



\$100/kWh Tesla Battery Cells This Year, \$100/kWh Tesla Battery Packs In 2020

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June 9th, 2018 by [Dr. Maximilian Holland](#)



One of the more interesting revelations to come out of the [2018 Tesla Shareholder Meeting](#) was updated information about Tesla's current battery costs and projected reductions over the next 2 years.

Battery costs, coming through cutting-edge cell chemistry as well as more efficient production processes, are a key differentiator in **the race to enable EVs that achieve overall price competitiveness with combustion engine vehicles** — at the cash register, not just over the ownership lifetimes of the vehicles. Batteries are equivalent in importance to the historical importance of having efficient and cost-competitive combustion engine technology.

It is well known that Tesla has the highest production volume and lowest cost of lithium-ion batteries in the world, but more detailed figures on these costs only emerge occasionally. This past week included some such figures.

Thank you, Joel

A question was put forward by shareholder Joel Sapp, via twitter, during the annual shareholder meeting — “has Tesla broken the seal of \$100/kWh?” Initially, Chief Technical Officer J.B. Straubel gave a polite, interesting, but non-specific answer regarding the current costs. Then CEO and Chairman Elon Musk took the microphone and answered as follows:

“We think at the **cell** level probably we can do better than \$100/kWh maybe later this year ... depending upon [stable] commodity prices.... [W]ith further improvements to the cell chemistry, the production process, and more vertical integration on the cell side, for example, integrating the production of cathode and anode materials at the Gigafactory, and improved design of the module and pack, we think long-term we can get below \$100/kWh at the **pack** level. Which is really the key figure of merit for a car. But long-term meaning definitely less than 2 years.”

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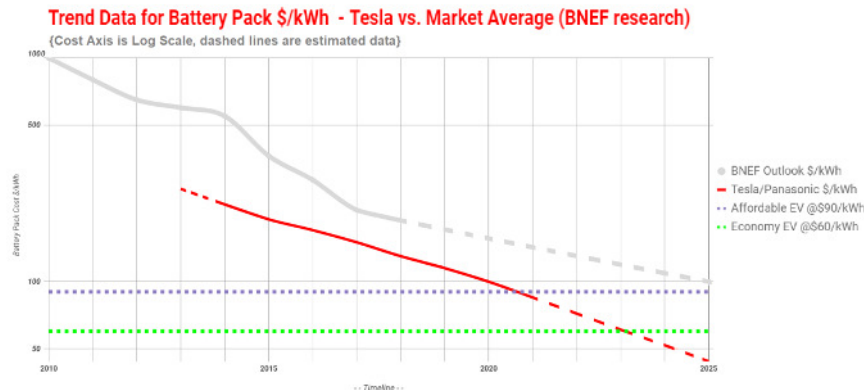
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The broader trend

It's good to see Tesla is still both well ahead of the competition on costs today and also still on track to keep improving costs **at around 15% per year**. The most recent cost indication we had was in early 2016, when Tesla said it was already under \$190/kWh cost at the pack level. Transforming cells, via modules, into the whole battery pack typically adds 30% cost per kWh on top of the cost of the cells alone. Here's the graph of Tesla's battery pack cost trend line, showing significant cost advantage over the industry average, which is regularly tracked by **BNEF**:



This graph demonstrates that Tesla is around 4 to 5 years ahead of the industry average cost per kWh, a large part of the reason why the company can offer much more compelling and better value EVs than any of the legacy automakers. Indeed, in the **"small luxury car"** segment (or in the **"mid-sized premium sedan"** segment, depending on how you categorize things) Tesla is **already outselling combustion cars in the US**.

Implications for more affordable EVs

Given that Elon Musk said that in 2 years time (2020) the *battery pack cost* per kWh will likely achieve the cost point that the *cell cost* will achieve later *this year* (2018) — and estimating that the pack adds around 30% to the cost — we can see that Tesla remains on an approximate 15% per year cost reduction curve. Going forward, if it can maintain this trajectory (and there is every indication that it can and is determined to), Tesla will pass pack-level costs of \$90/kWh in 2021, and \$60/kWh in 2023.

This means that compelling and competitively priced EVs will soon be able to successfully compete in even lower priced segments of the auto market, and continue from there to make more and more affordable EVs possible. On this trend line, even the small economy car segment of the auto market (around the \$15,000 price point) will see compelling EVs capable of all use cases, including long highway journeys, by 2023. At that point, EVs will have indisputably won the competition with fossil fuel powertrains. [Editor's note: **Another note from the annual Tesla shareholder meeting**, perhaps the most interesting and exciting, is that Tesla has changed course and will go into the lower compact car segment — possibly in 5 years.]

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