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Power Struggles: Renewable Power Generation in a Changing Global Economy

A THREE-PART SERIES

Part 3: Battery Energy Storage Systems (BESS)

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This is the third in a three-part series regarding the impact of US tariffs on Renewable Energy Power Generation and addresses the newest renewable energy technology: Battery Energy Storage Systems (BESS). Part 1 of the series focuses on Wind Power Plants (see: **bit.ly/HalliwellPowerStrugglesWind**) and Part 2 focuses on Solar Photovoltaic Power Plants (see: **bit.ly/HalliwellSolarPV**).

BATTERY ENERGY STORAGE SYSTEMS (BESS)

The most often repeated criticism of renewable energy power generation has been its intermittent nature: the sun doesn't shine all day, and the wind doesn't blow all the time. BESS has the potential to extend the operational periods of these power generation sources and reduce their intermittent nature.

Installation of BESS has increased exponentially since the commercial prototype projects in 2012-2014.[1] The US Energy Information Administration (EIA) reported that a new record of 18.2 Gigawatts (GW) of BESS was scheduled for installation in 2025.[2] The pairing of BESS with solar PV power plants has improved the power production economics for these power plants. Stand-alone BESS installations increased dramatically after the Inflation Reduction Act included BESS as a qualifying "power generation" source and allowed developers and owners to collect the tax credits that were associated with renewable power generation, e.g. solar PV and wind energy. Market reports from American CleanPower and other industry analysists estimate the project pipeline for BESS will continue to accelerate upwards exponentially.[5]

The National Renewable Energy Laboratory (NREL) examines the cost of BESS and determined that approximately 63% of the cost of a BESS project is related to the lithium-ion (Li-ion) cells and their containers.[5] S&P Global reports that "the US has imported over $100 billion in electric storage batteries and components, reaching record heights in 2024."[3] The U.S. Energy Information Administration (EIA) reports that approximately 21GW of BESS capacity have been installed over that same time period (2021-2024).[4] This roughly translates to $4.762 million in imported products for every one Megawatt (MW) of installed BESS capacity in the USA between 2021 and 2024 (a blend of the averages over this time period that does not reflect the current cost per MW).



The USA is increasing domestic BESS cell, module, and container manufacturing capacity in response demand and domestic production tax incentives outlined in the Inflation Reduction Act of 2022. There are currently six BESS module manufacturing units (downstream process) with a maximum capacity of 35 Gigawatt-hours (GWhr) in the USA.[5] Ford Co. recently announced that the domestic battery cell and module production facilities that they built to support the EV business will now be targeted "to produce LFP prismatic cells, battery energy storage system modules and 20-foot DC container systems."[6] Nevertheless, the US domestic manufacturing capacity will not be able to support he expansive growth of BESS demand in the near future (barring a significant technology change or shift); current estimates target 52GWhr for 2025.[5] China is, and will be, the world's battery supplier for the foreseeable future; China currently accounts for 83% of the world's lithium-ion battery capacity.[5] Even if the rest of the world catches up and grows lithium-ion manufacturing capacity, China still dominates the upstream (mining) and mid-stream (processing, cell components) aspects of the supply chain so these companies will be integrated into other countries' downstream manufacturing (see image 3-3).

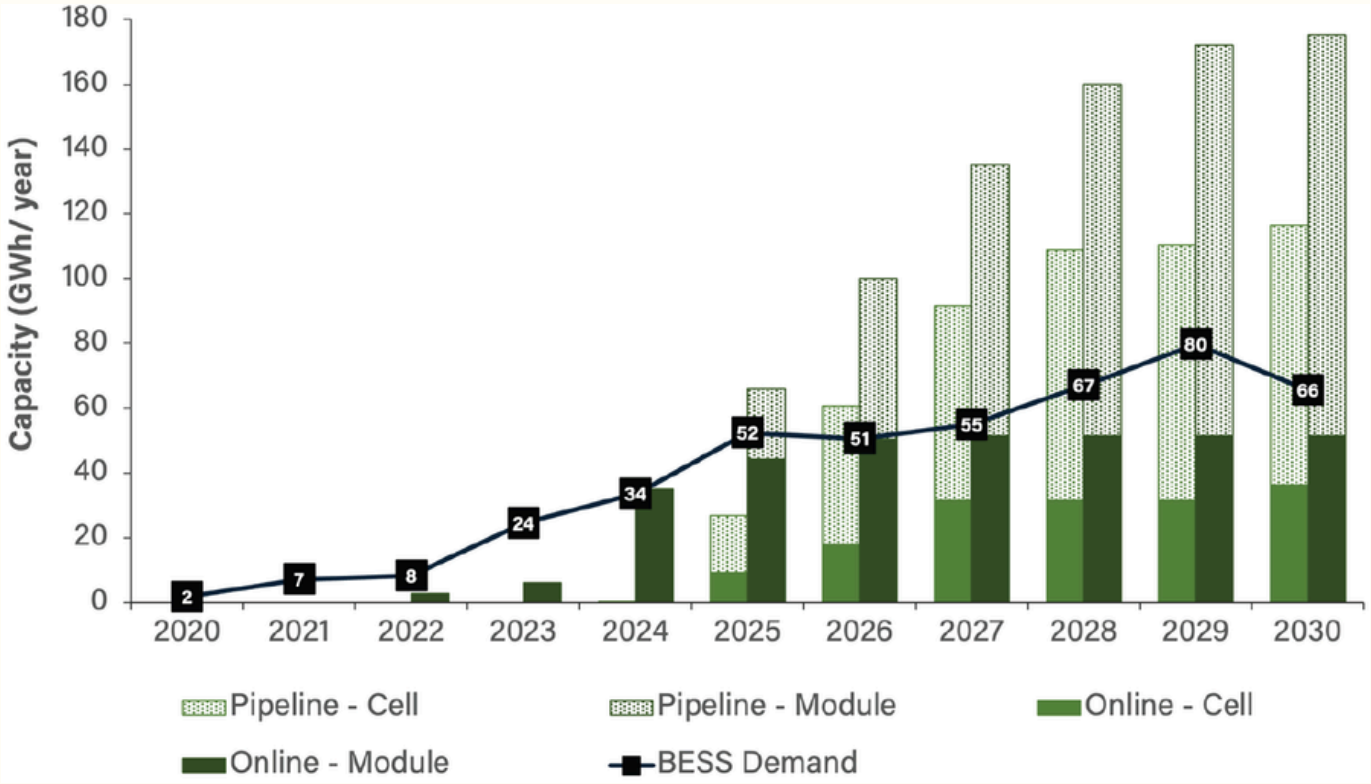

Image 3-1: Current and projected downstream manufacturing capacity in the USA[5]



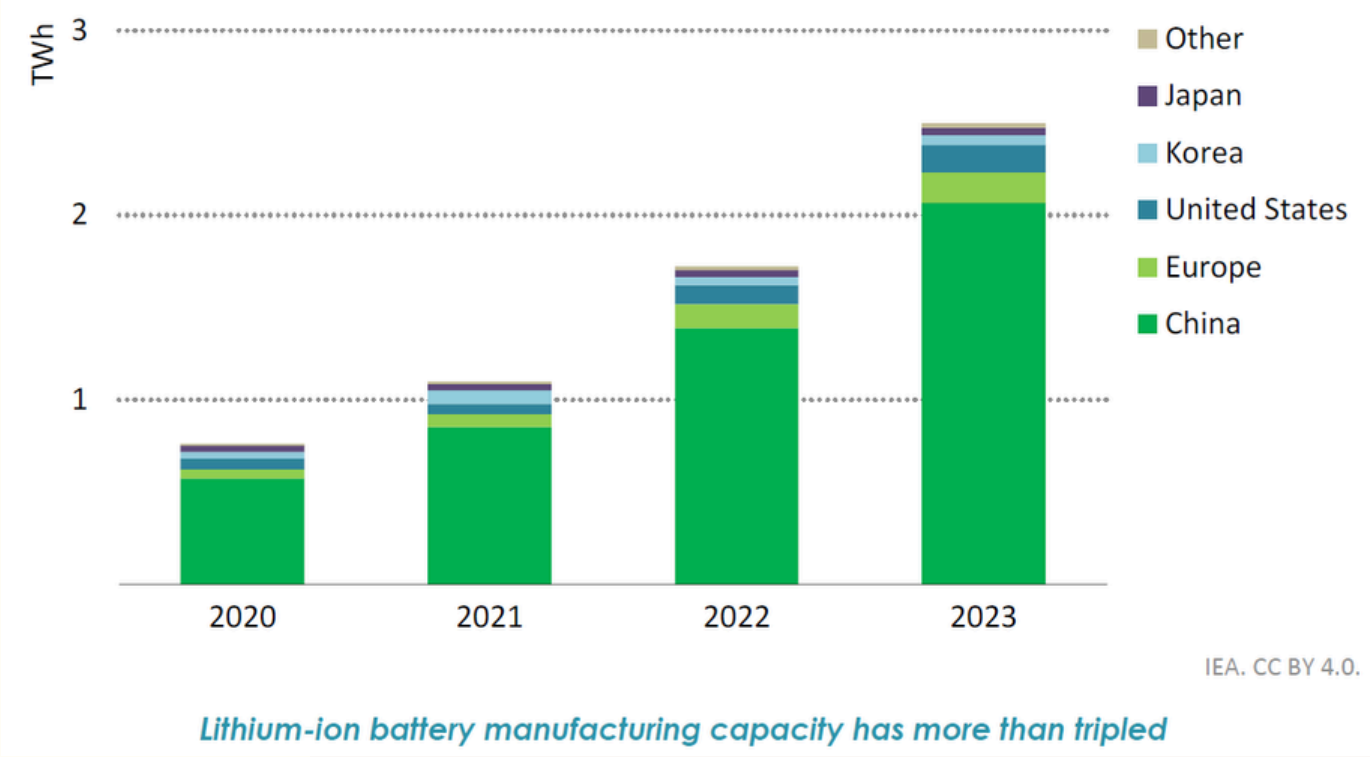

Image 3-2: Global lithium-ion battery manufacturing (downstream) capacity growth[4]

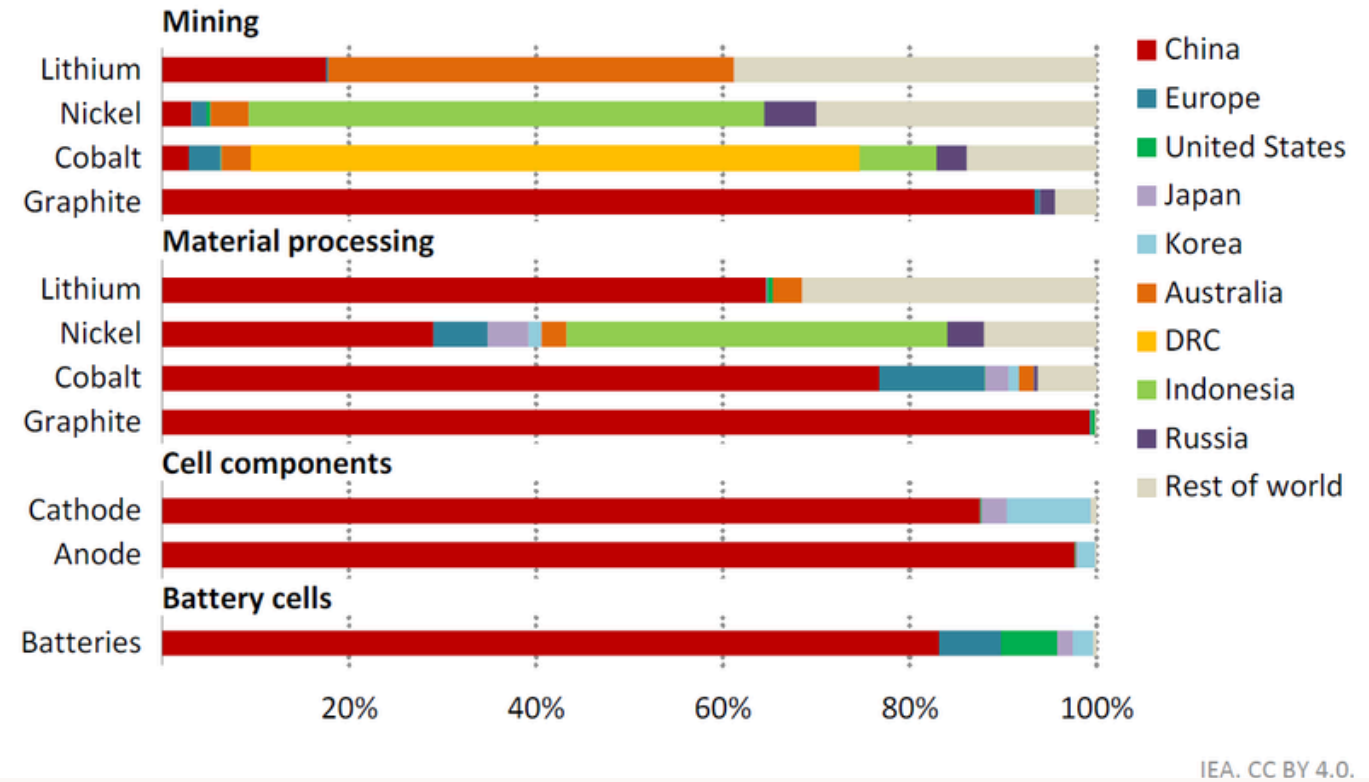

Image 3-3: Geographic analysis of lithium-ion battery supply chain[4]





The result of this supply chain concentration is that any broad tariffs on China are bound to impact the BESS industry. A proposed 145% tariff on BESS components imported to the USA could increase construction project costs by 91.3% since it is possible that nearly all of these components are coming from China. This would be a theoretical increase based on a tariff agreement that has yet-to-be determined; tariffs levels with China have been volatile and an agreement has not yet been reached. As domestic manufacturing increases, the effect of the tariff diminishes as it may only be applied to raw materials and not the final product: cells and modules. Even with manufacturing cost reductions due to technology or process improvements, material prices will increase to cover the tariff cost. Other major suppliers from different geographic locations, such as Korea and the EU, would be expected to raise prices related to increased demand and to capture artificial margin generated by US tariffs on China.

Interestingly, the recent legislation which created an accelerated sunset of the Production Tax Credit (PTC) and Investment Tax Credit (ITC) only impacted wind energy and solar PV energy. BESS may still take advantage of these tax credits until the end of 2032.[7]

PERSPECTIVES

Developers: The exponential growth in BESS projects under construction and in development have caused the backlog for BESS materials to grow. Many developers have already placed orders for their battery modules and/or containers for their projects. Those developers relying on imported BESS components from China may consider delaying or cancelling their projects as a result of the imposed tariffs. Other projects ordering BESS materials from domestic suppliers or suppliers with lower, more predictable tariffs will likely continue to build out as planned. The tariffs could impact an estimated 35% of the scheduled projects in 2025.

Conversely, the tax credit incentive for BESS remains in place and creates a strong incentive to continue to install utility-scale BESS. This will encourage developers to pair their BESS projects with new power generation sources, such as Solar PV. While new tariffs on solar PV components will increase the cost of new solar PV power plants,[8] creating hybrid projects (solar PV paired with BESS) will provide developers opportunities to counter these increased project costs with tax credit revenue. BESS developers will also look to add energy storage solutions to existing power plants, new thermal power plants (e.g. combined cycle plants), and new mega and hyperscale data centers. These opportunities indicate that new tariffs are unlikely to slow new BESS project development.

Owner/Operators: BESS facilities generally only require two to four scheduled service visits annually. These visits are for replacing HVAC filters and replacing any other consumable components. Component failures, such as cooling fans or compressors, may cause unscheduled maintenance visits but these replacement components should be readily available.

Lithium-ion batteries have a known degradation rate of 2-3% annually. To maintain PPA contracts with power off-takers, developers take into account this known degradation rate and "overbuild" the capacity of BESS facilities. Every five years, BESS facilities undergo planned augmentation to restore lost capacity of approximately 9-12%. In the case of a containerized BESS facility with 30 containers



this would require adding three containers. These scheduled augmentations are built into operating budgets and may not be able to be postponed due to supply agreements in the PPA.

Owner/Operators with scheduled augmentations during the tariff period may have no choice but to pay elevated material costs. However, increased domestic manufacturing will allow owners and operators of BESS facilities to source BESS containers for planned augmentation without paying the cost of tariffs on imported BESS containers (assuming domestic suppliers do not increase prices to match tariff costs on imported BESS containers).

Insurance Carriers: Insurance carriers are generally only involved in a project when a loss occurs. This places carriers at the mercy of market prices when it comes to purchasing replacement materials; the plant owner(s) wants to restore the BESS to operation as quickly as possible and the carrier(s) must quickly assess the loss to as a part of this process. Fire is the most common and expensive damage event that involves the carriers. The largest affected component of the BESS system are the battery racks or containers. Carriers can expect to pay elevated material costs due to tariffs if those materials must be imported to complete the repairs. However, domestic manufacturing capacity is rapidly increasing. If this trend continues as scheduled, alternative, equivalent battery modules and containers may be available to repair facilities at expected costs.

CONCLUSION

The BESS industry supply chain in the USA is almost entirely reliant on imported components, especially from China. The tariff levels on BESS components imported in the US from China are unclear at the moment, but other trade deals suggest an agreement is possible and forthcoming. These material cost increases will drive the imported cost of BESS components by a yet undetermined amount most influenced by the tariff schedule for China. This unplanned increase in material costs will drive all interested parties (owners, operators, and carriers) to try to develop new solutions or sources of materials. Owners of existing BESS facilities and their insurance carrier partners will have a more difficult time avoiding these material cost increases to get BESS facilities back online after a loss event. Continued tax credit incentives and escalating demand for BESS will push developers to continue plans for new projects and maintain the exponential growth path for utility-scale BESS.

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