Can the Global Automotive Industry Source Enough Critical Minerals to Meet EV Production by 2030?

written by Jack Lifton | March 31, 2023

American President, Joe Biden, has decreed, and the U.S. Congress has mandated, that, by 2030, 50% of new domestic American OEM automotive production must be of electric vehicles (EVs). Further, the U.S. government now requires by law that, by 2028, for a new EV purchaser to receive a tax credit of up to $12,500, then 80% of the vehicle's components must have been made in the United States from raw materials produced and processed in the United States.

American OEM automakers are losing money hand-over-fist on making and selling EVs. Ironically, it is their profits from internal combustion engine (ICE) vehicles that are keeping them afloat. Without subsidies, also known as "tax credits," no one could continue to make and sell EVs. And, quite frankly, without ICEs, Tesla could not afford to be in the EV business. The supply chains for universal automotive components used both by ICEs and EVs could not exist without the scale and sales of the ICE industry.

Sourcing Critical Minerals for EV production

I think that the idealogues, both elected and unelected, in North America and Europe need to answer some questions. Today I am asking, "How does the global non-Chinese OEM automotive industry plan to source enough critical minerals and metals, annually, to meet government-mandated, not market-driven goals for the production of EVs by 2030?

In the following discussion, I'm going to limit myself to the critical minerals and materials needed for the production of EVs just in the United States. Keep in mind that American domestic OEM automotive production is just 10% of the global annual total production.

The domestic American OEM automotive assembly industry most of which is owned and operated by foreign-owned manufacturers is building today, in North America, at least nine new factories to construct lithium-ion batteries for EVs. In addition, a half dozen EV drive train factories and a dozen assembly plants will be built or converted to pure EV production by the end of this decade.

Calculating the amount of Critical Minerals needed

The figures below are averages used in a variety of lithium-ion types. The only constants are for lithium and graphite, which are calculated for a 100 kWh Tesla battery no matter what the cathode chemistry.

The figures for material usage for rare earth permanent magnets are for one drive motor. American cars typically use two.

For the battery:

Material/Metal	Usage per BEV	For 7,500,000 EVs
Lithium (no matter which chemistry)	6-8 kg (measured as metal)	45-60,000 metric tonnes
Nickel	40 kg	300,000 metric tonnes

Material/Metal	Usage per BEV	For 7,500,000 EVs
Cobalt	12.5 kg	93,750 metric tonnes
Manganese	24.5 kg	183,750 metric tonnes
Copper	53 kg	397,500 metric tonnes
Graphite	66 kg	495,000 metric tonnes

For the drive motor and the 25 accessory micro-motors:

Neodymium / praseodymium (75:25)	1.5 kg	56,250 metric tonnes
Dysprosium	0.05 kg	562 metric tonnes
Terbium	0.01 kg	112 metric tonnes
Gallium	tbd	

Note that the amounts above are annual needs for 50% of projected American domestic production using a production number baseline of 15,000,000 vehicles per year, which is more than 2022 production and sales but far less than the 21st-century average.

The material usage per vehicle comes from the most recent estimates of the International Energy Association (“IEA”).

Finally, note that the amount of lithium required, up to 60,000 tonnes, measured as metal, is equal to 360,000 tonnes, measured as lithium carbonate equivalent (LCE), which is more than half of the global production of LCE in 2022!

Assuming that 50% of global OEM automotive production in 2030 will be EVs, you need to multiply the above demand numbers each by a factor of between 5 and 10 just to assume that the total global production of vehicles remains the same in 2030 as today, about 100,000,000 vehicles per year.

The amount of lithium necessary for enough stationary storage to manage a world totally converted away from fossil fuels is estimated to be 3.5 times as much as is necessary for the conversion of the global automotive fleet, so you need to add that demand to the above totals. I do not know how much of the world's energy production in 2030 will be from non-fossil fuels, but even if it is just 20% of the total the above demand numbers would double.

The question we need to ask…

The core questions are:

1. Can the world's economies divert enough of their total capital and natural resources to effect the above transformation(s)?
2. Even, if so, are there sufficient resources of the critical minerals and processing capacity for transforming them into end user products to carry out even this percentage of the transformation in just 7 years?, and
3. Would even the attempt to transform the global energy production economy from fossil-fuels to alternate energy destroy wealth creation and its wide distribution bringing about the decline of the Western standard of living and the destruction of any hope that the developing world has of achieving that standard?

It's time to decide if it's all worth it.