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Will nickel-intensive batteries increase battery demand in ?At present, nickel demand for batteries makes up only a small share (~3 percent) of class 1 nickel demand. However, growth in nickel-intensive batteries is expected to boost demand for batteries by a factor of ~17 up to (from ~30 kt to 570 kt). Will battery-grade manganese sulphate supply cover 55% of demand in ?Based on the project pipeline, battery-grade manganese sulphate supply would only cover 55% of demand in the STEPS in . China currently dominates both global PPA production (three-quarters of global supply) and battery-grade manganese sulphate production (95% of global supply). Will EV adoption be challenged by cobalt & nickel in ?Our analysis of raw material requirements for batteries, which includes a radical shift away from cobalt- to more nickel-intensive batteries, shows that with expected metal supply developments, EV adoption is likely to be challenged by availability of cobalt and class 1 nickel around . Is manganese a bottleneck for nickel-based chemistries?Refined manganese is another emerging bottleneck, critical for not only many nickel-based chemistries, but also leading sodium-ion chemistries and LMFP. Based on the project pipeline, battery-grade manganese sulphate supply would only cover 55% of demand in the STEPS in . Are cobalt-free chemistries better than NMC?Cobalt-free chemistries, notably Lithium Manganese Oxide (LMO) and LFP, have lost favor among OEMs. This is due to their lower energy density compared to NMC, which means a lower driving range for EVs - a key concern for prospective customers. Is battery manufacturing capacity a bottleneck?In the short run, manufacturing capacity does not seem to be a bottleneck. Based on recent announcements, battery manufacturing capacity is expected to grow from ~110 GWh in to ~360 GWh by (from ~3 to ~10 Gigafactory equivalents), comfortably above the projected demand of 250 GWh. Deploying Battery Energy Storage Solutions in TunisiaLithium Nickel Manganese Cobalt Oxide ('LiNMnCoO2' or 'NMC') NMC chemistry is one of the current leaders for stationary applications and especially in the electric vehicle sector due to its Beyond NMC batteries: Supply chain issues for emerging battery This remarkable battery chemistry shift is leading to new battery critical mineral supply chains coming into focus beyond nickel and cobalt. Nickel Cobalt Manganese Market Size & Growth The global nickel cobalt manganese (NCM) industry is projected to reach USD 2.7 billion in . The industry will rise tremendously, led by the growing demand for lithium-ion batteries in electric vehicles and energy Metal mining constraints on the electric mobility horizonBy reducing the cobalt content and replacing it with metals such as nickel or manganese, energy density can be further increased but often at the expense of cycle life and safety. The Global Lithium Nickel Manganese Cobalt(NMC) Battery Trends: The global Lithium Nickel Manganese Cobalt (NMC) battery market is experiencing robust growth, driven by the burgeoning electric vehicle (EV) sector and the EU to back 10 battery materials projects ouside the blockThe European Commission has named projects in Ukraine, Norway, Greenland, Madagascar, Kazakhstan, New Caledonia, Canada, Brazil, Zambia, Serbia, and South Africa Utility-Scale Battery Storage | Electricity | | ATB | NRELFor a 60-MW 4-hour battery, the technology innovation scenarios for utility-scale BESSs described above result in capital expenditures

(CAPEX) reductions of 18% (Conservative VERTICALLY BATTERYMANGANESE BATTERY MARKET: critical component in batteries, with demand for battery-grade manganese expected to grow 15x by coinciding with restrictions imposed by market leadersWhat are LFP, NMC, NCA Batteries in Electric Cars?Uses environmentally unsustainable raw materials Nickel-manganese-cobalt (NMC) batteries are the most common form found in EVs today, ranging from the Nissan Leaf to Mercedes-Benz EQS. As the name Improving process granularity of life cycle inventories for battery For instance, a recent parametric LCA study found that climate change impacts of raw materials for a nickel-manganese-cobalt (NMC-811) battery cell may quintuple from 23 to NMC vs LFP Batteries | Chemistry AdvantagesA Lithium Manganese Cobalt Oxide (NMC) battery is a type of lithium-ion battery that uses a combination of Nickel, Manganese and Cobalt as its cathode material. Deploying Battery Energy Storage Solutions in TunisiaLithium Nickel Manganese Cobalt Oxide (NMC); Lithium iron phosphate (LFP); Lithium Manganese Oxide (LMO) comparison of their KPIs is reported in Table 3 and in Figure 1. VERTICALLY BATTERY(1) changes in general economic and financial market conditions, (2) changes in demand and prices for EV batteries and manganese inputs, (3) the Company's ability to establish EU to back 10 battery materials projects ouside the blockAlmost all of the 13 non-EU critical raw material projects identified for strategic investment by the European Commission concern the supply of battery energy storage system Ni-rich lithium nickel manganese cobalt oxide cathode materials: Ni-rich lithium nickel manganese cobalt oxide cathode materials: A review on the synthesis methods and their electrochemical performances Heavy metals in soil linked to Moss Landing battery A fire at the Moss Landing battery plant may have released heavy metals into the nearby Elkhorn Slough Reserve. Researchers at San Jose State University found high levels of nickel, manganese, and

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