

Response to inquiry from the Business and Trade Committee on the UK Government's approach to industrial policy

25 January 2024

British Geological Survey

The British Geological Survey (BGS) is a public sector organisation and the UK's premier centre for earth science data, information and expertise. BGS is a component body of the Natural Environment Research Council (NERC), which is part of UKRI (UK Research and Innovation). It has an annual budget of about £50 million, a little over half of which comes from the UK government's Science Budget, with the remainder coming from external commissioned research, and employs about 650 staff.

We are the UK's principal provider of objective and authoritative geoscientific information and knowledge for wealth creation, sustainable use of natural resources, reducing risk and living with the impacts of environmental change. Our responsibilities include advising the UK government on all aspects of geosciences, as well as providing impartial geological advice to industry, academia and the public. Our knowledge is based on decades of corporate experience in the collection, collation, databasing, statistical evaluation, mapping and interpretation of geological and environmental data.

There are various groups in BGS which are involved in research that supports the achievement of net zero emissions in the UK, including the Geothermal energy, CCS, Minerals, International and National teams as well as the BGS-based centre of excellence – the Critical Minerals Intelligence Centre (CMIC). CMIC is a joint project of the Department of Business & Trade (DBT) and BGS. This submission outlines the work underway across BGS and CMIC and commentary is only provided where current and planned projects are relevant for this Call for Evidence¹.

Net Zero:

The Call for Evidence² outlines:

As part of this inquiry, the Committee will look at which sectors of the economy are crucial to the UK's transition to Net Zero, including the green growth industries where the UK has a competitive advantage internationally and how effectively the Government is supporting strategic industries to decarbonise. The Committee will also explore:

- *where it is desirable for the UK to cooperate internationally to achieve Net Zero industrial policy objectives.*
- *the progress the Government has made towards securing a resilient supply critical minerals for the UK's transition to Net Zero, since the Critical Minerals Strategy was published in July 2022.*
- *the extent to which the growth of green industries and the decarbonisation of industrial sectors will create new green jobs and an equitable transition to Net Zero*

¹ Call for Evidence – Business and Trade Committee Inquiry into Industrial Policy. UK Parliament, London, UK (see <https://committees.parliament.uk/call-for-evidence/3315/>) (Accessed 24 January 2024).

² Call for Evidence, *ibid*.

For international cooperation, we note for the Committee that BGS teams and CMIC are cooperating with organisations and agencies in many parts of the world, including with government geological surveys in Zambia, Kazakhstan, USA, India, Brazil, Canada, Chile, Argentina, the Philippines, South Africa and others. This work is often through the delivery of specialist training or joint research projects, focussing on the exploration, mineral resources and mining of critical minerals which underpin the technologies for net zero. For example, electric vehicles require energy storage batteries which rely on minerals such as lithium, cobalt, nickel, manganese and graphite – all assessed as elevated or high criticality to the UK economy in 2021³. The international work of BGS and CMIC is therefore helping to position the UK with respect to potential supplier nations of the critical minerals required to achieve net zero by building capacity and fostering collaboration with resource-rich nations. The work of BGS also reports on these activities and the larger policy, industrial landscape, and resource potential of countries to lay an evidence base for government to tie closer relationship with strategic partners.

By developing a detailed characterisation of supply chains from cradle to grave of the bill of materials employed in technologies essential to the green energy transition, the work BGS and CMIC enable targeted intervention in the most concentrated markets, reducing risks of disruption and improving resilience. This work includes a detailed assessment of the mining, refining, processing of raw materials and metals, to the manufacturing stages of sub-components and precursor materials and chemicals used in UK industries. As far as possible, this work is made in accordance to best-international practices evaluating technology-readiness level and standardised classification of resources to provide clear and transparent assessment.

With respect to progress made towards resilient supply chains since the release of the UK Critical Minerals Strategy in July 2022⁴ and the Critical Minerals Refresh in March 2023⁵, we note the following reports by or for CMIC (in date order from July 2022), including a brief synopsis for each to highlight aspects of relevance to this inquiry:

- Lusty, P, Josso, P, Price, F, Gunn, A G, Shaw, R, Deady, E, Grant, H & Idoine, N, 2022, *Study on Future UK Demand and Supply of Lithium, Nickel, Cobalt, Manganese and Graphite for Electric Vehicle Batteries*. Critical Minerals Intelligence Centre (CMIC), British Geological Survey (BGS), Commissioned Report CR/22/079, July 2022, 72 pages⁶.
 - *Reviews current plans for battery manufacturing and recycling in the UK, highlighting the critical raw material requirements for the supply chains (especially lithium, nickel, cobalt, manganese, and graphite). The potential for domestic supply was assessed as highly uncertain, meaning the UK will remain dependent on imports.*
- Bide, T, Horn, S, Gunn, A G, Price, F, Mitchell, C J & Patton, M, 2022, *Securing Sustainable Supplies Critical Raw Materials for the UK, Current Issues and Recommendations for*

³ Lusty, P A J, Shaw, R A, Gunn, A G & Idoine, N E, 2021, *UK Criticality Assessment of Technology Critical Minerals and Metals*. British Geological Survey Commissioned Report, CR/21/120. 76pp. (see <https://www.bgs.ac.uk/download/uk-criticality-assessment-of-technology-critical-minerals-and-metals/>).

⁴ *UK Critical Minerals Strategy – Policy Paper*. HM Government, United Kingdom, July 2022. (see <https://www.gov.uk/government/publications/uk-critical-mineral-strategy>).

⁵ *Critical Minerals Refresh: Delivering Resilience in a Changing Global Environment – Policy Paper*. HM Government, United Kingdom, July 2022. (see <https://www.gov.uk/government/publications/uk-critical-mineral-strategy/critical-minerals-refresh-delivering-resilience-in-a-changing-global-environment-published-13-march-2023>).

⁶ see: <https://ukcmic.org/downloads/reports/ukcmic-battery-minerals-report.pdf>

- Improvement*. Editor J Mankelow, Critical Minerals Intelligence Centre (CMIC), British Geological Survey (BGS), Commissioned Report OR/22/034, October 2022, 93 pages⁷.
- *Reviews current strengths and weaknesses in different approaches to supply chain management of critical minerals, especially considering environmental, social and governance ('ESG') issues and potential strategies to mitigate ESG-related risks.*
 - Bide, T, Horn, S & Gunn, A G, 2022, *Overview of Activities and Policy Related to Critical Raw Material Standards and Resource Management*. Editor C Mitchell, Critical Minerals Intelligence Centre (CMIC), British Geological Survey (BGS), Commissioned Report CR/21/124, October 2022, 79 pages⁸.
 - *Explores the potential for applying the UN Economic Commission for Europe's new UN Frame for Classification (UNFC) and UN Resource Management System (UNRMS) for mapping and quantifying sustainable supply chains and stocks of critical raw materials, although the ability to incorporate ESG risks is an area requiring further development.*
 - Deady, E, Goodenough, K M, Currie, D, Lacinska, A, Grant, H, Patton, M, Cooper, Josso, P, Shaw R A, Everett, P & Bide, T, 2023, *Potential for Critical Raw Material Prospectivity in the UK*. Critical Minerals Intelligence Centre (CMIC), British Geological Survey (BGS), Commissioned Report CR/23/024, April 2023, 57 pages⁹.
 - *Reviews the geology of the UK with respect to mineral systems (the processes that form mineral deposits) containing critical minerals, highlighting prospective areas in Central Highlands and Aberdeenshire in Scotland, County Tyrone in Northern Ireland, Cumbria, North Pennines, north-west Wales and south-west England.*
 - Singh, N, Lusty, P & Josso, P, 2023, *Scoping Study on Metals Used in Specialist Alloys in the Aerospace Industry*. Critical Minerals Intelligence Centre (CMIC), British Geological Survey (BGS), Open Report OR/23/016, May 2023, 54 pages¹⁰.
 - *Reviews the current alloys used in the aerospace industry, noting the strong dependence on imported materials and alloys and that these markets are negatively affected by COVID-19 and the Russian invasion of Ukraine. It is noted that the preference is for supply chains with strong ESG credentials and responsible sourcing practices, but this is increasingly difficult to obtain as well as leading to higher costs.*
 - Knights, 2023, *Review of Mineral Rights and Associated Issues in Great Britain in Relation to the UK Government Publication 'Resilience for the Future – The UK's Critical Minerals Strategy'*. Prepared by Knights Professional Services Ltd (Knights) for the Critical Minerals Intelligence Centre (CMIC), British Geological Survey (BGS), May 2023, 50 pages¹¹.
 - *Finds that current mineral rights and mining tenure does not impede the critical minerals sector; recommends some minor changes to enhance overall efficiency.*

⁷ see: <https://ukcmic.org/downloads/reports/ukcmic-overview-of-activities-and-policy-related-to-critical-raw-material-standards-and-resource-management-cr21124.pdf>

⁸ see: <https://ukcmic.org/downloads/reports/ukcmic-overview-of-activities-and-policy-related-to-critical-raw-material-standards-and-resource-management-cr21124.pdf>

⁹ see: <https://ukcmic.org/downloads/reports/ukcmic-potential-for-critical-raw-material-prospectivity-in-the-uk-cr23024.pdf>

¹⁰ see: <https://ukcmic.org/downloads/reports/ukcmic-specialist-alloys-aerospace-report-or23016.pdf>

¹¹ see: <https://ukcmic.org/downloads/reports/ukcmic-mineral-rights-report-knightsplc.pdf>

- SFA Oxford, 2023, *The UK Nickel Supply Chain*. Prepared by SFA Oxford for the Critical Minerals Intelligence Centre (CMIC), British Geological Survey (BGS), May 2023, 31 pages¹².
 - *Notes the current trends in the global nickel sector which means securing UK supplies is getting harder (e.g., competition from Indonesia in particular), the need for co-location of process plants and manufacturing as well as reliable clean energy supplies (especially given global trends towards carbon pricing). Various policy recommendations are suggested to improve supply chain resilience and sustainability.*
- Reeves, M, Newport, S, Clark, P, Hindocha, S and others, 2023, *Critical Minerals Research Landscape Review*. Prepared by staff from Innovate UK KTN, National Environment Research Council (NERC) and UK Research & Innovation (UKRI) for the Critical Minerals Intelligence Centre (CMIC), British Geological Survey (BGS), June 2023, 50 pages¹³.
 - *Notes the various strengths in the broader UK research landscape (e.g., specific sectors such as batteries, alloys, advanced materials and others; research infrastructure such as Royce, Catalysis Hub, etc) although extraction research for critical minerals needs to be improved (building on existing capacity in government, university and the oil and gas sectors); need to ensure funding aligns with priorities such as domestic extraction, interdisciplinary research on supply chains, materials science and circular economy approaches.*
- IOM3, 2023, *The Talent Gap: Critical Skills for Critical Materials*. Prepared by Institute of Materials, Minerals & Mining (IOM3) on behalf of the Critical Minerals Intelligence Centre (CMIC), British Geological Survey (BGS), July 2023, 58 pages¹⁴.
 - *Explores the current issues in attracting students to enter the professions required for critical minerals, especially perceptions of the mining and materials industries and associated career pathways, as well as the need for a larger pool of available expertise in midstream processing and metallurgical activities.*
- Price, F, 2023, *Scoping Report on the Material Requirements for a UK Hydrogen Economy*. Editors M Bentham & D Condon, Critical Minerals Intelligence Centre (CMIC), British Geological Survey (BGS), Open Report OR/23/017, July 2023, 29 pages¹⁵.
 - *Notes that current hydrogen production technology (i.e., electrolyzers) is dependent on platinum (Pt) and iridium (Ir), with the Pt supply chain most likely being able to meet potential demands whilst Ir faces constraints – leading to the need for reducing intensity of Ir use and improved efficiency and recycling.*

¹² see: <https://ukcmic.org/downloads/reports/ukcmic-uk-nickel-supply-chain-public-report-sfa-oxford.pdf>

¹³ see: <https://ukcmic.org/downloads/reports/ukcmic-critical-minerals-research-landscape-review-innovate-UK.pdf>

¹⁴ see: <https://www.iom3.org/resource/iom3-submits-report-on-critical-minerals-value-chain-skills-gaps-to-uk-government.html>

¹⁵ see: <https://ukcmic.org/downloads/reports/ukcmic-scoping-report-on-the-material-requirements-for-a-uk-hydrogen-economy-or12017.pdf>

- *The Geological Potential of the UK for Battery Metals*. Prepared by BGS / CMIC staff, January to September 2023, including cobalt¹⁶, graphite¹⁷, nickel¹⁸, manganese¹⁹ and lithium²⁰.
 - *Reviews the geology of the UK and known mineral deposits and prospective areas for the discovery of new deposits containing critical minerals, noting the need for modern exploration and investigations. All reports note the lack of code-compliant mineral resources and ore reserves (with one lithium resource being the exception), whilst noting that:*
 - *cobalt has potential as a by-product to base metal deposits;*
 - *graphitic rocks are widespread and research is needed to investigate further;*
 - *lithium has significant prospectivity in south-west England, north-east England and north-east Scotland;*
 - *nickel and manganese have potential in some areas but further research and investigations are needed.*
- Josso, P, Lusty, P A, Gunn, A G, Shaw, R, Singh, N, Horn, S & Petavratzi, E, 2023, *Review and Development of the Methodology and Data Used to Produce the UK Criticality Assessment of Technology-Critical Metals*. A Bloodworth (Editor), Critical Minerals Intelligence Centre (CMIC), British Geological Survey (BGS), Keyworth, Nottinghamshire, United Kingdom, External Report OR/23/044, October 2023, 93 pages²¹.
 - *Reviews current methodologies around the world for assessing and quantifying criticality and suggests changes to fit the unique requirements of UK industry and government. The new methodology is comprehensive and robust.*

This collected body of work to date represents a comprehensive (and ongoing) package of research, synthesis and analysis which provides the qualitative and quantitative framework and understanding of the need for and flow of critical raw materials through the UK economy. Collectively, they also form the basis for investment into new technologies, processes, systems and policies across government, industry, academia and the community to ensure the UK has a resilient supply of the critical raw materials it needs to achieve a net zero emissions economy.

At present, CMIC is close to delivering a range of new projects and reports for the 2023/24 financial year ending 31 March 2024. This includes detailed foresight studies on wind turbines, nuclear power, solar photovoltaics, electric vehicle batteries and traction motors, heat pumps, fuel cells, and electrolyzers, which will provide evidence of future raw and transformed materials requirements for achieving UK net-zero goals. CMIC is also finalising studies on critical mineral potential of UK mine wastes, critical metals requirements for medical

¹⁶ Cobalt in UK profile, see: <https://ukcmic.org/downloads/reports/the-potential-for-cobalt-in-the-uk-2022.pdf>

¹⁷ Graphite in UK profile, see: <https://ukcmic.org/downloads/reports/the-potential-for-graphite-in-the-uk-2022.pdf>

¹⁸ Nickel in UK profile, see: <https://ukcmic.org/downloads/reports/the-potential-for-nickel-in-the-uk-2022.pdf>

¹⁹ Manganese in UK profile, see: <https://ukcmic.org/downloads/reports/the-potential-for-manganese-in-the-uk-2023.pdf>

²⁰ Lithium in UK profile, see: <https://ukcmic.org/downloads/reports/the-potential-for-lithium-in-the-uk-2022.pdf>

²¹ see: <https://ukcmic.org/downloads/reports/ukcmic-review-and-development-of-the-methodology-and-data-used-to-produce-the-uk-criticality-assessment-of-technology-critical-minerals.pdf>

technologies, country critical minerals profiles and a circular economy review for the UK. A major project for the 2024/25 financial year, will be a new criticality assessment of the mineral and material requirements for the UK, with other studies and projects currently being finalised between BGS/CMIC and DBT. Outcomes from the assessment are expected to be available in the latter part of 2024.

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