

WMF 2020: Key messages about Critical Materials

Overall improvement of our Criticality Assessment together with steady but slow progress on substitution (8 elements of the Mendeleev table get better scores and only 4 worse)

Further improvement expected in the next 2 years for nearly all Red and Red/Orange elements

Focus still needed on the Red elements especially on vulnerable supply chains for core applications (1 new Red is Nickel with more volumes needed and Indonesia rated more unstable)

New KPI representing Environmental Footprint will highlight new challenges









McKinsey&Company



A. Europe, USA, Canada, Australia, Korea and Japan all committed to securing the supply chain of their critical materials

- 1. New rare earth capacities announced in California, Colorado and Texas and MP Materials to be listed on NYSE after merging with Fortress Value
- 2. Canadian Almonty is building the 2nd largest tungsten mine outside China (Sangdong in Korea) with 15 years off take in the US
- 3. 600 kt nickel capacity build up by 2025 with major projects in Australia (BHP capacity conversion at Nickel West and new comers such as Sunrise and Sconi)
- 4. Urban mining and critical materials recycling developing stronger and faster with new technologies and capacities in Japan (JX NMM) and in Europe (Northvolt)



B. OEMs are combining long term vision and short term flexibility in order to adapt economic constraints and uncertainty on technology race (fuel cells vs batteries and solid state vs continuous improvement of lithium ion design)

- 1. Various alternative drive systems at BMW or Toyota (Plug in hybrid, EV battery, Fuel Cell)
- 2. Substitution of critical raw materials and strategic sourcing with long term supply contracts (BMW with suppliers from e.g Australia, Marocco, Russia, South Africa)
- 3. Cooperation along the value chain to manage recycling of used batteries (e.g BMW, Northvolt and Umicore)
- 4. Direct investment in new recycling technologies (e.g Renault Environnement)



B. Cooperation (international, public-private and all industry sectors) is required at every level both to limit impact of political tensions and to enable balanced and sustainable development of EV batteries and fuel cells

- 1. Personal involvement of each key industrial actor (Robert F with US and China)
- 2. Use of existing international organizations to anticipate and smooth down possible conflicts (ICC, World Bank, European Development Bank)
- 3. China is aggressively accelerating in H2 on both mobility and infrastructures.
- 4. Beyond mobility, some other key applications will support the development of H2 supply chain (e.g. hydrogen reduction in steel production).
- 100 members of the Hydrogen Council today from 13 in 2017 CEOs of Air Liquide, Anglo American, BMW, China Energy, Cummins, Engie, Faurecia, Hyundai Motors, Johnson Matthew, Linde, Shell, Sinopec, Total and Toyota on the Board