Putting in My Nickel's Worth: Charging Toward Better Batteries!

Just like a century and a half ago, we are once again caught in a frenzy of a metal rush, speeding to mine resources for EV batteries faster than we can charge them. Although extensive nickel extraction is justified by global climate goals driving toward zero-emission tomorrow, it devastates the land today. The mining epicenter of the key EV battery component is Indonesia, and the country has already experienced the consequences of massive extraction through horizontal mining. This process mercilessly wipes out everything on the surface, causing widespread deforestation, water contamination, and environmental degradation for communities that depend on land and water resources for their livelihood. Such an unfavorable outcome raises questions about the real ecological benefit if nickel dependency and mining continue this way. To slow down Indonesia's environmental hardship, it is important to reduce global nickel dependency. This can be achieved by prioritizing alternative battery development, relying on more abundant minerals, such as lithium and sodium. Furthermore, improving existing battery recycling methods and installing additional charging stations will make EV cars more appealing and marketable, benefiting the initial global sustainability goal.

Nickel is a critical component of many current batteries, as higher content means an extended range for EVs, hence the popularity of this mineral. Indonesia alone accounts for 51% of the world's nickel production (Peh). As the country's nickel ore is found close to topsoil, the extraction employs horizontal mining techniques resulting in vast rainforest removal. Indonesia's two islands, Sulawesi and Halmahera, apart from being the major mining industrial parks, are also home to the Bajau Sea Tribe which depends on affected resources (Guo Ying Lo, et al.). Massive deforestation not only restricts and shrinks the tribe's territories, but also contributes to frequent flooding, stemming from rainfall and contaminated runoff from the mines (Mighty

Earth, et al.). Since large amounts of water are consumed for separating nickel from the ore, generated liquid waste, containing heavy metals and acids, is carried out into the river delta and subsequently into the ocean. This hazardous waste threatens Weda Bay life where the sea tribe lives and spearfish, making living around and hunting in contaminated waters impossible. Despite UNEP (UN Environment Programme) efforts and existing government protective measures, they are not entirely effective, but slowing down nickel extraction and dependency certainly can be (UNEP).

One of the possible alternatives to nickel is more abundant lithium, which is used as the main component in Lithium Iron Phosphate (LFP) batteries (MIT Climate Portal Writing Team). The benefit of lithium is its effectiveness in storing energy and its ability to provide the battery an extended lifespan. However, the sustainability of lithium mining depends on the methods of its extraction. The ecological way, called “lithium evaporation”, involves extracting lithium from brines by separating metal from the salty liquid through natural evaporation. This method is lengthy but does not require heavy machinery for brine pumping, unlike traditional mining demanding excavation of the hard rock and subsequent crashing. Although both mining methods are viable, their major downside is the vast amounts of water needed for evaporation and the rock-crushing processes. In the areas where water is scarce, it instead could be used for better purposes such as agriculture (Nadion Energy). Novel developing sustainable methods of extraction will recycle the water through filters for future use.

Another promising alternative to nickel-containing lithium-ion batteries is sodium-ion batteries which work similarly. Sodium salt is a plentiful and environmentally friendly mineral, which can

be extracted from seawater inexpensively, unlike lithium and nickel. Also, sodium batteries are safer than lithium ones, as they cannot catch fire or explode easily (Brower). However, sodium-based batteries have a shorter lifespan, up to 5,000 charges, while lithium battery variations can handle up to 10,000 (Supply Chain Strategy). Another disadvantage includes limitations of the shape they can be made into, meaning they are more suitable for larger EV vehicles. On the other hand, sodium-ion batteries are still in the development stage, and with improved technical performance, they will be a great cost-effective and eco-friendly alternative to lithium and nickel-containing batteries.

Apart from focusing on production, we must equally be concerned with unusable batteries and their utilization. Recovering minerals from old batteries through different ways of recycling would reintroduce them into the supply chain and diminish the need for unnecessary extraction of new minerals. Three main techniques for battery recycling include direct recycling or shredding batteries into black mass for subsequent smelting or chemical leaching (Batteries for Electric Vehicles). However, current recycling methods are yet to be improved. While direct recycling repurposes materials intact, smelting burns a lot of energy and chemical leaching contaminates water and soil. Recycling is an essential part of battery production, but the techniques are still in their infancy.

Although an attempt to make the battery as high-performing as possible sustainably is hands down vital in the long run, I believe that for many customers, range anxiety associated with fear of running out of charge before finding a charging station could be tremendously reduced through the installation of additional charging stations (Progressive). For instance, last year my

family and I traveled to New Mexico from Seattle. Making this long journey in an EV car, emission and cost-wise, was very appealing. However, because the trip included remote destinations with scarce charging stations in the area, the choice wasn't towards EVs. In the future, having solely a longer-range battery without charging stations in the area still wouldn't feel as reliable.

The current mineral rush is justified by a well-developed nickel battery production offering a longer range compared to nickel-free batteries. Making EV cars practical and marketable contributes towards a global zero-emission goal where by 2050 nearly all car sales are expected to be electric (Progressive). However, it conflicts with UNEP efforts for sustainable mining in Indonesia, which is experiencing an industrializing crisis. The broader strategy involves developing alternative battery production and improving recycling methods to reach the balance point where the wolves (the progress) are full, and the sheep (the environment) are safe.

Sources

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