

Weekly Briefing

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Raw Materials Used To Make Lithium-Ion Batteries

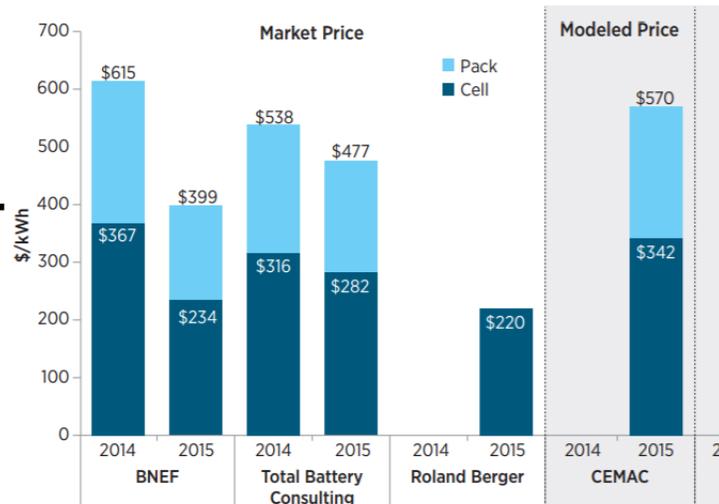
- There are many components and raw materials that go into lithium-ion batteries to power electrified vehicles.
- Fluctuations in commodity prices can have an impact on battery costs and prices.
- Two commodities which may be pressure points are lithium and cobalt.

In February, 2017, the U.S. Department of Energy issued a bulletin summarizing recent estimates of lithium-ion battery (LIBs) costs [here](#). The chart to the right appeared in this bulletin and shows several estimates of market prices and modeled prices of LIBs designed for electrified vehicles (EVs), with a breakout of the battery cell and pack pricing. The DOE took surveys of the market for different types of batteries, since battery costs and pricing vary depending on the type of EV being produced (plug-in hybrid, battery electric). The surveys are aggregated in an average manufacturers' price for commercially available technology, whereas the modeled price is a calculation made by DOE's Clean Energy Manufacturing Analysis Center (CEMAC).

This DOE bulletin is worth reading if you are interested in learning more detailed dynamics around battery technology and the bridge to commercialized costs and markups. One observation from this chart is that both BNEF and Total Battery Consulting surveys report battery cost declines in 2015 as compared to the prior year. BNEF's calculations imply that nearly two-thirds of the overall battery price reduction is due to a drop in cell prices, whereas Total Battery Consulting cell prices account for 55% of the overall battery price decline.

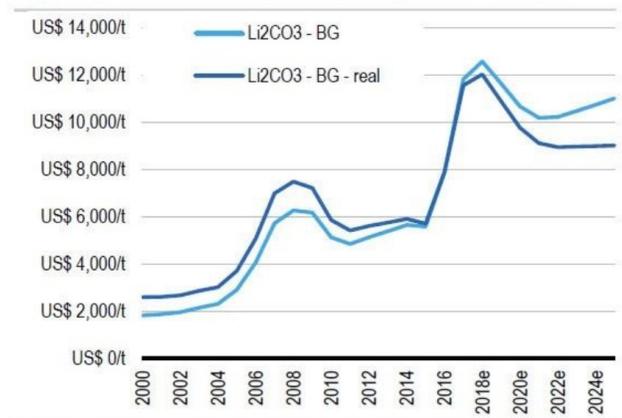
There are many factors influencing cell and pack prices, not the least of which is the array of raw materials used to produce LIBs. The charts on the right show recent pricing trends in two of the raw materials used for certain components of LIBs: Lithium and cobalt.

- Two forms of lithium — lithium carbonate and lithium hydroxide — are needed for the cathode (negatively charged electrode) of an LIB.
- Four major companies extract lithium on a large scale with production concentrated in Chile, China, and Australia.
- Lithium prices have been volatile and recent quotes are above \$10,000 per tonne (Li carbonate). Some of the recent surge could be due to rising expectations of EV production, particularly the Tesla Model 3 and GM Bolt.
- Cobalt pricing has also increased since 2016, when there was increased speculation that China, Europe, and other countries were potentially positioning policies to promote EVs. Cobalt is mined in the Republic of Congo, but is traded on the London Metal Exchange.



BNEF = Bloomberg New Energy Finance; CEMAC = Clean Energy Manufacturing Analysis Center

Figure 84: Lithium carbonate – battery grade – prices



Source: Roskill, Benchmark Mineral Intelligence, UBS estimates

Cobalt Prices on the London Metal Exchange US \$s per tonne

