REIA

Rare Earth Industry Association

REIA's Input for the EU Raw Materials Act

November 25, 2022

What it takes to establish European supply chains of rare earth permanent magnets that will fast-forward Europe's transition to energy saving technologies for Electric Vehicles and Wind Energy

REIA's Input for the EU Raw Materials Act

A. Policy Proposals:

- **Just Transition Fund**

  With the opportunity of the EU's Midterm Review of the Multi-year Financial Framework, the EU should amend the Just Transition Fund's maximum eligible grant amount per single projects and per single NACE code. Currently caped at €18.7 Million, it should be expanded to €80 Million.

- **Sovereignty Fund**

  Include the definition of the European Sovereignty Fund in the Raw Materials Act, as an EU fund that will provide high-CAPEX grants along Critical Raw Materials value chains. the Sovereignty Fund should secure financing of projects of up to 80 million EUR, in order to ensure a level-playing field between members states that do not have the fiscal space to benefit from IPCEIs, yet have projects and assets of strategic importance to the EU.

- **List of Strategic Projects for EU**

  The Raw Materials Act should empower the European Commission to create a list of Strategic Projects of European Interest, nominated by Member States. This list should qualify projects from Member States that do not have the fiscal space to participate in IPCEIs - creating the necessary level playing field between all Member States help de-risk investments in future technologies and industrial production capacities.

- **Public Procurement Premium for Domestic Supply and ESG**

  Public procurement for renewable energy generation should place a price premium on wind energy developers that include at least 10% of their permanent magnet supply from EU-domestic manufacturers that report on ESG criteria.

- **Priority of Recycling from Magnet Manufacturing Swarf**

  Recognize in the text of the Raw Materials Act that recycled rare earths in the EU – over the next decade, before EOL reaches critical mass – will originate from magnet manufacturing swarf. Without magnet manufacturing, the Commission's ambition for 20% content of rare earth magnets to originate from recycled sources will not be achievable.

- **Mining and Plant Land Use Permitting**

  Establish an EU agency that will act as a channel of communication between the EU Commission's shortlist of strategic EU Projects and local land use and environmental permitting authorities, in order to identify ways to fast-track approvals.

- **OEM Procurement Incentives for Supply Chain Diversification**

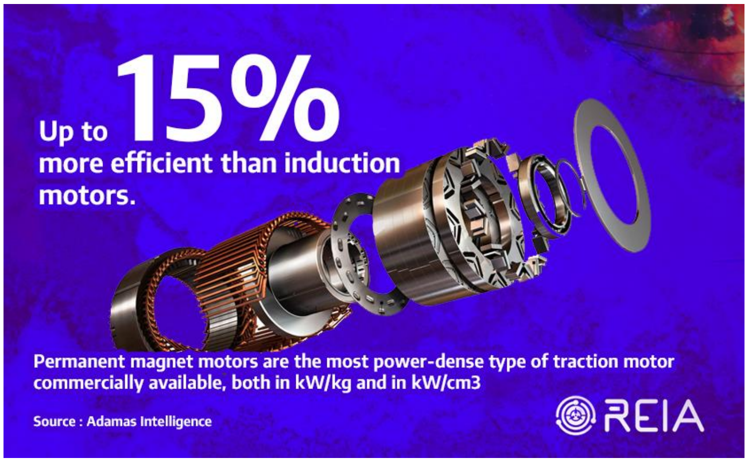
  Tax incentives (either on capital gains or on corporate) for EV motors and wind turbine OEMs that are REPM buyers if they procure from EU-made sources could be effective, but they need to match in magnitude a 20-30% premium over imported China prices.

- **Raw Materials Investment Vehicle:**

  State-supported investment and procurement organisation acting as lead buyer and pooler of raw materials demand across European countries, similar to JOGMEC, which does direct investment or is guarantor of private sector investments.

B. Rare-earth permanent magnets in the drivetrain motor of EVs yield the efficiencies make battery economics work

There is no shortcut to resolving the Critical Minerals supply chain conundrum – it takes a holistic approach of including all minerals and incentivizing heavily (and immediately) recycling facilities. If one type of Critical Minerals (e.g. rare earths) is not addressed appropriately, then the policy prescription for Battery Materials – that has been successful so far – becomes inadequate.



REPMs provide the most energy-efficient technology solution for the drivetrain motors of EV. For an EV to achieve a given range without using rare-earth permanent magnets in the drivetrain motor design, the energy loss will be higher, and therefore the battery will have to be circa up to 30% larger.

- **Economic trade-off:** Amount/cost of Lithium/Nickel/Cobalt/Graphite required for batteries vs. amount/cost of rare earth permanent magnets for energy savings in drivetrain motor.
- **Engineering Design trade-off:** If automotive OEMs were to minimize cost and substitute magnets in their motors for automotive working temperatures/speed, the only alternative technology they could be theoretically left with is Switched Reluctance Motors (SRMs). These SRMs, however, have low power density, much higher control complexity, and very high noise and vibration.

Therefore, there is no credible substitute for automotive drivetrain motor applications that does not use rare-earth permanent magnets, while also achieving energy efficiency in a way that could truly support the large-scale transition from ICEs to EVs.

For the average passenger Electric Vehicle to be competitive enough in terms of performance to average passenger Internal Combustion Engine Vehicle, it would require 2 kilograms of rare-earth permanent magnets used in its drivetrain motor. Of this 2 kilogram amount of rare-earth permanent magnets needed for use in the average Electric Vehicle, this is the breakdown of the most used rare earths:

- 21% Neodymium
- 7% Praseodymium
- 2% Dysprosium
- 1.5% Terbium
- Total ~31.5% Rare Earths used per kg of magnet

In effect, to satisfy the EU's target of 30 million EVs manufactured and used by 2030, there is a demand of approximately 60,000mt cumulatively of rare earths magnet (60,000mt x 31.5% = ~19,000mt of which is rare earths) only for European EV manufacturers.

The average single car lithium-ion battery pack (of a type known as NMC532) could contain around 8 kg of lithium, 35 kg of nickel, 20 kg of manganese and 14 kg of cobalt, according to figures from Argonne National Laboratory. If rare earth permanent magnets are not used in EV drivetrain motors because of lack of adequate industrial policy intervention by the EU to establish domestic midstream and downstream, a battery pack that is 30% larger would mean that European EV manufacturers would need – by 2030 alone – approximately up to: 72,000mt more lithium, 315,000mt more nickel, 180,000mt more manganese, 126,000mt more cobalt.

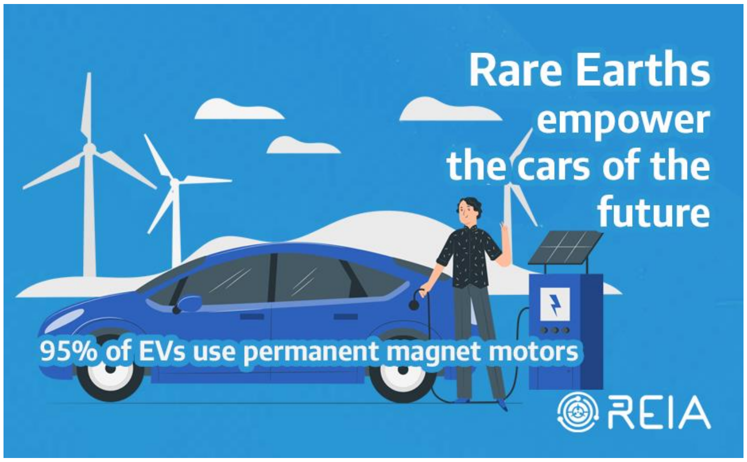
None of these critical minerals for batteries are in (or will be) in adequate supply by 2030 to satisfy the target demand – even if prices keep rising more, at which point EVs will become so uneconomical that even consumer incentives will not suffice to create momentum for transition to them.

C. What Prevents Private Sector from Proceeding with Rare Earth Projects

Lack of the right type and magnitude of EU funding options for CAPEX and OPEX. When it comes to developing policy that shapes supply chains and mobilizes the required private capital for establishing local production of rare earths, there are three risks that require management: Market, Technology, and Financial.

- **Market Risk**
  Addressed by European Green Deal, setting expectations for industry to converge to EU's 2050 climate targets.

- **Technology Risk**
  Addressed by EU HORIZON funding programs incentivizing innovation and R&D collaboration.



- **Financial Risk**
  Not addressed adequately yet for Rare Earths. For the European automotive manufacturing transition from ICE to EV transition to be successful, and for the corresponding automotive manufacturing jobs to be safeguarded as opposed to be offshored, the EU needs to ensure domestic resilient supply chains of critical raw materials.

There are two main technologies involved that require critical raw materials: batteries and drivetrain motors. The batteries' lithium/cobalt/nickel supply chain issues have been addressed by the European Battery Alliance. The solution was an IPCEI, which allows member states to lever their national budgets to provide direct state aid to strategic assets for the EU's broader benefit.

The drivetrain motors' rare earth permanent magnet supply chains, however, are a much more challenging case. Unlike the case of batteries, the supply chain challenge and the corresponding solution does not lie proportionately within member states. The EU member states that are hosts to most automotive jobs tend to be larger countries, whereas the EU member states that are host to the EU's most strategic rare earth assets tend to be smaller countries. Therefore, applying the same IPCEI policy prescription for Rare Earths might not work that successfully, as smaller EU member states that have the most strategic rare earth assets do not have the ability to lever their national budget to tackle the financial risk of the solution, they are host to, in order to solve the problem that is located in larger member states.
Financial support for rare earth supply chains in the magnitude and in the unique ability of the European Sovereignty Fund to support CAPEX with grants. It takes support of this kind to unlock the business cases of such strategic asset in smaller EU Member States– a funding tool that has the unique ability to support CAPEX with sustainability-linked outcomes.

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