Natural Resources' Forum

Critical Minerals: Green Materials, Green Technologies & Green Applications

Summary

ESG Week: Energy and Mining Forum

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Participants:

(Chair) Tom Hoskyns – Editor, **Mining Journal**
Puruvi Poddar, Chief – Corporate & Business Development, **Tirupati Graphite**
Julian Treger, Chief Executive, **Anglo Pacific Mining**
Ken Hoffman, Basic Materials Practice Senior Expert, **McKinsey & Company**
John Drexhage, Consultant, Energy and Extractives, **World Bank**

Increasing production of critical minerals including graphite, copper and lithium are essential for the transition to net zero to support the development of green technologies and applications that are urgently required to balance growth with maintaining our ecosystem.

How is the battery industry changing?

Ken Hoffman: "The battery industry is very nascent with sales of 47,000 electric vehicles now [increasing to] 6 million this year. The industry is rapidly changing with 30% more copper in EVs versus traditional cars. Car companies are nervous about battery minerals including lithium, nickel – every part of the battery industry is going to see stresses and strains. There's going to be 20-30 different battery chemistries to manage the EV revolution."

Julian Treger: "End users are willing to pay more for less polluting commodities - there will be a premium on better sourced commodities and also more battery chemistries in the future. Cobalt has a great future and we're betting on much better cobalt prices in the years ahead."

Where does graphite fit into this?

*Puruvi Poddar: "*What remains constant in the battery evolution is the role of graphite – it forms the anode, is classified as a critical metal by the EU and US and cannot be replaced by another material. Demand will rise by 5-10 times in the next 10 years. Graphite is mostly produced in China so we now seeing companies looking to diversify supplies. It will move a long way in the next few years."

*Ken Hoffman: "*LFP batteries have poor density, but the newer battery technologies hold great promise. LFP's made a roaring comeback in 2021 and will have a place in the EV revolution. There are currently 50 companies globally looking at new battery technology.
We want to change the battery anode [from graphite] to new technology. You will see lithium anode batteries later this decade."

*Puruvi Poddar: "*Graphene batteries are coming and provides the capability of enhancing the anode. A lot of new technology will come but for the next ten years, the technology that are already commercialised are being adopted."

What are the implications for the mining sector as it looks to expand output while sticking to low carbon emissions goals?

*John Drexhage: "*There's a growing recognition of climate goals but from a recycling perspective, there's are real problem – each OEM is developing its own battery design and not taking recycling into account. Countries with clean mining practices will also get rewarded. Tesla and BHP have signed an exclusive arrangement for lithium offtake coming from its Australian mine due to its net zero credentials."

Can you comment on recycling in the critical minerals space?
*Julian Treger: "*The margins for recycling are too low. A change in incentives is needed to subsidise recycling. People will start to come up with solutions to extract materials [from used batteries]. The aim is to have a smaller mining sector and a larger recycling sector."

*John Drexhage: "*There is a family of 18-20 critical minerals that are required for batteries including base metals and precious metals. There needs to be a broader eco system approach to mining in order to meet net zero emissions targets. There needs to be other forms of activity to compensate for negative impacts [of mining] and a need to manage this effectively in order to ensure a sustainable future."

*Ken Hoffman: "*Recycling is a really interesting area, but LFP batteries have the least amount of raw materials at the end of life with iron and lithium difficult to extract. The public doesn't want batteries to be landfilled. There are a lot of interesting [technology] solutions that will lower emissions and costs and a lot of innovation in the mining sector, which is often accused of being too slow. Governments want to help in this regard."

*Julian Treger: "*We're going to have a convergence of technology [and mining] with new funds emerging from Silicon Valley and also SPACs are interested in convergence stocks. There is a global age of advancement of technology and a significant change of attitude coming. Waste in the future will be a strategic asset – sending waste abroad will be seen as crazy. Global supply chains are breaking down and there will be national supply chains that will include recycling, assets etc."

*John Drexhage: "*A price signal will send things in the right direction and can be used to incentivise companies to deal with tailings. There's not enough attention paid to upstream activities."

*Puruvi Poddar: "*I agree. Very soon the focus will be on zero waste. There will also be demand for local supply chains and localised facilities."

Will deep sea mining play a role in future critical metals supply?
*Julian Treger: "*Its preferable not to go into deep sea mining – there are too many unknowns."

*John Drexhage: "*The one thing I now think of is the entirely different governance regime required in international waters. The Law of the Sea is hardly equipped to effectively govern a robust deep sea mining regime."