Critical Raw Materials for Defence

UK Midstream Manufacturer

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Less Common Metals

Located in Northwest England with over 30 years of experience in the metals and alloys industry.

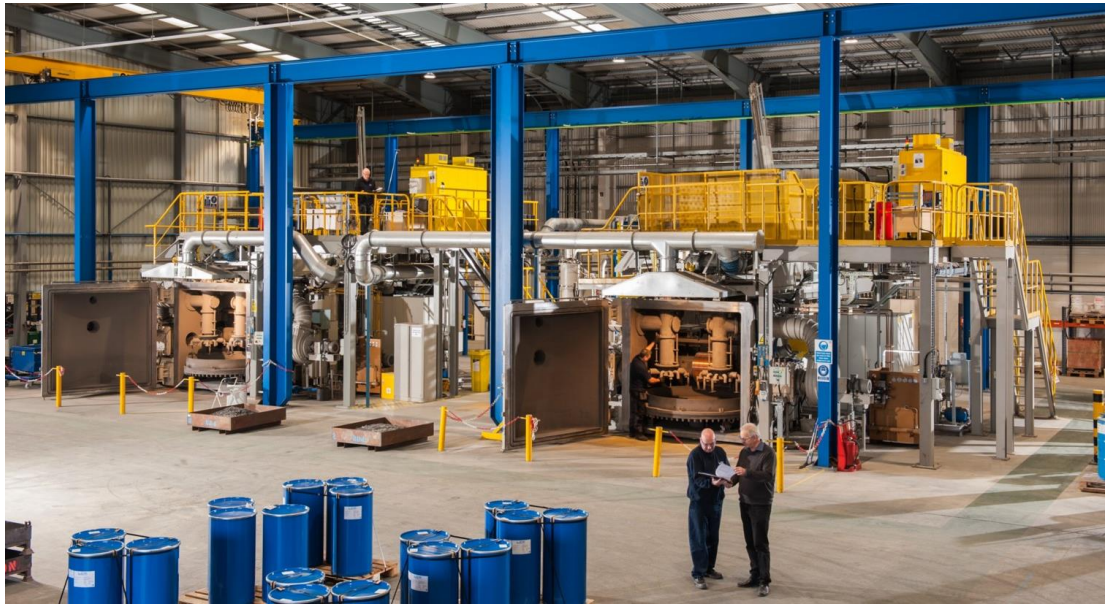
Main products

- Rare earth metals and alloys
  - Nd, NdPr, NdFeB, SmCo, Dy, Tb, La
- Rare earth alloys for non-magnet applications
  - Speciality alloys
  - Hydrogen Storage Alloys

  Producer of non-rare earth vacuum-melted alloys

Supply globally

- Main markets – Europe, Japan, North America
- Operates to the highest possible standards of Quality, Environmental, Health & Safety stewardship
  - Fully permitted for all activities (ISO 9001 & ISO 14001)
  - Extends this expectation throughout the supply chain



LCM | QUALITY PRODUCTS, SUSTAINABLY PROCESSED.

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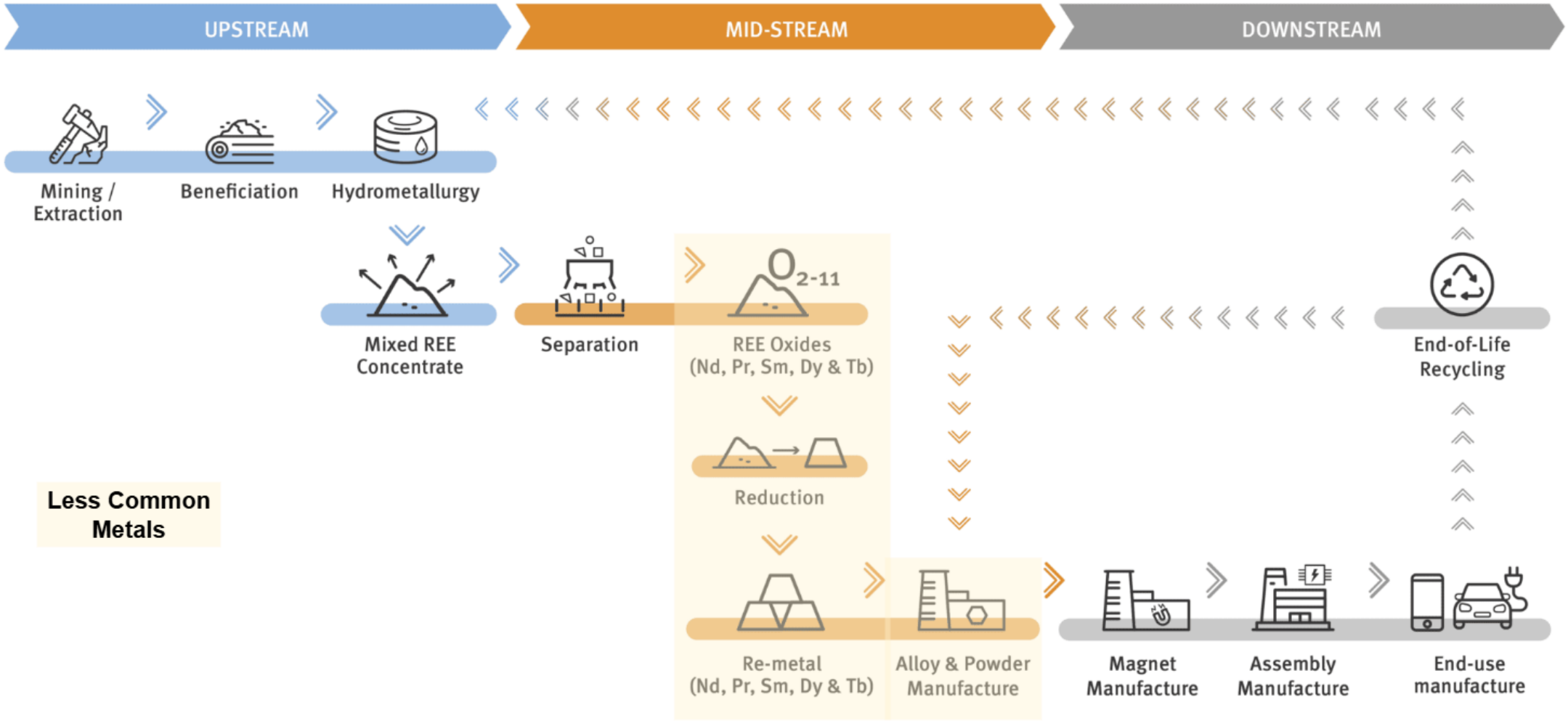
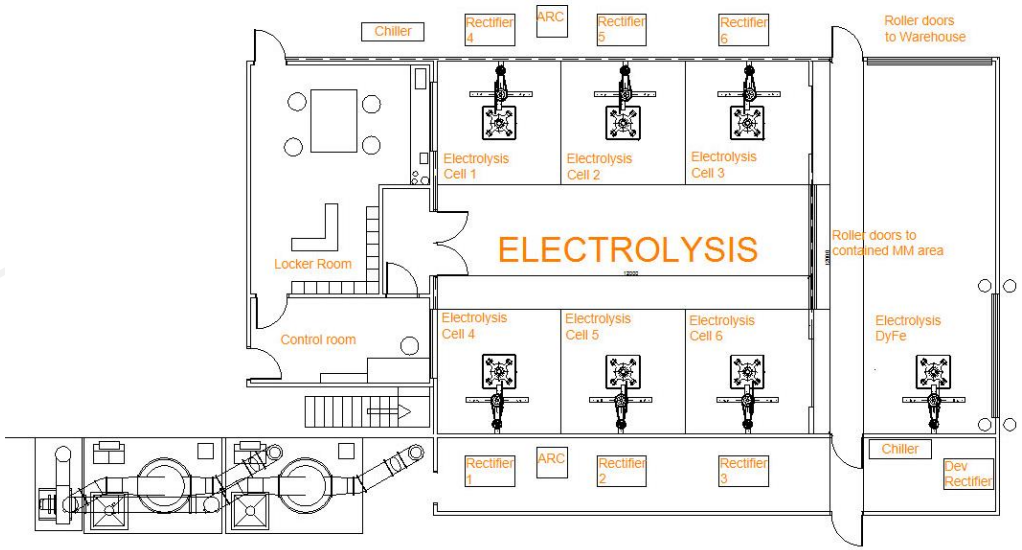
Mine to Magnet supply chain diagram

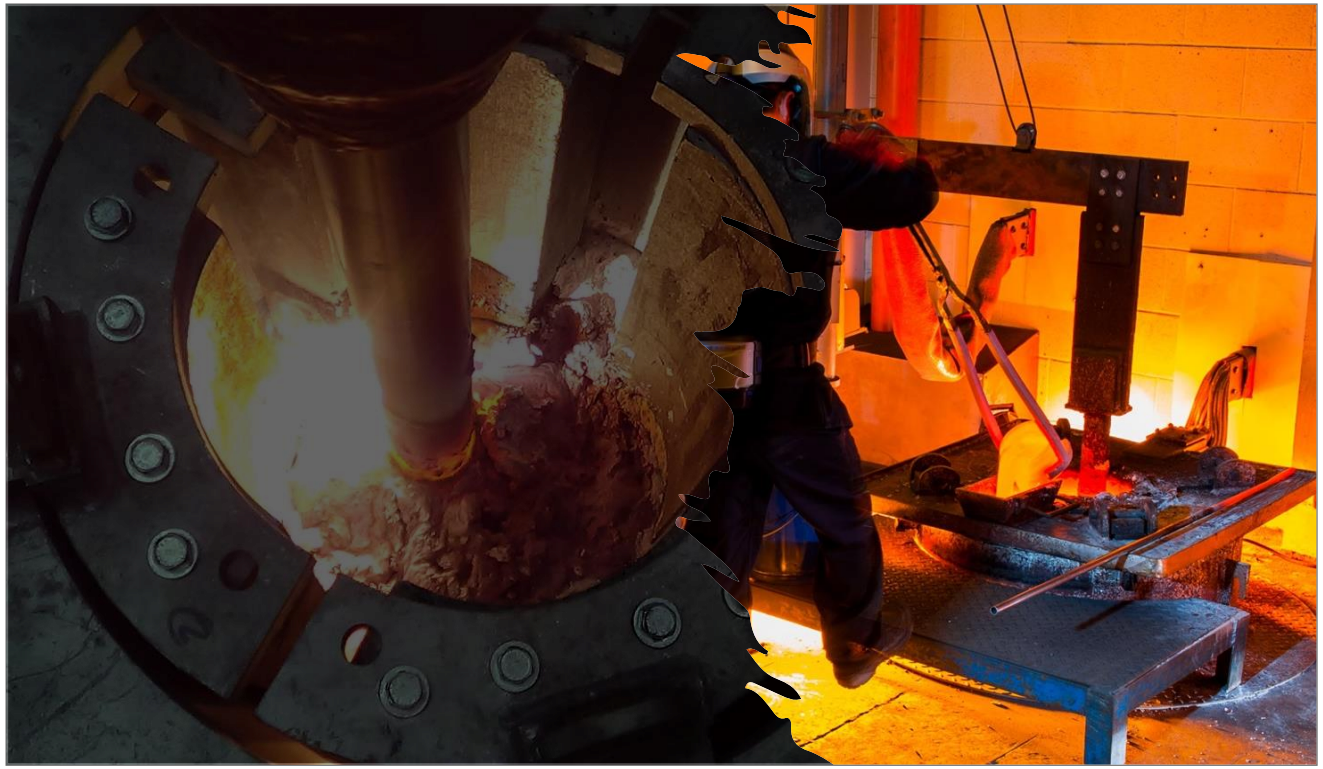


Electrolysis at LCM

Can expand our current Nd/ NdPr/ DyFe metal production from a 2-cell operation to 7 cells in the UK

- Approximate increase from 55t per cell/ per annum to a total capacity of 330t per annum





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Tb/Dy Metal via metallothermic reduction

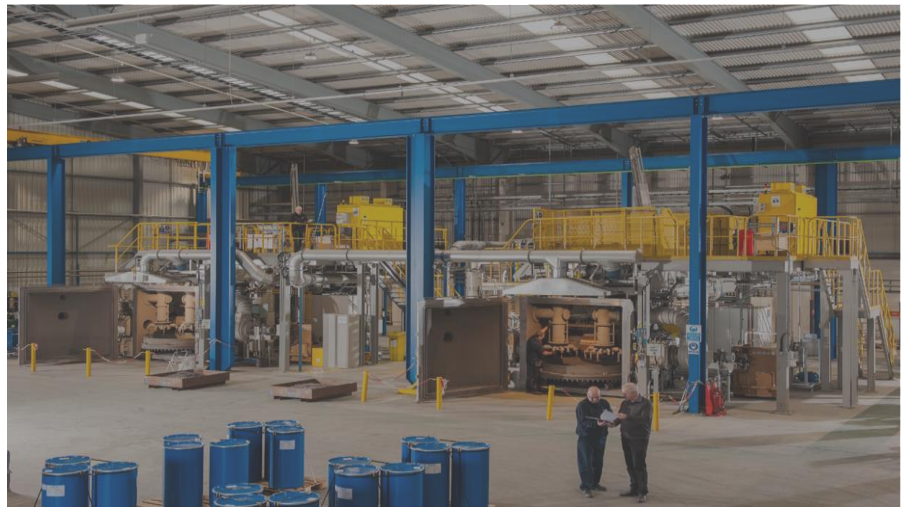
Terbium metal (Tb)

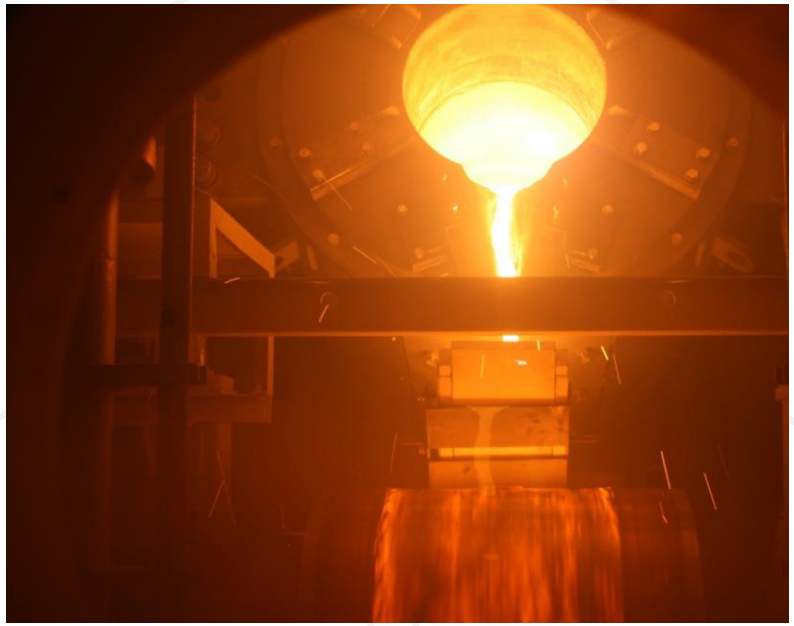
Dysprosium metal (Dy)

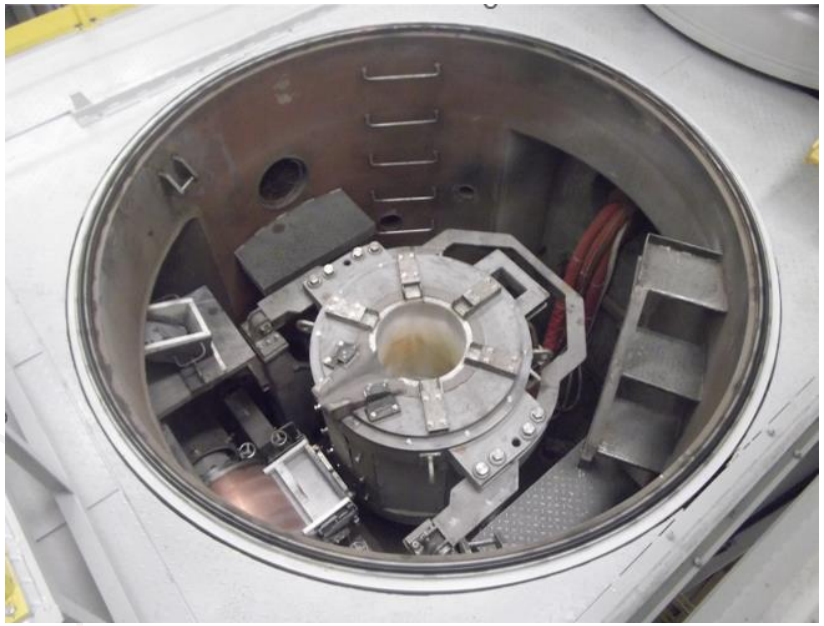
2 furnaces processing to an output of 10t capacity per annum, increasing to 30t in 2025

Strip Casting

- Industry standard for production of NdFeB alloys
- Significant technical advantages over alloys produced by “traditional” casting methods
  - Gives uniform (fine) grained microstructure
  - Allows for compositions close to optimum with minimal free α-iron formation







A spotlight on Samarium

A critical RE vital for high-tech applications

Why is samarium important?

Samarium (Sm) is used in permanent magnets for the military and defence sector. There are very few effective substitutes for Sm in many of these applications, increasing its strategic importance.

Risks:

- China currently controls 90% of the production and refining process, giving the country significant control over the supply chain
- Dependence creates supply chain vulnerabilities
- There is a lack of domestic production, and this poses a risk to the Western World.

Jet engine

Processing Samarium at LCM

Solution:

- Through successful trials, LCM has successfully produced **high-purity Sm metal at 99.9%.**
- This project will establish the **first independent Western production** capability for Sm metal, reducing reliance on Chinese imports and **diversifying supply chains**.
- This will meet the **rising US demand** in **defence, magnet** and **clean energy applications**.

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Partnerships

LCM works on a number of UK-funded projects which focus on building a circular economy supply chain.

HyproMag

- REEMELT: In partnership with HyproMag, LCM is trialing an oxygen reduction process to recycle EOL magnets.
  - Funded by Innovate UK's CLIMATES programme

Ionic Technologies

- CirculaREEconomy: This project brings together leading recyclers, manufacturers, and OEMs to develop advanced recycling technologies and foster strategic integration across the REPM value chain.
  - Funded by the APC UK and in connection with the DBT DRIVE35 programme, which supports the transition to zero-emission vehicle manufacturing.

- REEVALUATE: LCM is leading an Industrial Scrap-to-Magnet initiative in collaboration with Ionic Technologies and VAC.
  - Funded by Innovate UK's CLIMATES programme

- Ford/Ionic Technologies: Establishing a trial circular supply chain for REEs in the UK using 100% recycled REE for the production of REPM for EVs.
  - Funded by Innovate UK's CLIMATES programme

Recycling

For over 30 years, LCM has used a number of reprocessing routes to recycle materials and is dedicated to a closed-loop circular economy.

Inhouse

- Re-processed RE oxides
- Scrap magnets
- SmCo magnet recycling
- HfNi from the aerospace industry
- Copper recycling

Other recycling projects

- MultiMag – Recycling RE oxides from EOL magnets.
  - Funded by the EU's Horizon 2020 programme
- SUSMAGPRO – Recycling of end-life magnets.
  - Funded by the EU's Horizon 2020 programme
  - Project now completed

SUSMAGPRO
SUSTAINABLE RECOVERY, REPROCESSING AND REUSE OF RARE-EARTH MAGNETS IN THE CIRCULAR ECONOMY

MultiMag

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