

Jack Lifton on the Real X-Factor in the Critical Materials Supply Chain

America's permanent civil servants, otherwise known as the employees of Federal agencies and the staffers of the elected officials of both local and national governments, are required to believe in the efficient market hypothesis as promulgated by the credentialed clerisy, in this case the Chicago (Milton Friedman and his disciples) School of Economics. This school holds that it is a law of nature that the demand for and the supply of any commodity will always trend towards an equilibrium in which the one equals the other, so that, for example, if the demand for copper wire exceeds the supply then capital will pour into the copper production industry until the supply equals the demand, or prices for copper will increase so as to deflate the demand increase, or some combination of both will occur.

Since there is no infinite reservoir of copper just waiting to be mined, refined, and fabricated by the driver of increased prices, the efficient market hypothesis fails to be reliable when the real world is involved.

This would, of course, be common sense if not only the correct (Ivy League) education, but also first-hand knowledge, experience, and skill in the particular subject matter were valued in Washington, DC. They are not.

What the Chinese refer to and define as "New Energy" is the production of electricity by means other than using fossil fuels for heating water to a boil and using the steam to spin turbines. This definition includes solar, wind, fuel-cell, nuclear, and recently commercialized chemically based rechargeable storage devices and systems such as batteries.

Thus, all, or in-part (hybrids) battery powered, fuel cell powered, and even hydrogen powered (internal combustion engine) motor vehicles in China are called "new energy vehicles" (NEVs) and I am going to adopt that terminology here.

The contemporary market for NEVs globally is primarily driven by politicians, not consumers. In authoritarian industrial economies such as China, consumers can be forced to demand NEVs by laws and ultimately by the mandated production of only NEVs. This is known as industrial policy planning. In the free-market economies, politicians attempt to do the same thing by artificial price manipulation, aka subsidies in the form of tax incentives or outright grants to make prices appear lower than they actually would be if only efficient market dynamics were involved. These payouts sourced from taxation are known as "free money" in the capitalist economies. This free money is of course a transfer of wealth from the general population to the wealthiest by the pretense that it is for the common good.

Legislators (a.k.a., politicians) attempting to drive, not just influence, the consumer market for energy use, do not understand thermodynamics as applied to the production and use of energy by man-made devices. The relatively inexpensive electrical energy derived by burning fossil fuels cannot economically or efficiently be substituted by more expensive methods of transforming sunlight and wind through the use of the scarce resources of the electronic and magnetic properties of metals that are scarce mainly because of the energy needed to collect, separate, purify, and concentrate them. That energy can never be recovered by using them to transform light energy or the kinetic energy of wind into useful forms of electricity. Alternate energy construction economics fails with wind and solar.

It is argued that, even so, such relatively inefficient methods of energy production are a common good, even a

necessity, since their purpose is to preserve an environment that is best for human beings. This is a moral judgment not a scientific one, in any sense. In an open system, it is not possible to balance or preserve or recycle energy efficiently. The world is an open system and pretending it is a closed one is a thought experiment and is not realistic.

Natural resources available to us are limited by the amount of energy we are able to deploy economically to extract, refine, and fabricate them into forms useful not to the inanimate world but to our species for its comfort, health, safety, or survival. Extracting particular resources means reversing the natural forces that created and mixed them together in the first place, and this always needs an excess of energy input over what is recoverable from the use of the resource.

Natural resources are not organic. They do not reproduce themselves. Human beings use and must continue to use the energy of fossil fuels to produce the structural metals necessary to recover relatively tiny amounts of technology enabling metals for energy transformation and then pretend that the relatively small and expensive amounts of useful energy obtained by the use of the electronic or magnetic properties of the technology enabling metals are saving the world, but the net irreversible flow of energy used to obtain these metals overwhelms the useful production of electricity obtained and due to the fact that the new energy generators wear out (I.e. return to their natural oxidized and useless state relatively rapidly) can never be recovered. In fact, additional energy must be applied to recycle them to the metastable state in which they are useful. Peter is being used to rob Paul.

A good example is the production of lithium for lithium-ion batteries. The best deposits of lithium currently used to produce it are the South American brines in which the lithium content is 2000 parts per million or 1/5 of 1 percent.

In order to produce 2000 tons of lithium, it is necessary to process 1,000,000 tons of water! It will be argued that most of the energy necessary for this is from natural solar evaporation, so that no fossil fuels need to be burned to create it. However, it must be noted that half of the world's lithium is still derived from hard rock deposits of the mineral spodumene. The average run of mine grade of spodumene is 1% Li, measured as metal, so that 2020's 50,000 tons of Li from spodumene required the moving, crushing, and processing of 5,000,000 tons of rocks.

The 140,000 tons of cobalt, measured as metal, produced in 2020 required the mining of 30,000,000 tons of copper and 2,500,000 tons of nickel in both of which the run of mine content of Co was less than 0.5%. The rock moved to produce this amount of copper, nickel, and cobalt was 3,000,000,000 tonnes.

The energy necessary to mine, crush, roast, smelt, extract, separate, purify, and fabricate these metals into useful forms is staggering, and it is all produced by burning fossil fuels!

Just as the Chinese were allowed to set costs of producing rare earths without considering environmental degradation, health, and safety so western politicians do not consider the energy costs or source development necessary to produce New Energy.

The Chinese minimize their need for the most energy intensive part of resource production, mining, by buying and importing ore concentrates whenever and from wherever possible. Lately, this has included even the rare earths. America and Europe have fallen far behind China in globally sourcing mined materials.

The amount of energy just consumed in mining, but not refining critical materials outside of China is staggering. There is no way this can be economical or efficient. This need for energy

will inhibit the development of countries such as the DRC in Africa, slow the development of Chile, Argentina, and Bolivia and raise the cost of living in Australia.

The prices for the critical metals for new energy production will continue to rise but if present trends continue their supply will only be what is leftover from Chinese domestic needs and from those sources outside of China not controlled by China, because it doesn't need them. China is the single largest producer of electricity of any nation; it has already allocated the necessary power for its new energy construction as well as obtained the necessary flow of raw materials without impeding its consumer's needs for their standard of living.

No one but the Chinese has looked at the life-of-mines of critical natural resources. This is the key to a new energy future.

The laws of nature supersede those of economics.