Disposal of EV batteries – Challenges and Opportunities

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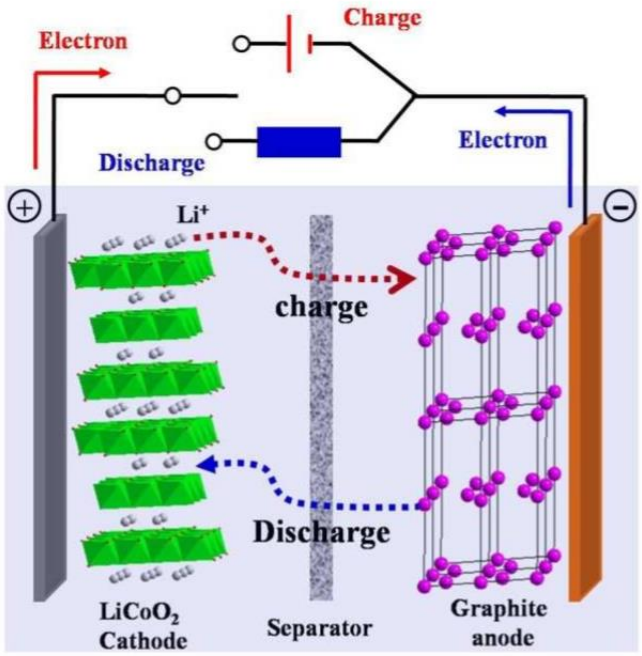
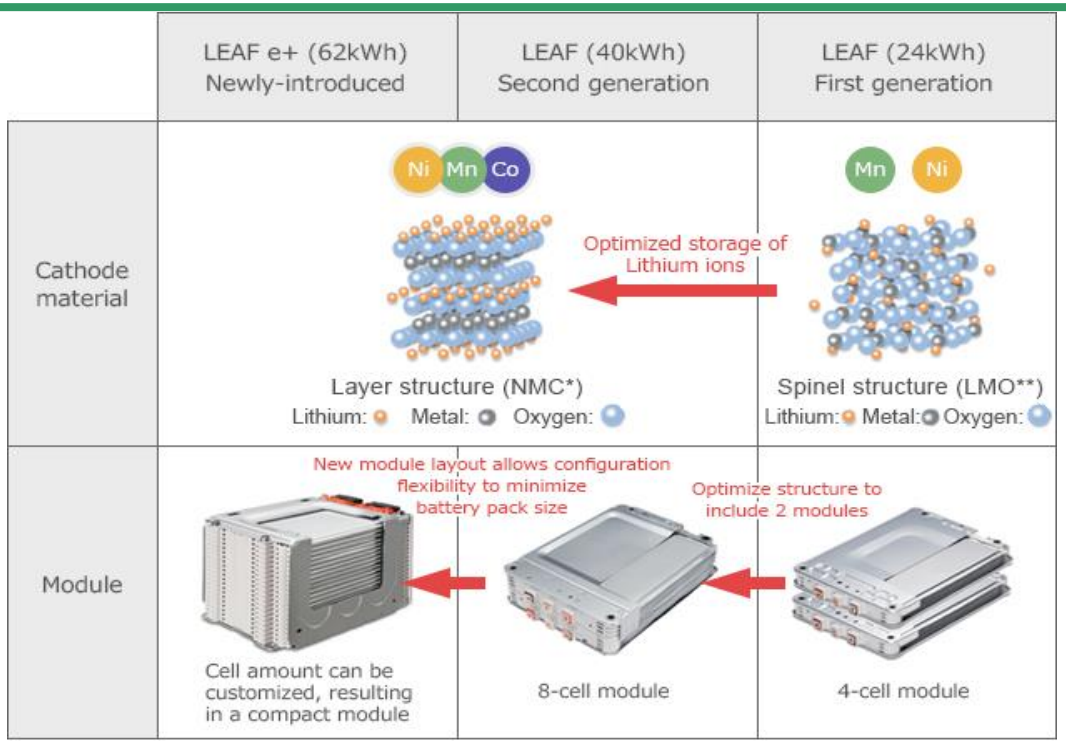
EV Battery – A quick Glance





Schematic diagram of Li-ion battery

Source: Source: Xu et al, 2014
Xu, et al, 2014, *Tuning the structure and property of nanostructured cathode materials of lithium ion and lithium sulfur batteries,* J. Mater. Chem. *A*, 2014,2, 19941-19962

Evolving materials used as cathode in Li-ion batteries

Source: https://www.nissan-global.com/EN/TECHNOLOGY/OVERVIEW/li_ion_ev.html

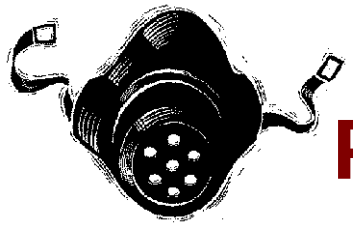
Challenges

Disposal

- Toxic elements like Li and Ni, other chemical moieties
- Lithium reacts vigorously with water, can significantly alter and destroy the natural chemistry of soil and water bodies.
- Indian EV market is projected to increase by 10 folds between 2017 and 2025, from $71.1 million to $707.4 million, which will lead to a massive increase in the stockpiles of spent batteries in the next decade.

Quantum of waste

- The EV battery market in India is expected to grow by 35 percent to 132 GWh by 2030 with projections stating that a recycling market will be valued at $1 billion is expected by 2030 (Economic Times, 2019).
- Blanket incineration is not feasible, as simply incinerating the 2 million tons of its e-waste, would result in 77 MtCO2e, thereby increasing our emissions considerably.



Present Rules and Regulations

- **Batteries (Management and Handling) Rules, 2001,** Includes battery but limited to lead acid battery which is a source of electrical energy and contains lead metal.

- **Hazardous Waste Management Rules 2003 -** waste which by reason of any of its physical, chemical, reactive, toxic, flammable, explosive or corrosive characteristics causes danger or is likely to cause danger to health or environment

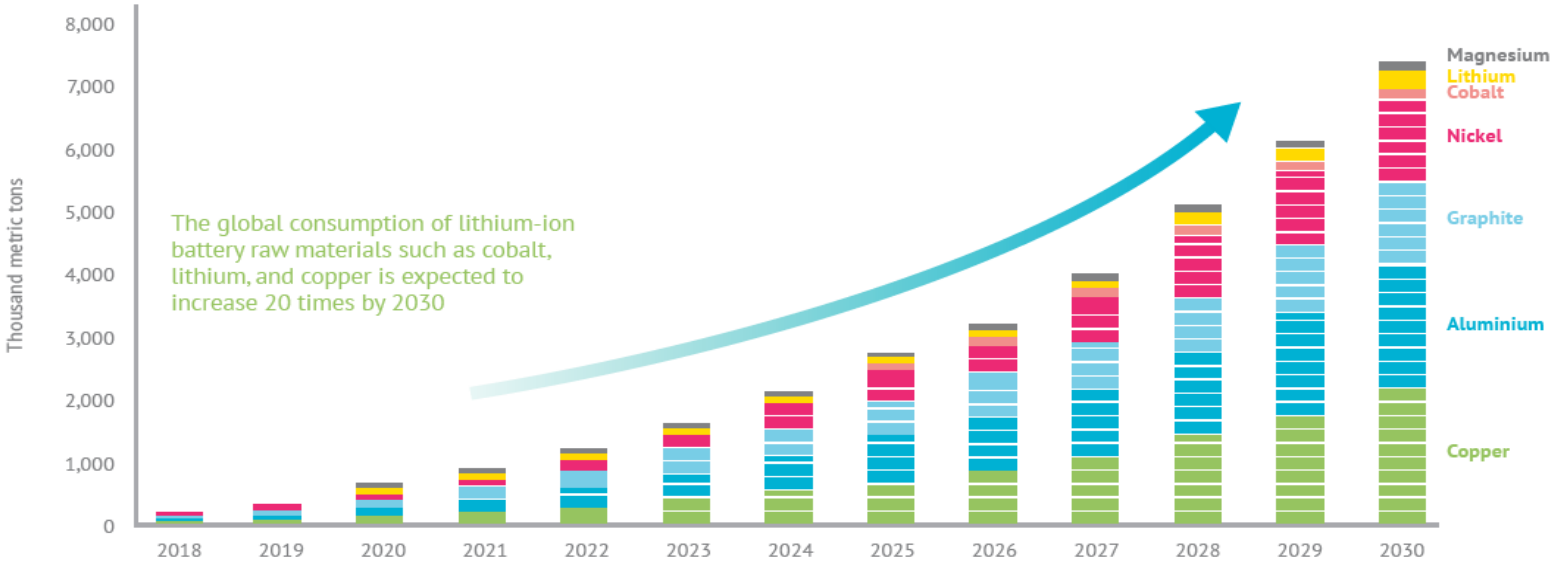
- **The Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008**. A list in Schedule I which inter-alia includes industries engaged in petro-chemicals, oil & gas, petroleum, mines and minerals, zinc, copper, lead based production, textiles, steel, asbestos, electronic, tannery.

- **E-waste (Management and Handling) Rules, 2011** was introduced that aimed to put in place an environmentally sound e-waste management system by regulating issues of disposal, import and recycling of e-wastes. **The E-waste Rules apply to every producer, consumer or bulk consumer (including factories under Factories Act)**

- **E-Waste Management Rules, 2016, and E-Waste Management Rules, 2018** work towards implementing revised percentages of EPR targets for companies within Schedule III. DO NOT mention Lithium

- **Battery Waste Management Rules, 2020** (Draft) – Does include Lithium – Not Notified yet, not specific to EV batteries.

What can be done



Source: “EV Outlook 2018, Bloomberg New Energy Finance

Second Life Usage → **Recycling** → **Safe Disposal**

What can be done?

Second Life Usage	
Spent battery – still has 80% power	**Grid, Energy Storage**
Recycling	
New legislation & infrastructure needed	**EPR – Specific to EV battery**
Disposal	
Potential dumping ground	**Develop Circular Economy**

Thank you!
Questions? Comments?