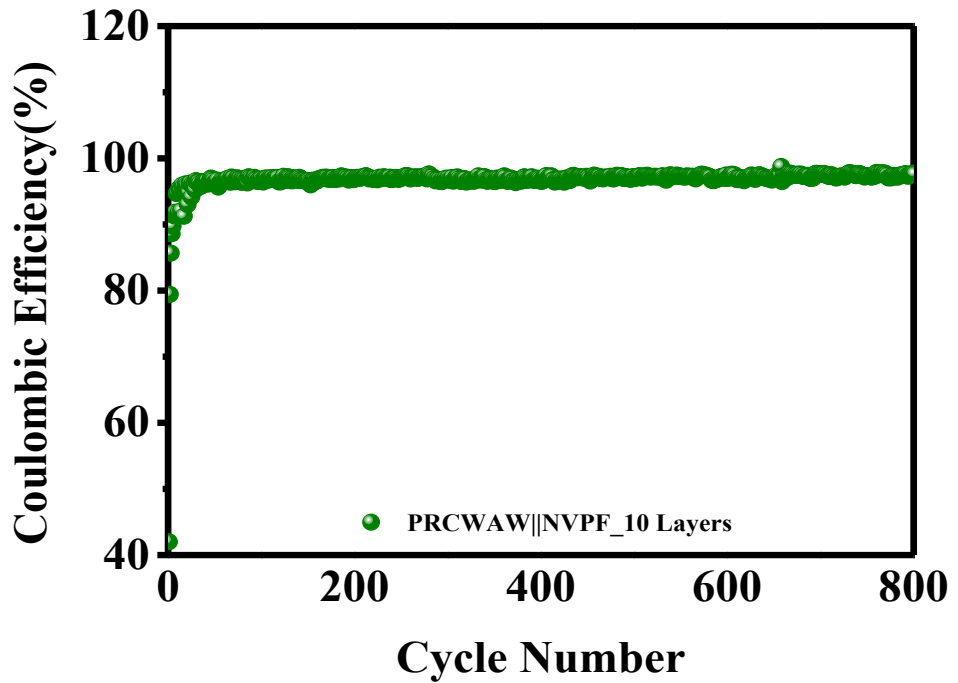
Pouch cell performance

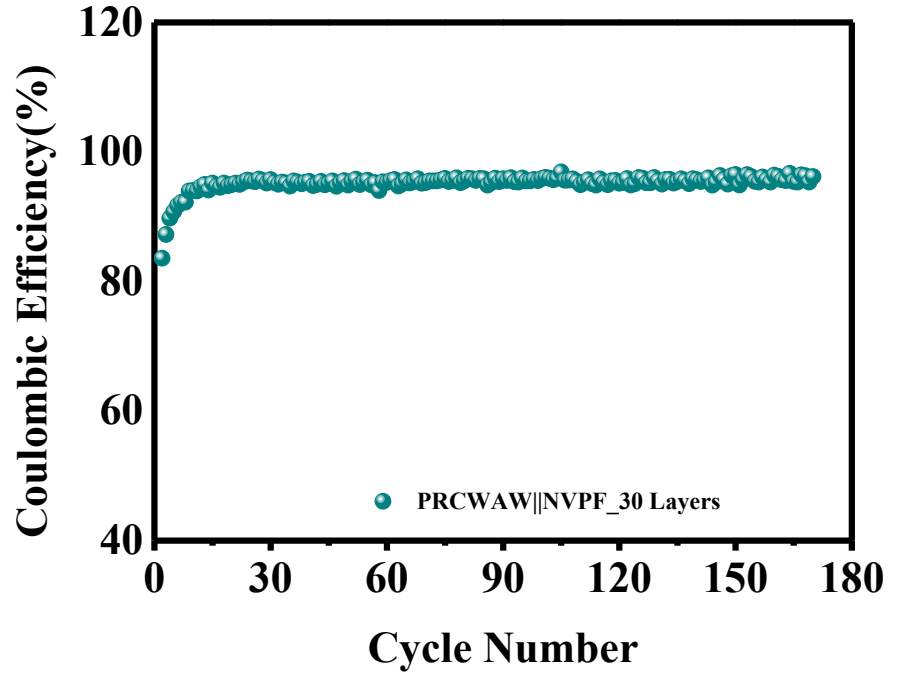


Multilayer Stack





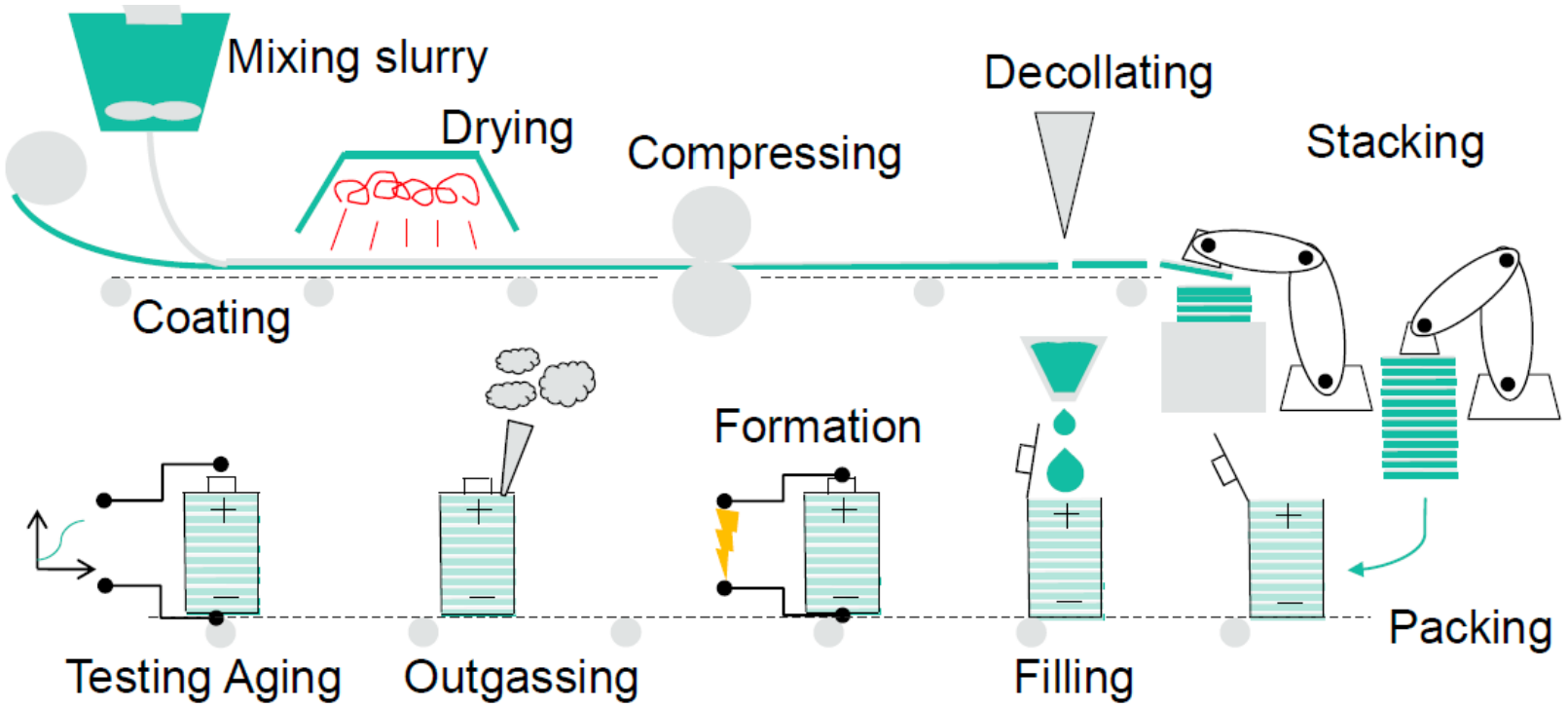


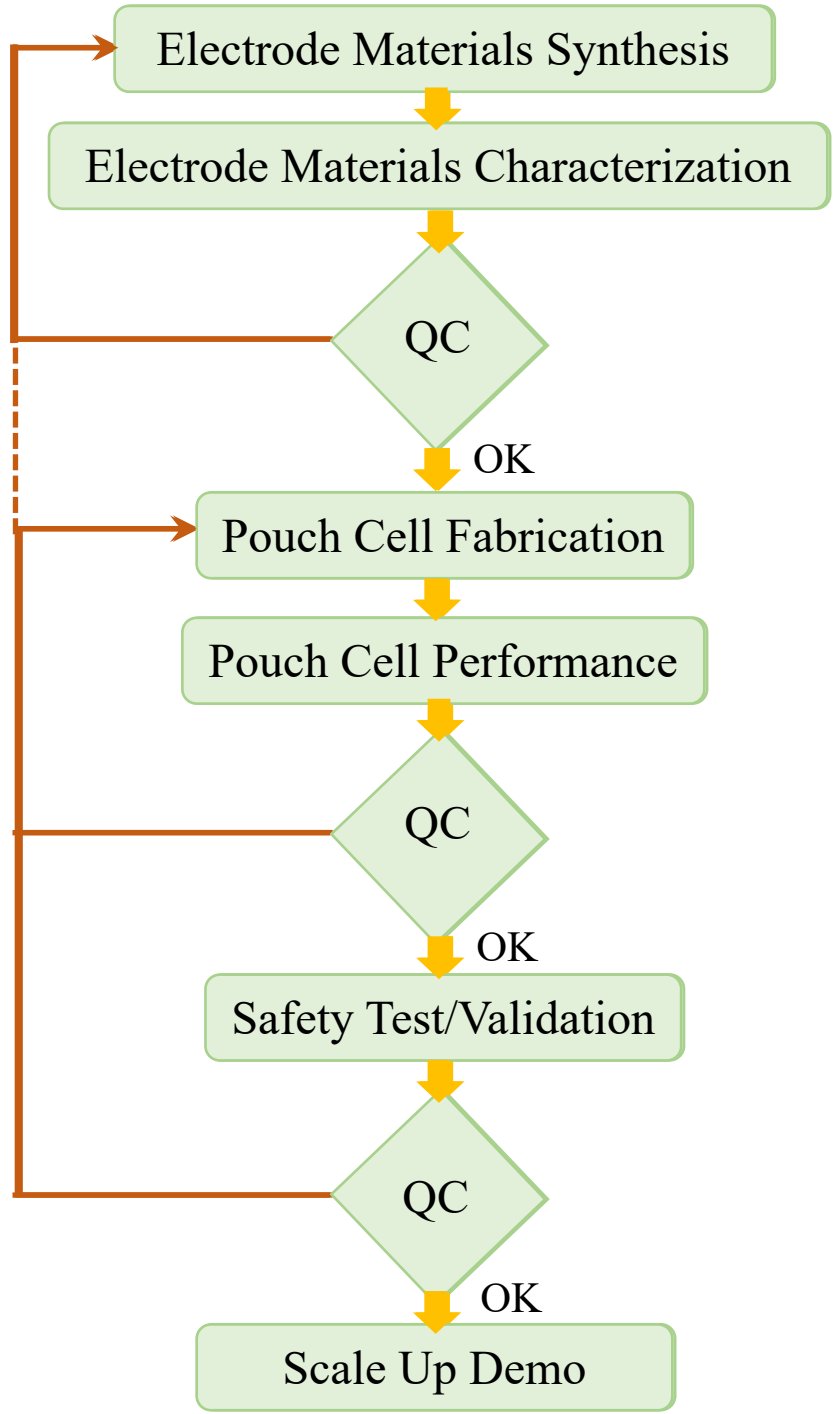


Scale-up Strategy

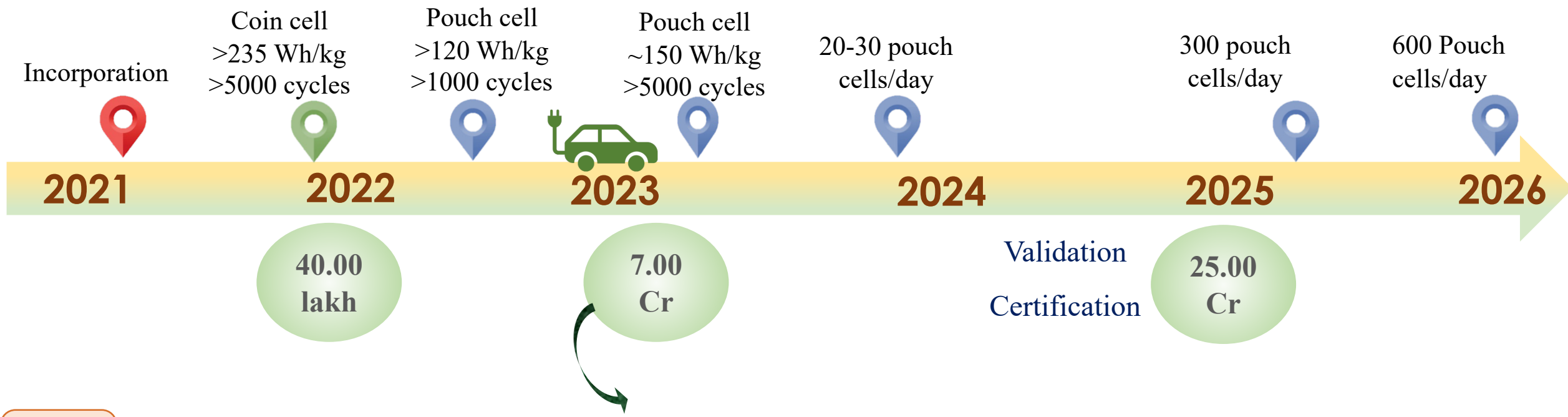
Translational Research from Laboratory scale to Industry Scale

- Electrode materials synthesis in kg size batches
- Customizable size and layers stacking pouch cell fabrication at pilot scale
- Large scale battery performance analysis
- Safety tests, validation, certification of the product





Roadmap



S	• Disruptive Technology
W	• Supply Chain
O	• Colossal Market size
T	• Inferior manufacturing

Source	CapEx (INR lakhs)	OpEx (INR lakhs)
MHI Industry Accelerator	**88.30**	**303.87**
US-India Endowment fund	**48.00**	**52.00**
Social Alpha	**150.00**	
United Nation Ind. Dev. Org.	30 K USD*	
NIDHI-SSS (MST)*	50.00	
Samridh Accelerator (MEiTY)*	40.00	
Atal New India (Niti Aayog)*	24.00	56.00

Business / Revenue Model

Sodium ion battery pouch cell

JV & strategic Partnerships in overseas market

Manufacturing 1000 pouch cells /day

Supply to Battery pack manufacturer

Supply to Electronic appliances manufacturer

Consumer

Supply to Secondary manufacturer

Consumer

Team

Founders

Chemist 19 Yrs

Dr. Manjusha Shelke

Chief Technology Officer

National Chemical Laboratory · RICE UNIVERSITY · PURDUE UNIVERSITY · iemn

Physicist 25 Yrs

Dr. Vilas Shelke

Chief Executive Officer

UNIVERSITÉ PARIS SUD · THE UNIVERSITY OF ALABAMA · RICE UNIVERSITY

Business 30 Yrs

Dr. John Normanton

Director, Strategic Mang.

imperial innovations · Sterix · 3i · IPSEN Innovation for patient care · UNIVERSITY OF OXFORD · NOVARTIS

Advisors

Dr. V. Premnath
Director, Venture Center,
NCL Innovation Park, India

Ms. Ujjwala Karle
Director, Tech Gr,
Automotive Research Asso. India

Prof. James Robinson
University College
London, UK

Company Profile

- CSIR- National Chemical Laboratory, Pune spin-off incorporated in 2021
- Techtonic Innovation in Clean Energy challenge, Social Alpha, 2021
- ARAI-UpTech challenge, Ministry of Heavy Industries, GoI, 2022
- NIDHI-PRAYAS grant, Ministry of Science & Technology, GoI 2022
- Industry Accelerator Program, Ministry of Heavy Industries, GoI, 2023
- US-India Science & Technology Endowment Fund, Ignition grant-II, 2023
- United Nation Industrial Development Organization, FLCTD challenge, 2023

Venture Center, Pune; AIMPRIME, NITI Aayog, India; UK-India Tech Start-up, UK; Soft Landing New York, USA

Scalability

Anode Materials:

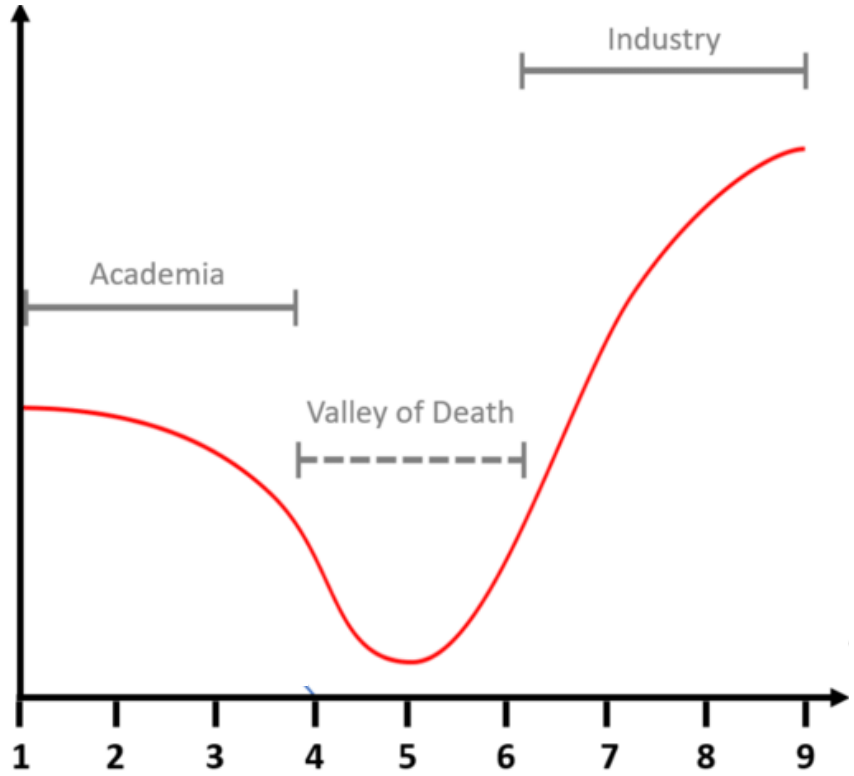
- Omnipresent variety of source material (Agro-waste, Bio-waste, Tar, Polymer etc)
- Functional groups and structural uniformity
- Phase purity and Homogeneity in kg or tonne batch size
- Processing infrastructure and logistic
- Environment and economics

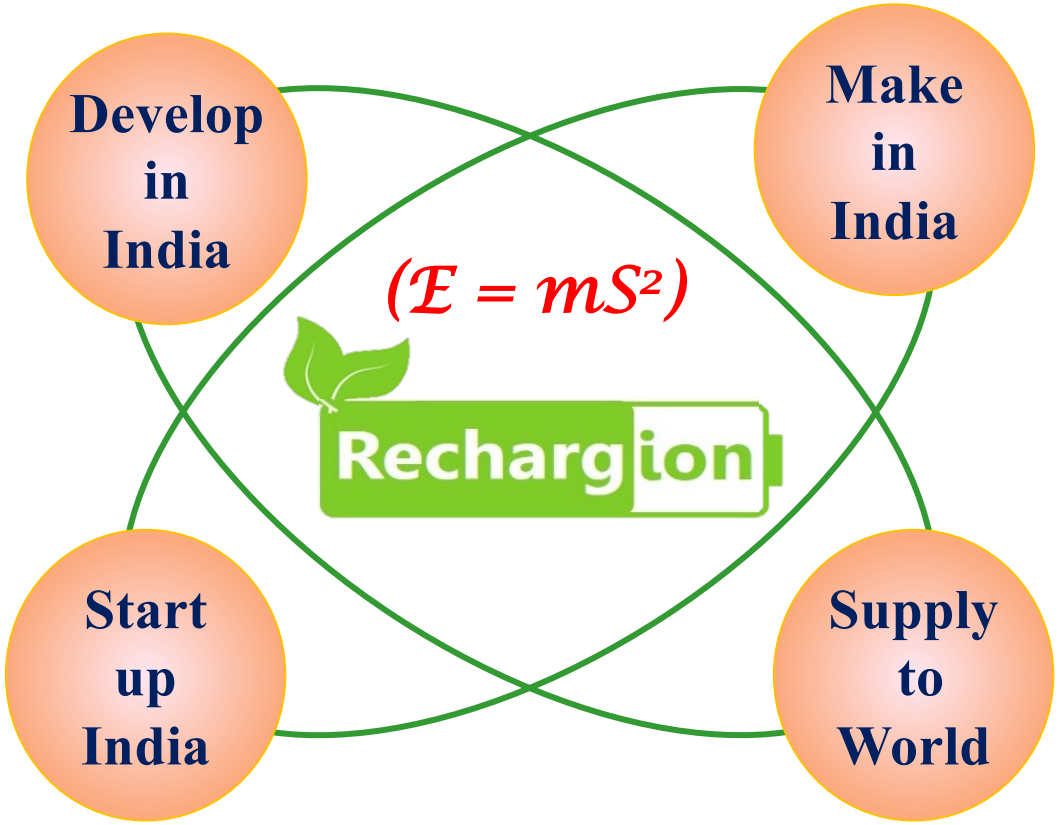
Cathode Materials:

- Industry scale availability and purity of raw materials
- Phase purity and Homogeneity in kg or tonne batch size
- Moisture sensitivity

Battery Fabrication:

- Glove box free dry room processing
- Automated assembly line
- In-line batch testing





We will make battery so **Cheap & Safe** that only the rich will use petrol!

THANK YOU