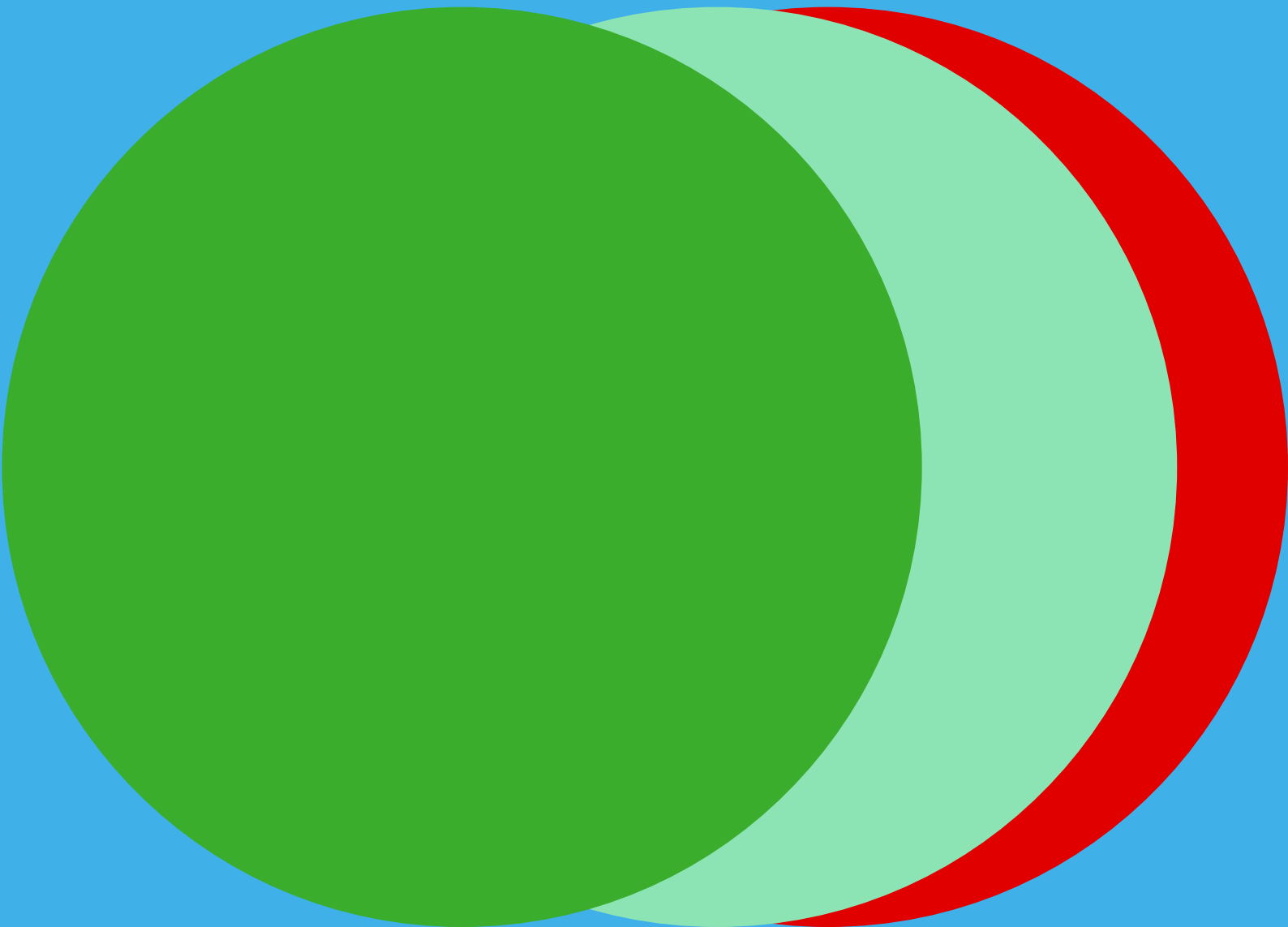
Institute of Materials, Minerals & Mining

Materials, Minerals & Mining: Securing a resilient and sustainable future for the UK



Priorities for the next Government

Materials, minerals, and thus the mining that provides them underpin the economy, our every-day lives and the low-carbon transition. From our homes and transport systems to healthcare and how we communicate, they are critical building blocks of modern society. Materials and minerals are essential for a range of industries and technologies from automotive and aerospace, to renewable energy, construction and defence.

A proper focus and strategic approach to materials, minerals and mining is therefore vital to the UK's economic, social and environmental development including competitiveness, national security and reaching net-zero.

IOM3 is therefore calling on the next Government to:

1. Establish and implement a UK Materials Strategy: a comprehensive, cross-government, cross-economy strategic approach to sustainable use and management of materials covering the full life cycle to ensure supply chain resilience, secure access to the materials and minerals required for modern society and to deliver net-zero.

2. Advance the transition to a resource efficient and resilient society: embedding resource efficiency and productivity across government policy, driving the transition to a more circular economy where materials are kept in circulation at their highest value for as long as possible, building resource and energy security and reducing environmental impacts.

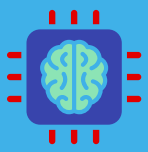
3. Bolster the UK's approach to critical materials: developing a better understanding of critical material flows and building responsible supply chains through domestic capability and collaboration with international partners driving resilience vital for UK industry, energy and national security and delivering the low-carbon transition.

4. Support energy intensive industries to decarbonise: advancing the low-carbon and resource efficient transition and ensuring a competitive and viable future for manufacturing industries in the UK.

5. Deliver a plan for skills and workforce development: across materials, minerals and mining including updating perceptions and advancing equity, diversity and inclusion to address the current and future gaps and minimise the risks posed to the UK economy.

These priority areas should be underpinned by:

Long-term, stable policy frameworks: providing clear and reliable policy direction to boost confidence in the UK for public and private investors.



Systems thinking: implementing tools and approaches to deliver solutions that account for the interconnection within and between systems and that many of the challenges being faced require collective action to be taken across boundaries.

Cross-department, multidisciplinary approaches: breaking down siloes and making the most of valuable resource and insight.

Collaboration: working cooperatively with industry and academia across disciplines and sectors as well as harnessing the power of professional bodies and learned societies.

Evidence-based policies: using the best available evidence to formulate well-informed decisions.

Effective systems for data collection, sharing and use: to address knowledge gaps and inform decision-making.

Research, development and innovation: aiming to lead the G7 in research and development (R&D) intensity with a rising annual public R&D budget from £22billion by 2026-2027, implementing a regulatory framework that fosters innovation and collaborative approaches, developing scale-up and building investment confidence to translate the UK's world-leading fundamental science into products, services and systems.

1.

A strategic approach to materials

Establish and implement a UK Materials Strategy: a comprehensive, cross-government, cross-economy strategic approach to sustainable use and management of materials covering the full life cycle to ensure supply chain resilience, secure access to the materials and minerals required for modern society and to deliver net-zero.

Materials and minerals are essential to the current and future prosperity, wellbeing and security of UK society. The extraction and conversion of materials to goods and services underpins our economy and our daily life. In an increasingly uncertain world, our national security could depend on access to specific materials and the industrial capacity to exploit them.

Each year in the UK, £430 billion in revenue is generated from producing and exporting materials-reliant products and services. Materials underpin the UK's manufacturing sector, contributing £203 billion gross value added to the UK economy in 2021 and accounting for 45% of total UK exports. Almost 2.5 million jobs are supported with an estimated 5 million across the entire manufacturing value chain. Small and medium sized enterprises account for 99% of registered businesses and 58% of employment.[1]

Materials and manufacturing accounts for 61% of all business expenditure on UK R&D and in 2019 attracted 22% of all inward foreign direct investment in the UK economy. 84% of manufacturing takes place outside London and the South East and is key to local economies across the UK.

Over 2,500 companies in the UK are active in materials innovation contributing just under £45 billion to the UK economy. Combined, these companies employ more than 635,000 people in the UK.

Many of the technologies we are counting on to reach net-zero greenhouse gas emissions rely on materials, minerals, and mining; from lithium and cobalt for batteries, through composites for lighter vehicles to packaging to avoid food waste and concrete and steel for wind turbines.

Substantial parts of medicine and health protection rely on materials and novel applications, such as hip replacements, anti-viral surfaces, or implanted devices as well as diagnostics, delivery of vaccines, personal protective equipment and advanced therapeutics. Advanced technologies like smart phones, quantum computing and nuclear fusion are dependent on the materials used to build them.

The technology and equipment we rely on to protect our national security requires key materials to be available, as well as the materials-based industrial capacity and capability to produce them. The UK defence sector adds £9.8 billion in value add to the UK economy, exports £7.4 billion worth of products and directly employs over 147,000 people across all regions and nations of the UK including 6900 apprentices[2]. The sector requires a variety of materials and custom-made components to manufacture products and is currently heavily reliant on imports including for critical materials.

Materials research, development and innovation is fundamental to the future of UK defence and securing strategic and operational technological advantage. Advanced materials related activity contributes an estimated £14.4 billion in gross value added to the UK economy, equivalent to around £72,000 per employee[3].

Recent global events and changes in geopolitics have highlighted the vulnerability in supply chains of materials. This has been reflected by resource policy developments in a number of countries and business action to restructure supply chains and reduce risks. Alongside supply vulnerability, the demand for materials continues to grow.

Whilst critical enablers of the transition and fundamental to healthy living, materials and their extraction and processing are also a significant source of greenhouse gas emissions alongside environmental and social impacts and must therefore be managed as responsibly as possible.

There is an increasing urgency for the development and application of a range of new and advanced materials to meet the global challenges. The timescales to bring new materials to market need accelerating including through development at multiple levels in parallel rather than in sequence and using new computational tools.

[1] https://www.ukri.org/wp-content/uploads/2023/03/IUK-06032023-Innovate-UK-Materials-and-Manufacturing-Vision-2050.pdf

[2] https://www.adsgroup.org.uk/facts-figures/ads-defence-outlook-2023/

[3] https://www.gov.uk/government/news/new-advanced-materials-centre-of-excellence

However, materials activity is too uncoordinated and uneven to deliver the kind of accelerated and focused developments needed. A UK Materials Strategy is necessary to bring a structure and focus to materials sourcing, management, research, development, testing, and regulation to ensure maximum benefit to the UK economy and society. There are many horizontal topics where a strategy would add value. These include:

- Materials 4.0: the use of digital technologies to discover and develop new materials.
- Future materials needs: including solutions for new energy systems (including hydrogen, fusion), sensing, communications, integrity monitoring and structural capabilities.
- Materials sustainability: the transition to renewable feedstocks for composites, polymers and major construction materials, next generation of compound semiconductors, supercapacitors and photovoltaics and light weighting.
- Materials supply chain resilience: security of supply and leadership in strategic and next generation materials; recovery or substitution of critical materials to increase security of supply.
- Materials durability: materials and coatings suitable for harsh and extreme environments, such as nuclear, defence applications, offshore and space, and increased product life, maximising value retention in the resource.

Recommendations:

Establish and implement a UK Materials Strategy: a comprehensive, cross-government, cross-economy strategic approach to sustainable use and management of materials that:

- Considers the entire materials supply chain from raw materials to end-of-life to maximise the benefit to the UK.
- Drives the transition to a resource efficient circular economy.
- Serves all the different Government departments with an interest in materials and provides a single point of strategic overview.
- Leads a shift from the current approach, which assumes that materials challenges will be largely overcome by the end use sectors, to a more strategic and holistic view of our future needs.
- Considers and protects capabilities, supply chains and technologies of strategic importance.
- Supports development of the manufacturing capability to transform materials into the products we need.
- Develops the UK's materials processing industry so that it can capture as much value for its own economy as possible and compete more successfully in global markets.
- Ensures coordination and collaboration between UK industry and the UK's world-class R&D ecosystem.
- Creates a regulatory and standards environment across diverse market sectors to enable the safe, secure, timely and transparent use of new materials and technologies and maximise benefit from international engagement.
- Develops technical standards with industry to achieve interoperability in key technologies.

2.

A resource efficient & resilient society

Advance the transition to a resource efficient and resilient society: embedding resource efficiency and productivity across government policy driving the transition to a circular economy, where materials are kept in circulation at the highest value, building resource and energy security and reducing environmental impacts.

Access to responsibly sourced, reliable and affordable supplies of the materials, minerals and products that sustain our way of life, our economy, our security, and the transition to net-zero is a growing risk to the UK.

Resources are being used at a rate that far outstrips the planet's capacity to supply them. Over 100 billion tonnes of resources enter the global economy each year, with less than 7.2% of those ever being reused.[4]

In addition, the demand for materials and minerals continues to increase with a growing and developing global population, evolving technologies and transition to net-zero. The World Bank predicts that in order to have enough metals and minerals to meet the Paris climate change target by 2050, global production will need to increase in some cases by up to five-fold.[5] This is further exacerbated by the changing global environment, geopolitical tension and international competition for resources.

Embedding circular economy principles moves from a wasteful 'take-make-use-lose' economic model to one that keeps materials, components and products in use, at high quality for as long as possible. It would also embed smarter use of materials in the first place, through resource efficiency and well-informed material selection.

The UK has access to large quantities of materials and minerals in products already in the economy. Increased recovery, reuse and recycling as well as business models and design for durability, longevity, repair and reuse can make use of those already in circulation alleviating pressure from growing demand on primary extraction and its associated impacts and risks. For example, the UK currently exports over 70% of its scrap steel, which is an essential input for the electric arc furnaces being contemplated across the country.

As well as a way to meet demand, there are wide-ranging benefits resulting from better valuing and managing our resources – from reducing emissions, improving security of supply and building resilience to price volatility, to supporting jobs, and reducing waste and pressure on the environment.

A more circular economy can deliver more than 470,000 jobs by 2035, a boost to UK GDP by as much as one per cent and gross value added by as much as £82 billion.[6,7]

The current macroeconomic model, however, does not promote circular practices, consumption reduction or reward waste prevention sufficiently to drive the behaviour alone, so government intervention is essential. This must reach beyond strategies that tend to focus on recycling alone to a whole system approach that encompasses every stage of the materials cycle.

[4] https://www.circularity-gap.world/2024

[5] https://www.worldbank.org/en/news/press-release/2020/05/11/mineral-production-to-soar-as-demand-for-clean-energy-increases

[6] https://green-alliance.org.uk/wp-content/uploads/2021/11/Levelling_up_through_circular_economy_jobs.pdf

[7] https://www.wrap.ngo/sites/default/files/2022-06/LEVELLING%20UP%20THROUGH%20A%20MORE%20CIRCULAR%20ECONOMY__2.pdf

Recommendations:

Advance the transition to a resource efficient and resilient society driving the transition to a more circular economy where materials are kept in circulation at their highest value, including commitments to:

- Embed resource efficiency and productivity across government policy, including setting resource use reduction targets with binding interim targets and clear roadmaps for specific sectors and strategically important materials.
- Develop a regulatory framework, design principles and standards that promote the transition to a more circular economy including resource efficiency, enabling reuse, ease of disassembly, improving the economic viability of recovering materials, circular business models, certification for the performance properties of recycled materials and waste prevention. This could be based on the proven eco-design regime.
- Introduce fiscal mechanisms to reflect full lifecycle economic and environmental benefits such as by adjusting VAT rates on repair and refurbishment services and building retrofitting.
- Work with stakeholders to identify and remove regulatory and other policy blockers to the implementation of circular economy principles and business models such as resource efficient design and production and service-based and lease systems.
- Through the UK Infrastucture Bank and other tools, invest in vital infrastructure for the circular economy including facilities for recycling, repair, manufacture and reuse.
- Create mechanisms that leverage public and private financing to develop strategic domestic capability or address where the market is not working.
- Use procurement spend to drive demand for products and services that promote a more circular economy.
- Follow the lead of the Mayor of London's London Plan and require circularity statements for new developments over a certain size, which is a proven measure to grow a local market for circular products.
- Mandate the measurement and reporting of whole life carbon emissions in building construction driving more resource efficient and circular practices.
- Introduce a national mechanism to map and track stocks and flows of materials and minerals through the economy to support secondary markets, enable better management and infrastructure planning, for example by pursuing the ONS National Materials Data Hub project.
- Deliver and expand Extended Producer Responsibility (EPR). Maintain momentum and delivery of packaging EPR implementing the scheme as soon as possible with an effective fee modulation system to incentivise more circular design and unlock investment in infrastructure.
- Extend EPR to other material-intensive product sectors in the next Parliament.

3.

A bolstered approach to critical materials

Bolster the UK's approach to critical materials: developing a better understanding of critical material flows and building responsible supply chains through domestic capability and collaboration with international partners driving resilience vital for UK industry, energy and national security and delivering the low-carbon transition.

Critical materials are vital to increasing energy security and domestic industrial resilience. However, supply chains are complex, opaque and at risk from market shocks, geopolitical events and rising demand. The market for minerals required for the clean energy transition has doubled in size over the past five years including a tripling in overall demand for lithium, a 70% increase in demand for cobalt, and a 40% rise in demand for nickel.[8] Commodity markets show that the risks of inadequate supply are emerging. Price spikes in lithium and other minerals have resulted in significant increases in manufacturing costs of clean energy technologies such as wind and solar photovoltaics. Shortages of supply risk weakening the UK's technological and manufacturing base, negatively affecting economic resilience and competitiveness, reducing attractiveness for investment and giving rise to a source of military vulnerability.

The UK's approach to critical materials should be bolstered by developing a better understanding of critical material flows and building responsible supply chains through domestic capability, transitioning to a more circular economy and collaboration with international partners.

The UK's current approach focusses on 'critical minerals' yet technology, industry and the low-carbon transition doesn't rely on individual minerals or elements, but on combinations processed into engineered materials – often through multiple steps – for the unique properties they bestow. As critical materials are mainly useful as part of components or products, the pathway from ore/element to end use is therefore more complex and open to challenges than is currently commonly discussed. In addition, even with a given element, it is often required in particular form, for example nickel for stainless steel production isn't the same as nickel superalloys for turbine blades or battery components.

Focus should be expanded to 'critical materials' recognising that:

- The defined critical minerals provide a snapshot of a dynamic landscape – the level of criticality for a material can change quickly, for example in the event of a market shock, or over a longer period of time due to changing demands.
- Some minerals are produced as co- or by-products of major commodities, there can be numerous stages of processing and many variations of product.
- Minerals are rarely relied on as individual minerals but rather as combinations processed into materials.
- The form required is often application specific and cannot be accounted for by mineral alone.

The unique strengths and comparative advantage of the UK and how these can be leveraged must be considered, as well as what will be required for national and economic security. For example this could include:

- UK deposits – providing domestic production and increasing resilience.
- UK processing – helping to secure supplies, improve traceability and support the use of secondary resources through developing robust midstream processing infrastructure for key materials.
- Circular economy – maintaining and maximising the value of materials and minerals, and harnessing the opportunity of secondary resources.

[8] https://www.iea.org/news/critical-minerals-market-sees-unprecedented-growth-as-clean-energy-demand-drives-strong-increase-in-investment

Recommendations:

Bolster the UK's approach to critical materials: developing a better understanding of critical material flows and building responsible supply chains, including commitments to:

- Expand the UK's approach and policy focus to 'critical materials'.
- Secure supplies where possible including through responsible exploitation of UK deposits and domestic processing capacity as well as robust purchasing agreements.
- Taking the Task & Finish Group report on Industrial Resilience to Critical Minerals[9] as a starting point, develop a long-term strategy to address the issues identified.
- Develop domestic production and midstream processing and refining capabilities. This could be assisted by creating a kind of guarantee scheme for processing facilities to enable them to secure long-term purchasing agreements with mines.
- Drive a more circular economy employing policy levers to improve the economic viability of recovery and promote materials efficiency and technologies that reduce demand.
- Promote supply chain transparency through improved data collection and availability and by working with others to consolidate the various international reporting standards on environmental, social and governance (ESG) issues.

[9] https://www.gov.uk/government/publications/task-and-finish-group-industry-resilience-for-critical-minerals

4.

Support for UK industry to thrive & decarbonise

Support energy intensive industries to decarbonise: advancing the low-carbon and resource efficient transition and ensuring a competitive and viable future for industries in the UK.

Foundation industries, including the cement, glass, ceramics, paper, metals, and bulk chemical sectors, are vital for UK manufacturing and construction. They produce over 75% of the materials we see around us, comprise over 7,000 businesses, more than 250,000 employees, and are worth £52 billion annually to the UK economy[10,11]. As these materials are used in almost every industry, their impact also reaches far greater. They underpin activity across a wider segment of the economy with two-thirds of output sold to other UK businesses. However, they tend to be energy intensive, consume significant quantities of raw materials, produce large amounts of waste and are responsible for over 10% UK CO_2 emissions. These sectors also face significant challenges to transition as they tend to be capital intensive, often with large legacy facilities with limited additional physical space. They have high process emissions and the novel technologies needed tend to have a difficult risk profile.

Supporting these crucial industries to decarbonise at the urgent pace required, move towards a more circular economy, and remain internationally competitive is essential. Otherwise, the UK will not be able to secure domestic supplies of vital materials, avoid import dependency and reduce associated impacts of emissions.

Recommendations:

Support energy intensive industries to decarbonise: advancing the low-carbon and resource efficient transition and ensuring a competitive and viable future for industries in the UK, including commitments to:

- Set out a long-term, robust strategy for industry establishing a clear policy direction, framework and enabling environment for decarbonisation and the investment in technology and infrastructure required.
- Build on research, development and innovation funding to transform the foundation industries promoting productivity, competitiveness, resource and energy efficiency, and collaboration to address common challenges.
- Deliver targeted interventions through the UK Infrastructure Bank, fund R&D and use programmes such as the Automotive Transformation Fund to overcome the challenge of commercialising novel low-carbon, resource efficient technologies.
- Implement an effective UK carbon border adjustment mechanism (CBAM) that links closely with the EU mechanism, providing a level playing field with EU competitors and avoiding trade distortions.
- Use tax incentives, minimum quality standards for export and capital allowances for processing machinery to improve scrap collection, advanced sorting and domestic processing incentivising the supply of valuable scrap and waste materials to UK industry rather than the export market.
- Reform the legal definition and requirements associated with waste to maximise the potential of secondary raw material use.
- Accelerate the deployment of clean energy to support electrification solutions and incentivise the rapid scaling of low-carbon infrastructure and technologies through fiscal incentives.
- Provide a prioritisation plan for the use of low-carbon fuels and technologies such as electrification and hydrogen to give clarity on decarbonisation pathways alongside a blueprint for the infrastructure needed.
- Enhance planning and streamline processes and permitting to accelerate the deployment of critical infrastructure.
- Publish a roadmap for decarbonising businesses located outside of industrial clusters including planning and permitting guidance for local authorities.
- Promote industrial symbiosis and facilitate collaboration across sectors.
- Employ demand-side policies to create demand for low-carbon products and materials such as mandatory product standards on embodied carbon content or recycled material content, labelling schemes to empower consumers, fiscal incentives for the value chain and risk mitigation such as Government-backed insurance schemes.

[10] https://www.iom3.org/resource/transforming-foundations-industries.html

[11] https://iuk.ktn-uk.org/materials/foundation-industries

5.

Secure the skills

Deliver a plan for skills and workforce development: across materials, minerals and mining including updating perceptions and advancing equity, diversity and inclusion to address the current and future gaps and minimise the risks posed to the UK economy.

There are significant and growing skills gaps across materials, minerals and mining sectors that play vital roles in our economy, society and the transition to net-zero.

Meeting the growing demand for materials and ensuring their responsible and resilient sourcing and management will only be possible if we have enough people with the necessary skills and access to the right training. These people will be needed by industry to carry out the activities and by regulators to ensure these activities are carried out to the necessary high standards.

While an increase in the workforce is required, there is simultaneously a decline in the availability of skilled people. Many professionals are reaching retirement age and insufficient new talent is entering and developing through the industry to fill the positions. In many materials, minerals and mining sectors there is a recognised skills and knowledge continuity gap between an older generation of qualified and competent persons about to retire, and replenishment of those skills from too small a number of new people coming through the system and into the industry. This can be seen in the age demographic of qualified mining-related professionals in the UK – in 2022, of the 1,237 mining and mineral processing engineers registered with the Engineering Council via IOM3, 80% were over the age of 50, with 39% over the age of 66 with other sectors seeing similar trends.

In addition, skill sets are changing, reflecting the evolving needs of the sectors, with advancements in technology and a greater focus on data skills and environmental, social and governance standards. Greater integration of skills, combining different skill sets and understanding different aspects of the value chain is becoming increasingly important.

With other countries facing similar shortages and moving to secure their supplies, the UK will be competing in an increasingly challenging and competitive labour market.

The growing demand for and shortages of key skills professionals across materials and minerals are a significant risk to the UK economy. The challenges include:

- Across the minerals value chain, from extraction to end-of life, including declining provision of higher education courses and critical shortages of metallurgical skills. The talent gap: critical skills for critical materials report[12] highlights that industry has benefited from skilled professionals exiting the coal sector in the UK, but this suppressed demand for new entrants as companies found it easier to recruit trained former coal mining professionals than to sponsor new students and apprentices. The UK is reaching the end of this legacy that has largely sustained the industry to date.
- To meet the growing demand in the packaging sector including skills to implement the Extended Producer Responsibility reforms and more sustainable design requirements.
- The polymer industry suffering impacts on recruitment following negative media related to plastics.
- The construction sector is facing growing pressures and shortages, such as for retrofit designers.
- Nuclear industry with skills shortages delaying projects and issues with attraction and retention in the sector.
- Industrial decarbonisation projects face recruitment challenges due to skills shortages with 87% of foundation industry businesses citing a difficulty in recruiting technical skills[13].
- The composites sector is facing significant shortages of trained staff at all levels.
- Defence, safety and security technology is developing at significant pace with the lack of available skills posing a significant risk including concerns around attracting talent to the sector.

[12] https://www.iom3.org/resource/iom3-submits-report-on-critical-minerals-value-chain-skills-gaps-to-uk-government.html

[13] https://www.ukri.org/what-we-do/ukri-challenge-fund/clean-growth/transforming-foundation-industries-challenge/equality-diversity-and-inclusion-in-the-foundation-industries/

Addressing these skills challenges can only be achieved by attracting and retaining the best talent, yet there remains a concerning lack of diversity within the workforce. For example, in the occupation census for 2021 in England and Wales 7,220 people were counted as 'mining and quarry workers and related operatives'. Men made up 96.2% and women just 3.8%, compared with 52% and 48% across the whole working population[14]. As of mid-2021 just 16% of core and related engineering occupation roles were held by women compared with 47% of the overall UK workforce[15] and 18.5% of engineering and technology first degree undergraduate entrants were women, which is low compared to 56.5% of students across all subjects[16].

There is wide-ranging and substantial evidence demonstrating the benefits of a more diverse team and workforce, from increasing innovation, through non-linear novel thinking, to increased productivity, and greater effectiveness.

At school age there are inequalities that can significantly affect children's experience of and access to high quality education[17,18]. For example, research shows that, in England, careers provision is 'patterned' around social inequalities and students who are most in need are less likely to receive careers education . A good quality well-informed system for career advice and guidance, with up-to-date information about the careers available, that expands focus beyond the university route is crucial to attracting more people to consider a position in materials, minerals and mining.

To build the necessary talent pipeline, a multi-tiered approach is required. It is crucial to engage individuals from a young age and continuously throughout their education to inform their perceptions and career choices. School education has an important role in supporting a sustainable talent pipeline over the medium and longer term and offers an opportunity to help address inequalities in the workforce. Research has shown that children are influenced about their future education and career choices by the age of seven, making early engagement essential. However, there are serious and concerning teacher shortages in science, technology, engineering and mathematics subjects.

Materials are so ubiquitous and integral to every-day life that they rarely receive attention until there is a shortage of supply. Public and media discussions commonly focus on negative impacts. A dialogue shift is required to ensure materials are properly valued and recognised for their far-reaching benefits and underpinning role in the transition, our society and the economy.

Actively addressing the perception and awareness issues will help significantly towards creating a better-informed society that recognises the importance of minerals and the opportunities they present for sustainable development and the low-carbon transition.

As skills development can take time, a sustained, consistent and long-term approach is necessary.

[14] https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/articles/howmanypeopledomyjob/2023-05-31

[15] https://committees.parliament.uk/writtenevidence/42416/pdf

[16] https://www.engineeringuk.com/media/318874/engineering-in-higher-education_report_engineeringuk_march23_fv.pdf

[17] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/973596/The_road_not_taken_-_drivers_of_course_selection.pdf

[18] https://www.sciencecampaign.org.uk/app/uploads/2023/03/CaSE-Inspiring-Innovation-education-review-2021.pdf

[19] https://www.engineeringuk.com/media/232354/our-future-our-careers-2020.pdf

Recommendations:

Deliver a plan for skills and workforce development: across materials, minerals and mining that:

- Builds on the qualitative assessment of skills gaps[20] identified in *The talent gap: critical skills for critical materials* with quantitative skills forecasting for materials, minerals and mining to understand the future workforce and skills needs, plotting the changing labour market and mapping competences.
- Conducts a gap analysis on education and training provision and provider capacity for materials, minerals and mining needs in the UK.
- Takes forward the actions outlined in *The talent gap: critical skills for critical materials* to stimulate a pipeline of strategically important skills[21] working with industry and academia.
- Develops a strategy and sets targets to fill the gaps in line with the timing of job creation including through options such as dedicated, funded apprenticeships, T-Levels or Higher Technical Qualifications available to workers of all ages.
- Plans for skills transfer for example for individuals moving away from jobs in industries such as oil and gas.
- Embeds measures to actively advance equity, diversity and inclusion attracting individuals from underrepresented backgrounds and ensuring inclusive and equitable education, training and working environments.
- Sets out to a plan to work with industry and other relevant bodies to increase the visibility of careers and update perceptions to communicate their importance to the economy, society and low-carbon transition including a programme of public engagement.
- Includes a mechanism to include modern materials, minerals and mining career opportunities into careers provision within a wider education and skills plan.
- Forms part of a wider strategic approach to addressing skills shortages and the UK's changing labour market needs that co-ordinates relevant activity across government departments and brings together current taskforce activity for more targeted joined-up action to equip the UK with the skilled and sustainable workforce it needs. This should link closely with an education and skills plan that:
    - Reforms apprenticeships to improve uptake and value to learners including introducing bespoke qualifications to support niche apprenticeships, ensuring End Point Assessment is delivered by assessors that are technically competent in the field, addressing the challenges from removal of mandatory qualifications and building visibility and appeal.
    - Delivers careers provision to schools and colleges that is reflective of current and future career opportunities.
    - Implements strategic initiatives and investment to improve teacher recruitment, training and retention.

[20] https://www.iom3.org/resource/iom3-submits-report-on-critical-minerals-value-chain-skills-gaps-to-uk-government.html

[21] https://www.iom3.org/resource/the-talent-gap---critical-skills-for-critical-materials-pdf.html

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