CellEst 2.1 Update

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CellEst has been updated to version 2.1. The largest update is the addition of consideration for stack-level costs as a separate entity from cell-level costs. These calculations omit cell design considerations, allowing users to focus purely on the properties of the active stack. This may be useful in early research stages when factors such as overhangs and cell thickness are not yet known or relevant. The layout of the model has been modified to accommodate these additional calculations. Other minor edits were also made throughout the model such as streamlining of equations and formatting changes.

Since CellEst 2.0 was published along with its accompanying study in the Journal of Power Sources Advances (https://doi.org/10.1016/j.powera.2021.100055), the market prices of battery components and materials has changed. Accordingly, prices have been updated. When CellEst 2.0 was constructed, the Shanghai Metal Market (SMM) was used for most prices, but some were unavailable on the website. SMM now provides prices for aluminum and copper current collector foils, however, so the "Material Costs" sheet has been updated. They are provided as processing fees rather than the prices of completed foils, so these processing fees are added to the prices of their respective metal ingots to calculate a total foil price. This resulted in an increase in copper foil price and a decrease in aluminum foil price. As SMM indicates that 6 µm copper foils are now commercially sold, the copper current collector foil thickness in CellEst has been set to 6 µm, reduced from its previous value of 10 µm.

Cathode-related prices have seen significant development. While the prices of manufactured cathode active materials (CAMs) have reduced slightly, the prices of the metal compounds used to produce these CAMs have increased dramatically. This was observed for all compounds, though some cases were particularly extreme, such as for lithium carbonate and lithium hydroxide, whose prices have increased by over 150% relative to their December 2020 values.

Because of these price fluctuations, the "metal costs" calculated in CellEst are now larger than the open-market prices of the associated CAMs. This results in negative Processing Cost and Profit Margin (PCPM) values, indicating that CAM material manufacturers relying on the open market for their materials would currently be forced to sell at a loss. The PCPM values calculated in CellEst 2.0 have thus been reused in CellEst 2.1, as it is not realistically possible for the CAM manufacturing process to have no cost or a negative cost. This reflects something closer to the "true" bottom-up cost of the cells. Users may edit these PCPM values to 0, or use solely the manufactured CAM prices, if they so choose. This would reflect the costs that a cell manufacturer might pay in a market where its CAM supplier sells at a loss due to market dynamics.

Graphite prices also slightly increased, though not as significantly as did CAM raw material prices. Electrolyte, however, nearly doubled in price.

A scan of Alibaba did not reveal significant changes in the markets for the materials whose prices were sourced from it. These material prices were thus unaltered from their values in CellEst 2.0. However, it should be kept in mind that these prices are more subjectively chosen, as there are often dozens of vendors for each material with a variety of possible prices.

Overall, market prices of lithium-ion battery materials can be seen to have increased in the last year. As a result, using the CAM prices calculated as described above, total cell costs per kWh increased by 26%-36% depending on cell chemistry when utilizing graphite as the sole anode active material. These results illustrate the need to perform regular updates when analyzing costs, as markets can change significantly over time.