Response to Public consultation on the European Commission's proposal for Regulation for ensuring a secure and sustainable supply of critical raw materials.
COM(2023)160
(Critical raw Materials Act)

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About SuperNode and Superconductors

SuperNode, headquartered in Dublin, Ireland, is a global technology development company that designs and delivers cutting-edge, superconducting cable systems for bulk electricity transmission.

Conventional transmission cables are limited in terms of current levels which in turn limit their power transfer capability. Electricity grids based upon superconducting cable systems can move larger quantities of power over longer distances with smaller and less obtrusive infrastructure, without electrical losses and at significantly lower voltages. SuperNode's technology will connect electricity producers and consumers in a way that facilitates the most efficient integration of large-scale renewables and the achievement of energy independence and a decarbonised pan-European energy system.

SuperNode was founded in 2018 by Dr. Eddie O'Connor and renewable energy developer Mainstream Renewable Power Ltd. SuperNode is jointly owned by Dr. O'Connor and Norwegian green investment group AKER Horizons.

Integrate Raw Material Circularity in infrastructure purchasing processes

SuperNode welcomes the Critical Raw Materials Act proposed by the European Commission on 16 March 2023. It is vital that the EU identifies and secures delivery of all the raw materials that will be necessary for the transition to a fully decarbonised economy.

According to the IEA, 152 million km of electricity transmission cable would be needed to meet the net zero target, requiring 427 million tons of copper or largely half of total global copper reserves, estimated at 870 million tons[1]. If such an amount of copper were to be used for electricity transmission, there would not be enough to copper available for those wind turbines, batteries and other clean technologies needed for net zero.

For comparison, a pan-European offshore DC transmission grid capable of integrating 450 GW of offshore wind capacity, would require 0.03% of global copper reserves, 0.0015% of global nickel reserves, 0.000009% of global rare earth reserves, and 0.0021% of global silver reserves.

Copper can to some extent be substituted by aluminum. Nevertheless, many new, innovative solutions with significantly improved raw material use – whether compared to copper or aluminum cables - are becoming commercially available this decade, including superconducting cables for long-range bulk transmission of power without energy losses. It is vital that Europe starts to actively integrating raw material resource use and circularity into the purchasing and tendering processes of large scale infrastructure projects such as power grids.

Copper to become a bottleneck for Net-Zero

The availability of copper is inevitably going to become one of the key bottlenecks for reaching Net-Zero in time, as it will be key for e.g. the deployment of electric vehicles and increasing the capacity of the transmission and distribution system. In scenarios developed by S&P[2], annual copper demand is expected to double by 2035 (from 25 MMt to 50MMt) and continue to grow until 2050 (53MMt).

This is why Europe needs to do everything possible to use copper as efficiently as possible by accelerating the development of new, innovative enabling technologies for the transition with improved circularity, using less critical raw materials and, reduced resource intensity.

Superconducting transmission technologies are a more efficient use of materials

Superconducting distribution grids are already commercially available and SuperNode is working on extending the scope and application of existing superconducting cable technology, developing long-distance, superconducting transmission technology that would be commercially available from around 2030. Superconducting electricity transmission reduces the materials use of energy transmission dramatically. To carry one kA one metre, superconducting cables requires 7 times less copper than conventional, copper-based power cables.

Additionally, superconducting transmission technology will be able to transfer 5 or 6 times as much energy as conventional HVDC technology at a given voltage level. Alternatively, the technology can transfer the same amounts of energy at a much lower voltage level. This would be associated with far fewer environmental impacts and raw materials use than conventional copper-based cable.

[1] Copper Demand and Long-Term Availability - Copper Alliance

[2] S&P Global | The Future of Copper: Will the looming supply gap short-circuit the energy transition? – July 2022

Meanwhile, significant savings in materials would accrue from far smaller related infrastructure, e.g. from significantly smaller offshore collector stations needed in lower voltage systems. For example, a modern 2.4 GW, 525 kV offshore collector station weighs more than 15,000 tons and cost up to € 1 billion. A collector station for a superconductor cable that can carry the same amount of energy would operate below 100 kV and weigh and cost about one third.

Moreover, superconducting electricity transmission cables are far less sensitive to raw material price volatility. At the current price of copper ($9,000/tn), 70% of the cost of a conventional transmission cable is contributed to copper. For a superconducting cable with similar power transfer capability, copper is 7% of the cost. Thus, a 40% increase in the price of copper, would increase the total raw material cost of a copper cable by 47% per kilometre, whereas the raw material cost of a superconducting cable would increase by 5%.

Approximately half the cost of a superconducting transmission cable is attributed to the high-temperature superconducting tape (HTS tape), which contains various raw materials including nickel, copper, silver, substrate, and rare earths. These are all characterized by a relatively abundant supply.

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