Rechargeable Batteries

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Key Question:

How can we use rechargeable batteries in a safe, sustainable, and economical way?
History

1980: John Goodenough made first lithium ion battery

1991: Battery first commercialized
Background

Parts Of Battery:

- Anode
- Cathode
- Electrolyte
Experiment
Public Policy

The Two Main Concerns Regarding Lithium Ion Batteries:

- Transportation
- Disposal

![Lithium Battery Mark](image)

![Class 9 hazard label](image)
Health, Safety and Environmental Concerns

While there are many advantages, there are also several risks:

- The EPA found that Li-ions can cause resource depletion and ecological toxicity
- Lithium accumulation in the human body can cause genetic, renal and neurotoxicity
- The use of flammable organic electrolyte solutions pose safety risks
- There is not yet a significant recycling infrastructure for rechargeable batteries
Economic Impacts

- **Affordable** energy storage links reliability and renewable energy together
  - Productivity increases
  - Less wasted inputs
  - Number and/or scale of businesses increases

- **Demand-charge Management**
  - Customers are charged during peak times
  - $9 per kw can drop to $5-4 per kw
Looking Into the Future

- Rechargeable battery with liquid electrodes
  - Longer-lasting and faster recharge time
- Using alternate elements
  - Sodium, Hydrogen, Magnesium, Sulfur, Potassium
  - All abundant and much cheaper than using Lithium
  - Similar performance
Classroom Applications

A battery lesson can be easily incorporated into the classroom setting.

Students could:

- Take a poll of battery usage in their homes and record the findings.
- Compare rechargeable batteries to non-rechargeable ones.
- Calculate the number of batteries used and disposed.
Example Lesson Plan

Objectives
Students will:
1. Follow the development of primary and secondary batteries.
2. Become familiar with the different types of batteries
3. Explore the many uses for batteries
4. Study the parts of a battery and how one works
5. Learn which batteries can be recycled
6. Realize the economic and environmental advantages of using rechargeable batteries
7. Become familiar with the rechargeable battery recycling program
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Questions?
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