The cleantech disconnect between rising demand and the global technology metal supply

InvestorIntel is hosting the Cleantech & Technology Metals Summit in Toronto on May 10-11th, 2016 with the materials and technologies of Cleantech as its theme. It will be a survey of those sectors and an introduction to some of the key players for Investors.

Over the next three months I will introduce the conference themes and give you details of who will speak about which topics. Each full session of the conference will be concluded with a panel of experts who will be questioned by sector specialists such as , John Petersen on battery storage, Professor Dudley Kingsnorth on the global technology metals market, and, of course, me. As a finale the sector specialists themselves will be put to the question on a panel chaired by InvestorIntel's publisher, Tracy Weslosky, with no holds barred. No one will be allowed to leave the conference without a clear understanding of Cleantech and the issues and opportunities it raises for Investors.

Cleantech is an agenda for giving mass produced technologies a direction. The idea is to choose and utilize them with minimal, and ultimately, no net environmental impact. Ideally Clean technologies will additionally reduce existing pollution. The economics of Cleantech are not straightforward, because although a Cleantech agenda must include the capitalization of the direct costs of health and safety it must also include as a setoff the value brought by the Cleantech methodology by the elimination of the long term costs of the risks to health and safety ameliorated by the implementation of the Cleantech agenda. The measurement of these "savings" is often very subjective, and politicians and bureaucrats tend simply to "adjust" them to fit whatever model they are using to justify the expenditure of public funds to subsidize the Cleantech Agenda. Ultimately though an objective measurement will be needed.

Cleantech however in any case should not and most often does not countenance or condone hidden agendas such as, for example, the obvious fact that a great deal of fossil fuel must be consumed today to produce an electrified vehicle. Necessity requires that such procedures, at least today, must be used. I personally for example know of no factory for manufacturing traction batteries that uses solar energy or wind generated energy exclusively for its total manufacturing needs. Since the overwhelming majority of global "base load, "the electricity generation that is available around the clock, is produced by burning fossil fuels this means that the direct manufacturing of batteries, wind generators, and solar cells consumes fossil fuels.

Achieving and sustaining the Cleantech agenda is a goal. And in order to achieve this goal we must deconstruct the total manufacturing supply chain and reconstruct it to minimize and ultimately eliminate pollution while minimizing costs of all kinds.

To begin this series of articles I'm going to focus on my area of expertise, materials and their sources, in this case I'd like to begin with the materials necessary (and therefore critical) for the construction of the energy storage devices known as batteries. There are two categories of these materials: 1. The finished (chemical) forms of them that go into the final end-product, the battery, and 2. The raw materials that are needed to produce the finished chemical forms. I will also address the processes by which the raw materials become finished (chemical) forms, because this is an area all too often overlooked, ignored, or assumed to be easy by naïve investors. Let's first look at the raw materials and their sources in nature. This is the very beginning of where the deconstruction of the total supply chain leads us.

One last note: I'm going to save for later in this series discussions of the fuel, construction, and process raw materials for nuclear reactors, because it is a complex subject best left until we have more background.

The replacement of fossil fuels COMPLETELY by nuclear fuels for generating base load is possible, and this has generated a great deal of controversy unrelated to whether or not nuclear generation of electricity is economically superior to fossil fuel generated electricity from both an environmental and a health and safety aspect. The non-technical, non-objective issues characterized in our polity as the "anti-nuclear forces" form a complex subject and it needs quite a bit of explanation and explication both of which will be easier to follow after we have a grounding in some more easily understood aspects of the direction of and impediments to the Cleantech Agenda.

Today I going to discuss the material basis of the storage of artificially produced electricity by batteries. I say "artificial, because the basis of our contemporary technologically themed civilization is our ability to produce, transmit, and convert into various forms of work electricity at will and to deliver that electricity to any location we choose.

The battery economics data I am going to use comes from the research and work of my InvestorIntel colleague, John Petersen, who is a leading expert on the economics of energy storage for all uses by rechargeable batteries.

Putting aside for the moment the Cleantech aspects of the lead-acid and lead-carbon batteries that have been in wide use in the automotive industry as well as the power storage industry for at least a century it cannot be overlooked that the economics of scale have driven the manufacturing costs of these devices probably as low as they can go. In some ways then the cost bar for batteries has been set, and for lead/carbon acid I think we are at rock bottom; it won't go lower. Keep in mind that lead from storage batteries constitutes 85% of the lead recycled annually in the USA, and that the impact of recycling on the lead "cycle" has reduced the need for new lead production in this country dramatically. I would go so far as to say that the widespread adoption and use of lithium-ion battery chemistry for vehicle powertrain electrification along with the current capacity for the recycling of lead could eliminate the need to mine new lead in the USA in the near future.

In any case the electrification of vehicle power trains cannot be accomplished by the use of lead-acid or lead-carbon batteries. Why? Because such battery chemistries cannot store enough energy to move a one to two ton vehicle more than 60-70 miles at highway speeds to which we have become accustomed before needing to be recharged.

In fact this limitation has until recently been the main impediment to the electrification of vehicle powertrains for consumer use. And this impediment has stood for nearly a century.

However, change is upon us and the impediment is rapidly disappearing at least from a purely technological viewpoint. The rechargeable lithium-ion battery originally introduced for personal consumer products by Japan’s Sony Corporation in the early 1980s has undergone massive and sustained development in the last 35 years, and the result has been an improvement in power storage and operational capacity (cycle life). The key metric for consumer applications of vehicle electrification is cost per kilowatt hour. This is a measure of the cost of the battery to manufacture and assumes that the particular chemistry chosen exhibits the necessary cycle life, ease of charging, and ability to discharge at any and all rates encountered in vehicle operation without a catastrophic (irreversible) failure.

Although actual manufacturing costs are proprietary several major battery manufacturers and vehicle manufacturers with electrified vehicle products are moving production forward rapidly, and this indicates that those who have the data are satisfied that a manufacturing cost of $200/kWH, or less, has been achieved. Those who understand the costing of motor vehicle production, for example, are certain that the battery of forthcoming (Fall 2016) Chevrolet Bolt with an advertised range under ordinary conditions of 200 miles and a selling base price of $30,000 after government tax credits, has met the magic $200/kWH standard. GM itself has publicly stated that the cost of its Bolt battery is today $145/kWH and that by 2020-22 it expects that cost to reduce to $100/kWH. If this last figure is accurate and if the batteries perform as advertised between now and then the age of vehicle electrification will have arrived.

The global OEM automotive industry is traditional and conservative when it comes to engineering and planning. GM, for example, has chosen what it calls a “nickel rich” lithium-ion battery chemistry from Korea’s LG.

Therefore orders have been issued and parts delivered already for the first 3-6 month of planned Bolt production. And even though GM continues to life test (reliability, durability, cycle life, performance to specification, etc.) batteries the manufacturing of the batteries in Michigan from cells built in Korea by LG is well under way.

So, what’s the problem?

The problems that I see arise from the disconnect between the demands for the critical natural resources and processing capacity needed to produce finished chemicals for lithium-ion batteries and the supplies of the raw materials from which these finished chemicals are made.

It goes without saying that the recycling of lithium-ion batteries is a business that will boom if vehicle electrification takes off.

But we also need to ask whether or not there is enough lithium, cobalt, manganese, nickel, and graphite available, and this means not only is there sufficient current production, but also whether new capacity if needed can be brought on line at the same speed as the ramp up of demand. To answer these questions requires a look not just at the financial but also at the geopolitical issues involved.

It’s easy to get complacent by just talking about a Global Lithium Economy, but this is very misleading. The production of lithium from mines and of the capability and capacity to refine it into finished chemical forms for use in batteries is NOT uniformly distributed over the planet giving no one nation any advantages. Just as with rare earths producing lithium resources are concentrated in just a few places, and unlike rare earths lithium processing for use in batteries is not concentrated in the countries where it is produced and neither at the moment is the demand.

The new Chinese 5-year plan calls for a Cleantech agenda for the electrification of motor vehicles. It calls for 5,000,000 EVs by 2020. China does not now have the capacity to build that many EVs or their batteries, so a plea for subsidies has gone out inside of China from the battery industry. Simultaneously Chinese mining companies are acquiring and seeking out non-Chinese deposits from which lithium can be produced *for the Chinese domestic market's EVs*. This will not increase the amount of lithium *available* in the global marketplace.

Is there a mismatch between lithium supply and demand? If not how soon might there be one? And is there a mismatch between demand and processing capacity for any or all of the raw materials needed to make lithium ion batteries, not only lithium but also graphite, cobalt, nickel, and manganese, for example?

InvestorIntel's Cleantech and Technology Metals' Conference in May will address those questions and many more and show you how to keep informed about the issues important to investors.

In the meantime, I'm going to get you ready to ask questions in May by discussing the raw material and processing issues arising from

1. Vehicle electrification and alternate energy storage
2. The production of energy by means alternate to fossil fuels
    1. Wind,
    2. Solar,
    3. Nuclear, and
3. The determination where recycling is necessary not just nice

Coming on Monday, Feb 1: The situation with the materials for the storage of energy in batteries.