

INDEX House View

Trading volumes are down during the past two weeks, with US equity prices going slightly lower from their historical peak, but European equities surpassing it. Overall, global equities are about 20% higher than at their pre-Covid peak. Developed markets do not seem worried or on the brink of a correction, but more likely waiting for the next catalyst, which could indeed be the coming earnings season. US bond yields have also stopped climbing, perhaps momentarily – the US 10 t-bill yield currently hovers around the 1.70% mark. The monster in the closet, inflation, currently reads 1.70%, showing natural mean reversion. It does not mean it won't overshoot, an eventuality largely considered by central bankers and by now probably accepted by markets – let us remind that inflation did overshoot in 2010 and 2011, but only as a strong rebound from an unprecedented -2% deflation state (last time in September 1949).

Taking advantage of these flat waters, we focused on new ideas surrounding our target industries.

Battery recycling industry

The electric vehicle took a lot of time to become even noticeable in annual sales globally. The production of the first electric model, the Nissan Leaf in December 2010, is about 11 years old. The industry has gone and is going through major shifts, starting from technology, followed by the quest to break free from fossil fuels. The fuel aspect has been worked on for the past 30 years in Europe and the US, with many successful milestones reached – starting from the cost per Kw/hour of solar energy being competitive with oil and natural gas, to the world's second largest offshore wind farm located in Denmark, partly owned by Orsted A/S and Norges Bank Investment Management (the \$1.3 trillion Norwegian sovereign wealth fund).

The degree of change this industrial ecosystem is experiencing is accelerating. Now, the automotive sector faces the challenge of recycling 10 years of batteries from Nissan Leaf and many more models from other manufacturers. No existing industry is prepared to dismantle and recycle them safely because batteries cannot be recycled through the conventional way, in light of the chemical and metal compounds built in. In addition, recycling means reuse, not permanent destruction of natural elements, which can contribute to lowering the still high cost of an EV.

Considering the novelty of the industrial process, there are only startups around and a couple of manufacturers as first responders. One of the startups is Redwood Materials, founded by the ex-CTO of Tesla (left in 2019). The company claims it can recover 95-98% of a battery's nickel, cobalt, copper, aluminum, and graphite, and more than 80% of its lithium. The battery is broken down into its basic ingredients which are rendered suitable to be reutilized in the manufacturing process. In the CEO's word, mr. Straubel, "materials can get reused almost infinitely. There's no inherent degradation to the metal atoms". Redwood Materials has partnered with Panasonic and Envision AESC – the battery manufacturing business founded as a partnership between Nissan, NEC Corp. and NEC Tokin Corp in 2007, responsible for the development of the Leaf battery pack and eventually sold to Envision Group in August 2018 – to complete the supply chain in a neat way: Panasonic and Envision AESC supply spent batteries that Redwood recycles and eventually re-sells, broken down into elements, to the same manufacturers. Another startup, Li-Cycle from Canada, is designing facilities specifically to cook down lithium batteries. They claim to produce no meaningful air emissions, waste water, heat or other kind of waste. They too convert almost every element to a reusable state. The positioning of their factories is also strategically close to battery manufacturing plants, to minimize the risk of hazard during transportation. The main electric vehicle manufacturer, Nissan Motor Corp., is also taking steps to expand sustainability along the supply chain. The Blue Switch project started 11 years ago was already designed to solve the challenge of spent batteries. The keiretsu partnered with Sumitomo Corp. to set up 4R Energy Corp. with the aim to develop the tech and infrastructure to "refabricate, recycle, resell and reuse the batteries in Nissan EVs – not for their scrap value, but to power other things". After 10 years of Leaf manufacturing, the company estimates that recovered batteries have a life span of about 10 to 15 years, which makes them usable for lower-intensity jobs – such as powering shopping mall generators or camping trailers – before going into recycling. Furthermore, because batteries can be almost fully reused in new packs, therefore increasing the end-of-life value for owners – rather than being a sell-for-parts kind of deal. This financial possibility could contribute to reduce the overall cost of electric vehicles going forward.

There are also efforts from a governmental level. Among the ones we found out about, there is ReCell in the US. This is the first battery recycling R&D center sponsored by the US Department of Energy's Vehicle Technologies Office, designed to both help the US to compete in the global recycling industry and to reduce reliance on foreign sources of battery materials. The immediate effect of efficient battery recycling is a reduction in cost of battery manufacturing. The center is focused on developing new recycling method, known as "direct recycling", that does not break the battery's chemical structure. This is a valuable approach, as the cathode is engineered into a crystalline nanostructure that is expensive to manufacture and hardly deteriorates through the battery's life. So the mainstream smelting and bleaching methods, while indeed helping in the breaking down of elements to a pure state, would essentially force the duplication of an expensive manufacturing process.

From an investment perspective, all these projects go under the ESG umbrella – companies or investments focused on environmental, social and governance aspects. Investment in publicly listed ESG are becoming predominant among major investment players, despite an initial and

probably current wave of green washing – companies that claim to be involved in green projects, but are not. Blackrock recently raised \$4.8 billion for its third fund on this theme, almost doubling the initial target. However, as it happens with initial stages, the battery recycling industry is far from liquid and almost impossible to find in a pure-play, listed format. From a business perspective, this business looks like high capital expenditure on fixed assets and low single digit margins. There is a chance government will step in to speed up technology advancements, as much as we've seen in solar energy and surely in EVs in US, Europe and China. Therefore, this nascent industry deserves attention in the years to come, as supply of spent batteries look wildly optimistic on the International Energy Agency prediction of a 800% increase in EVs in the next decade.

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