Lithium-ion Technology

Why in News

India, through a newly-floated state-owned company **Khanij Bidesh India Ltd,** has inked a pact with **an Argentine firm** to jointly **prospect lithium in Argentina,** a country that has the **one of the largest reserves** of Lithium in the world.

Key Points

- **Khanij Bidesh India Ltd** was incorporated in August 2019 by three state-owned companies, **NALCO, Hindustan Copper and Mineral Exploration Ltd,** with a specific mandate to **acquire strategic mineral assets such as lithium and cobalt abroad.**
    - It is also learnt to be exploring options in **Chile and Bolivia,** two other top lithium-producing countries.
- Lithium is a crucial building block of the **lithium-ion rechargeable batteries** that power **electric vehicles** (EVs), **laptops** and **mobile phones.**
- Currently, India is **heavily dependent on import of these cells** and the move to ink sourcing pacts for lithium is also seen as a move to **reduce its dependency on China** which is a **key source of both the raw material and cells.**
- India is seen as a late mover as it attempts to enter the lithium value chain, coming at a time when **Electric Vehicles** are predicted to be a **sector ripe for disruption.**
    - 2021 is likely to be a **turning point for battery technology,** with several potential improvements to the **Li-ion technology,** and alternatives to this tried-and-tested formulation, under **advanced stages of commercialisation.**

- **About Li-ion Batteries:**
    - A lithium-ion battery or Li-ion battery is a type of **rechargeable battery.**
    - Li-ion batteries use an **intercalated** (Intercalation is the reversible inclusion or insertion of a molecule into materials with layered structures) lithium compound as one electrode material, compared to the metallic lithium used in a non-rechargeable lithium battery.
    - The battery consists of electrolyte, which allows for **ionic movement,** and the two electrodes are the constituent components of a lithium-ion battery cell.
    - Lithium ions move from the **negative electrode** to the **positive electrode during discharge and back when charging.**
- **Lithium-ion Battery Applications:**
    - Electronic gadgets, Tele-communication, Aerospace, Industrial applications.
    - Lithium-ion battery technology has made it the favourite power source for electric and hybrid electric vehicles.
- **Disadvantages of Li-ion Batteries:**
    - Long charging times.
    - Safety issues as instances of batteries catching fires have been there.
    - Expensive to manufacture.
    - While the Li-ion batteries are seen as sufficiently efficient for applications such as phones and laptops, in case of EVs, these cells still lack the range that would make them a viable alternative to internal combustion engines.

- **Potential Alternatives to Li-ion technology:**
  - **Graphene Batteries:**
    Graphene batteries may be an important alternative to lithium-ion batteries, with the latter having limitations due to the frequency with which lithium requires charging. Graphene is a newly stabilized and isolated material.
  - **Fluoride Batteries:**
    Fluoride Batteries have the potential to last eight times longer than lithium batteries.
  - **Sand Battery:**
    This alternative type of lithium-ion battery **uses silicon to achieve three times better performance** than current graphite Li-ion batteries. The battery is still lithium-ion like the one found in a smartphone, but it uses silicon instead of graphite in the anodes.
  - **Ammonia-powered Batteries:**
    - Ammonia-powered batteries may not be coming any time soon, but the chemical commonly known as a household cleaner is still an alternative to lithium in the way it can power fuel cells in vehicles and other equipment.
    - If scientists can figure out a way to produce ammonia without creating the greenhouse gas emissions that result right now, they can ship it anywhere in the world to be converted into hydrogen to power those fuel cells.
  - **Lithium-Sulfur Batteries:**
    Researchers in Australia say they have developed the world's most powerful rechargeable battery using lithium-sulfur, said to perform four times better than the strongest batteries currently available.
  - **Vertically Aligned Carbon Nanotube Electrode:**
    These are good candidates for lithium-ion battery electrodes which require high rate capability and capacity.
  - **Solid-state Batteries:**
    - It uses alternatives to **aqueous electrolyte solutions,** an innovation that could lower the risk of fires, sharply increase energy density and potentially take only 10 minutes to charge an EV, cutting the recharging time by two-thirds.
    - These cells can extend the driving distance of a compact electric vehicle while maintaining legroom - a quantum leap in battery tech.

Source:IE