Will Technology Metals' Supply Meet the Demand for EVs?

written by Jack Lifton | February 5, 2022

Since market economics' common sense was codified by Adam Smith in the 18th century, people have been aware of the fact that the price for a good or service is what a willing buyer will pay a willing seller. Of course, the seller must be able to get the good or perform the service and the buyer must have or be able to get the money. These last requirements seem to have escaped the notice or understanding of the market manipulators also known as Western politicians.

The global OEM transportation vehicle market is really not free. It is being politically manipulated by climate change politics, based on the belief that eliminating the carbon dioxide output from the use of fossil fuels in vehicle powertrains, based on internal combustion engines (ICEs) and replacing them with onboard stored electricity in batteries driving electric motors (BEVs) will have a significant "positive" effect for humans on the earth's climate. Whether or not this cause-and-effect hypothesis is true the total conversion of the world's transportation fleet to battery electric power is not possible for the size of the present fleet and its projected growth. This is because the (battery) technology metals necessary to effect this change simply do not exist in sufficient quantities that are accessible to mankind's engineering abilities, willingness to deploy capital, and the real global energy economy.

This supply limit will not become apparent until after 2025, so it is being ignored as a problem easily solved by the "efficient" market, whose actual strictures the political class does not understand.

One clue about structural limitations, which politicians either do not understand or do not believe, is that the current Western commodity price inflation is driven by efficient market supply shortages, which will automatically correct from infinite supply resources, not by free market excess (unsatisfiable) demand. Another, perhaps more insidious, supply limitation is simply the price ceiling, the maximum amount that the consumer can/will pay for a metal, before that metal becomes too expensive for the intended use. This is happening now, for aluminum, as soaring energy costs in Europe, for example, force the shutdown of aluminum electrolytic smelters, the production cost from which has become more than the market price of aluminum. This was caused by an entirely man-made shortage of electricity through sheer political short-sightedness, not by the aluminum marketplace.

The politically driven demand pull for BEVs has already skewed the lithium market by driving lithium prices high enough to allow mines and sources, that would have been marginal or worse, to appear to be economical and to develop. But lithium prices are already too high for the continuing decline in battery costs to achieve par with fossil-fueled engines in the near term, if ever. The politicians' answer to this is to restrict fossil fuel production and make it more costly. Thus a (n inflationary) price spiral has begun that could price BEVs as well as reduced production, thus more expensive, ICEs and their fossil fuels "out of the mass market!"

The structural metals and materials used to make vehicles used for the transportation of people and freight can be, and mostly are, recycled. This is driven by the fact that it takes less energy to recycle structural metals than to produce new material from mines. A significantly large proportion of the iron, aluminum, copper, zinc, and lead used to construct new vehicles is recovered each year from the recycling of end-of-life

scrapped vehicles. Cars in North America, have average useful lives of 12 -17 years. The North American car “fleet” is over 300 million vehicles and each year about 5% of the fleet is scrapped. This means that enough iron, copper, aluminum, and lead is recycled each year to build 15 million new vehicles if 100% perfect recycling is assumed. It is noteworthy that the recycling efficiency of the American scrap, iron & steel, aluminum, copper and lead industries is very high and that most American steel for automotive use is made from scrap in, reliable, fossil or nuclear fueled (electrical) baseload requiring, electric arc furnaces. The North American OEM automotive industry considers 17 million vehicles produced and sold to represent a good year, so it does not have a problem sourcing structural metals for components. In fact, enough new vehicles are imported into North America that the need for structural metals for just domestic production by the OEM American automotive industry is met by just the metals produced from recycling.

So far, so good.

Now comes the not-so-good news about the technology metals required for manufacturing automobiles. Today’s internal combustion engine powered motor vehicles use, on average, about 0.5kg of rare earth permanent magnets (REPMs), so the annual need for such by the domestic OEM industry is between 6,000 and 8,500 tons of REPMs (here I assume that of the 17 million units sold each year up to 5 million are imports from another country (including Mexico and Canada besides China, Japan, Korea, Germany, France and the UK).

And, a Tesla Model 3, electric vehicle (EV) with the range required by American buyers uses up to 5kg of REPMs, and 6-8 kg of lithium, measured as the metal, in its lithium-ion rechargeable battery-based powertrain.

How many Gigawatt hours of lithium-ion battery storage for use in EVs and stationary storage can be produced with the earth's known physically and economically accessible deposits of the necessary critical materials? I was going to submit that question as an abstract to a coming battery conference, but I realized that the academics and bureaucrats, and corporate researchers who attend the conference don't have enough background in industrial mineral economics to understand what I want to say, and, in any case, don't want to hear it.

Below is Bloomberg's guesstimate of the demand growth for the supply of all of the metals necessary to build (projected levels of) EVs through 2030. It is very important to understand that the only increased demand for metals for building EVs that matters are for those metals that are non-structural, **the EV Technology Metals**. EVs will use no more of structural metals in the aggregate than ICEs do, so that as the ICEs are replaced by EVs, there will be no increased demand for iron, aluminum, or zinc, and a marked decline in the demand for lead as starter lead-acid batteries are phased out.

Source

But those technology metals specifically required for an EV's powertrain, the battery and the electric motors will see a dramatic increase in demand if and when EVs achieve a significant market penetration.

For some reason, which I think is just ignorance, the major news media "predictors" pay no attention to the distinctions between the demand for structural metals, which will simply be the same total, with the exception of that for copper, as is used today unless the annual global total production of motor vehicles increases dramatically, which is very unlikely. Mature Western (and Japanese and Korean) domestic markets will decline in

demand as longer lived vehicles become necessities due to price. This may well have a negative effect on recycling efficiency for all metals as the scrap market re-adjusts to lower supply and lower annual demand for new vehicles.

EVs, however, as they replace ICEs will not increase the demand for structural metals per unit, but it is the demand for EV technology metals that could skyrocket, if that much supply were possible.

To reiterate: The above chart is wrong with regard to iron and aluminum demand for vehicles; they are a function of the total number of vehicles built in a year, and, since Western markets are mature in transportation vehicles, the demand for new iron and aluminum for that use is unlikely to increase more than 25%, if that, to add new vehicle production, perhaps mostly for the Indian and African home markets.

For EV Technology Metals the story is very different. An EV uses about 50 kg of copper for its wiring harness, electric motor windings, and lithium-ion battery internal circuitry. This represents a 50% increase over the demand for copper in an average ICE, so that the demand for copper for EVs could add fifty percent to the overall demand for copper by the OEM automotive industry today if and only if ICEs are completely replaced by EVs. Thus, the factor for copper in the above chart, 10X, should be 1.5X.

The potential demand growth for the most critical EV Technology Metal, lithium, is the limiting factor in the projected transformation of power trains from fossil fuels to battery moderated electricity. Today BEV sales are reported to be 3% of the global total vehicle sales. This is projected to reach 10% by 2025, so that by 2025 at least three times as much lithium will be needed to satisfy the demand for batteries.

In 2021 some 86,000 tons of lithium, measured as metal, were produced. 60% of that total was used to manufacture lithium-ion batteries. Let’s call that 50,000 tons for batteries in 2021.The 36,000 tons of lithium used for non-battery uses is unlikely to grow, so the necessary supply increase to satisfy the needs for producing 10% BEVs in 2025 is 3x, for a total demand in 2025 of 150,000 tons of lithium, measured as the metal. Adding the 36,000 tpa of lithium demand for other uses we get a total lithium demand of 186,000 tons for 2025, which is essentially 2X 2021 total demand for lithium. This is most likely do-able by the lithium mining industry, but the downstream supply chain to turn 150,000 tons of lithium into fine chemicals and battery electrodes does not now exist, and although capacity increases may be planned it cannot be determined how much will actually be constructed in time. This is determined by the availability of capital, its proper allocation, the availability of engineering skills, and the availability of construction capacity. Although these can be quantified, government interference, also known as regulation, is the single largest time, and frequently capital, consuming impediment to mining and process engineering in the West.

The (mineral) economic illiterates who populate our universities and governmental bureaucracies live in a fantasy world of infinitely available natural resources and their unimpeded economic production. In that world, and only that world, is a green energy transition possible without an unacceptable decline in global standards of living, and the creation of a have and have-not society on a global scale. Let the UK’s current

Production and processing of the EV Technology Metals are and will continue to be a good investment until a consensus is reached about a balanced energy economy, in which fossil fuels continue to be used for critical needs for which they are irreplaceable. Continued production of EV Technology Metals

after that will be determined by price.