Lithium-Ion Batteries: The Incumbent Technology Platform for Coal Regions in Transition

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Prices
Lithium-ion battery prices have fallen 85% since 2010

Source: BloombergNEF
This is largely thanks to the EV industry

Annual GWh demand

- Stationary storage
- Consumer electronics
- E-buses
- Passenger EVs

Source: BloombergNEF, Avicenne
Battery rack costs

Other costs

Source: OERhub.net
System level prices continue to fall

20MW/80MWh system

Source: Bloomberg New Energy Finance. Note * Includes a 10% EPC margin. Developer overheads set at 5% of total system costs, and developer margin set at 10%.
This has led to Lithium-ion dominating the storage market (on a power basis)

Source: Bloomberg NEF. Note: Excludes pumped hydro. If multiple technologies are selected, the capacity is divided equally amongst them.
But other technologies can be better on an energy basis

Source: Bloomberg NEF. Note: Excludes pumped hydro. If multiple technologies are selected, the capacity is divided equally amongst them.
The Good & Bad
Why use storage? (and particularly lithium-ion)

Fossil Fuel generator providing frequency response

Source: Pixelartmaker.com
Generating assets aren’t good for quick response

Fossil Fuel generator providing frequency response

Battery storage providing frequency response

Source: Pixelartmaker.com

Source: Groundreport.com
Lithium-ion batteries biggest weakness is commodity prices

Lithium hydroxide price - Asia

Cobalt spot price - Shanghai

Source: Bloomberg New Energy Finance, Benchmark Minerals, Antaike Note: prices correct as of January 28, 2018
Cobalt can be avoided

Source: Bloomberg NEF Note: Excludes pumped hydro. If multiple applications are selected, the capacity is divided equally amongst them.
What does the future look like?
Energy shifting dominates the market

Source: Bloomberg NEF Note: Excludes pumped hydro. If multiple applications are selected, the capacity is divided equally amongst them.
Energy shifting will create new opportunities for storage

Cumulative storage deployments by application, based on power output

Cumulative storage deployments by application, based on energy capacity

Source: Bloomberg New Energy Finance
There are somethings lithium-ion probably won’t be able to do.

**Generation (GW)**

**Germany low renewable generation week, 2040**

- Curtailment
- Charging
- Discharging
- Solar
- Wind
- Dispatchable
- Nuclear
- Demand

**Source:** Bloomberg NEF
Particularly long duration energy shifting

New storage technologies, with a long storage duration, are needed for shifting loads by weeks or months.

Source: Bloomberg NEF
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