Lithium batteries for wind turbines

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The renewable energy transition involves harnessing epic forces of nature. Sleek solar panels forged from silver and silica from the depths of the Earth translate the sun"s blindingly fiery light energy into electricity. Wind turbines with blades each the size of a 12-story building punctuate the skyline of wind-swept fields and help power entire cities.

Batteries help store surplus energy. When the electric grid has all the energy it needs at a given time, but it"s a sunny or windy day and solar and wind energy systems are still generating electricity, batteries help store the surplus. Then, when the sun is down and the wind isn"t blowing, batteries can discharge that stored surplus energy to continue supporting power needs. While most energy storage for the US electricity grid today is in the form of pumped hydro systems, batteries are a growing piece of the storage pie.

Lithium-ion batteries include five components: an anode, a cathode, a separator between the anode and cathode, an electrolyte solution that transports the lithium ions, and current collectors made of copper and aluminum that connect the battery to wires.

The anode is typically made of graphite. The graphite is mixed until it is completely uniform, then coated onto aluminum foil. When making the cathode, the two most common chemistries are those that contain cobalt (either nickel-magnesium-cobalt or nickel-cobalt-aluminum) or those that don"t and instead contain lithium-iron-phosphate. For either type, the metal mixture is blended until uniform and coated onto copper foil. The coated foils are then compressed using rollers, then slitted into strips.

To calibrate the battery to the exact current and voltage needed, the cell is charged and discharged with precisely tuned amounts of electricity. At the same time, lithium ions are added to the anode. (The cathode already contained lithium from the first step of building the anode; the additional lithium ions added to the cathode are for extra stability.)

Finally, the cells go through an "aging" process, which looks similar for both EVs and grid energy storage batteries. For a period often lasting several weeks, the battery"s voltage is monitored to ensure stability and test for any malfunctions or degradations over time. Once the battery looks up to code, it is off to the grid to power our renewable energy future!

Battery energy storage can help store clean energy for the grid. Additionally, another smaller-scale advantage of batteries is their use in "mini-grids," which can help individuals and communities keep the lights on for extra hours when the grid falls temporarily offline due to blackouts or natural disasters.

The industry is growing. From 2020 to 2021, large-scale US battery storage system installations tripled from 1.4 to 4.6 gigawatts. Wood Mackenzie estimates that the US will add more than 63 gigawatts more batteries

by 2026. That increased energy storage system deployment will boost research in battery technologies designed specifically for grid storage, including new types of lithium-ion batteries and alternatives.

Fleets of batteries--acres and acres of unassuming stationary metal boxes--are a key to unlocking the renewable energy future. But are batteries, themselves, renewable? Can they be reused or recycled at the end of their life? Where do their raw materials come from, and how can we ensure their valuable contents are recovered rather than wasted? Click to learn more!

And what about the solar panels and wind turbines that generate the electricity that batteries store? Check out our previous posts on solar panel and wind turbine life cycles!

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