Policy insight
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green alliance...

# Mission critical

## Safeguarding resources for UK energy security

# Summary

**“The new government must be mindful of where the materials necessary for our energy infrastructure will come from.”**


Energy security is an increasing concern for governments across the world, following Russia’s invasion of Ukraine. But decarbonising power, transport and home heating will reduce reliance on imports of oil and gas and help to secure energy supply.

The new government insists the solution is “clean, homegrown power”. As the UK makes this transition, though, it must be mindful of where the materials necessary for our energy infrastructure, including renewables and electric vehicles (EVs), will come from. There is an opportunity to further improve energy security by reducing demand for these materials and keeping them in circulation, through reuse, remanufacturing and recycling.

Critical raw materials are central components of the renewable technology supply chain. These are economically and strategically important resources with supply chain risks, such as lithium, cobalt and rare earth elements. The UK imports most of the materials it needs for renewables and EVs, often in the form of components and finished products.

A new approach is needed, as part of an energy security strategy, that focuses first on reducing demand for critical raw materials, and then on building the capacity for reuse, remanufacturing and recycling to keep them in circulation at their highest value for as long as possible. This would allow the UK to break free of the current situation where it exports many critical materials as waste, only to pay to import them again as raw materials for building new infrastructure.

A strong champion in the new government is needed to co-ordinate this strategy across departments.

We propose the following five steps to greater energy security through demand reduction and circularity:

— make access to responsibly mined critical raw materials an international priority;

— gather the data, including commissioning a review of the material needed and circular economy opportunities of the energy system;

— integrate demand reduction and circularity into industrial strategy and climate policy;

— build skills in mining and metals processing;

— secure investment, including by developing a new approach to recognise the financial risks in linear business models.

# Introduction

> **“It will be crucial to reduce exposure to and reliance on volatile international supply chains.”**

Since the invasion of Ukraine in 2022, energy security has been a major concern for governments around the world. The drive to reduce reliance on Russian gas imports and lower energy bills has led to an increase in renewable energy installations and energy efficiency interventions across Europe.[1] In 2030, with an energy system dominated by renewables and a transport system moving towards electric vehicles (EVs), the UK will rely less on importing fossil fuels and more on importing the materials needed for this new infrastructure.

So, what will energy security mean in the 2030s and beyond? As we transition away from dependence on fossil fuels and competition rises for critical raw materials, it will be crucial to reduce exposure to and reliance on volatile international supply chains.

The UK has relatively few geological resources but a wealth of materials is building up in its imported products and infrastructure.

These factors mean that an energy security strategy should include measures to reduce reliance on critical raw materials. And, once imported into the country, they should be kept in circulation at their highest possible value through reuse, remanufacturing and recycling.

The previous government acknowledged the importance of a circular economy for critical raw materials in its 2021 Critical Minerals Strategy but policy progress was slow. To find out why, and what should happen to speed up progress, we held two in depth roundtables, one with businesses and trade associations from sectors dependent on critical raw materials, and one with civil servants across government departments. At both, we heard from third sector organisations working on improving the environmental and social impacts of mining, as well as experts on the geopolitics of critical raw material supply chains. This report is based on the insights from those discussions and sets out policy solutions to accelerate material reduction and circularity for critical raw materials.

# What does energy security mean in a renewables-dominated system?

> **“Demand for critical raw materials for the global energy transition alone is expected to grow by three and half times by 2030.”**

An energy system dominated by renewable power, low carbon technology and EVs means the UK will depend less on gas and oil from countries like Russia and the US for energy security, and more on the supply of materials needed to build wind turbines, batteries and solar panels from countries like China.

A renewables-dominated system has many benefits, including reducing the overall need to extract non-renewable resources and lowering the energy system’s impacts. For example, a battery powered EV requires 100 times less raw material input over its lifetime compared to a petrol vehicle.[2] Unlike fossil fuels, minerals like cobalt and lithium only have to be mined once and can then be reused time and again. But true independence and security in the future energy system can only be achieved by reducing, as far as possible, exposure to and reliance on volatile international supply chains.

Critical raw materials are economically and strategically important resources with supply chain risks. They include materials needed to manufacture renewable power technologies and batteries, like lithium, cobalt and rare earth elements, which are also essential for other sectors, such as defence, medical equipment and consumer electronics.

Demand for critical raw materials for the global energy transition alone is expected to grow by three and a half times by 2030, so competition will be strong.[3]

Businesses we spoke to are already concerned about competition between sectors for these resources, as well as between nation states, and they are keen for the new government to consider demand management as well as security of supply.

# The UK in a global context: high demand and scarce resources

The UK is currently almost

**100%**

reliant on imports of all 24 critical raw materials

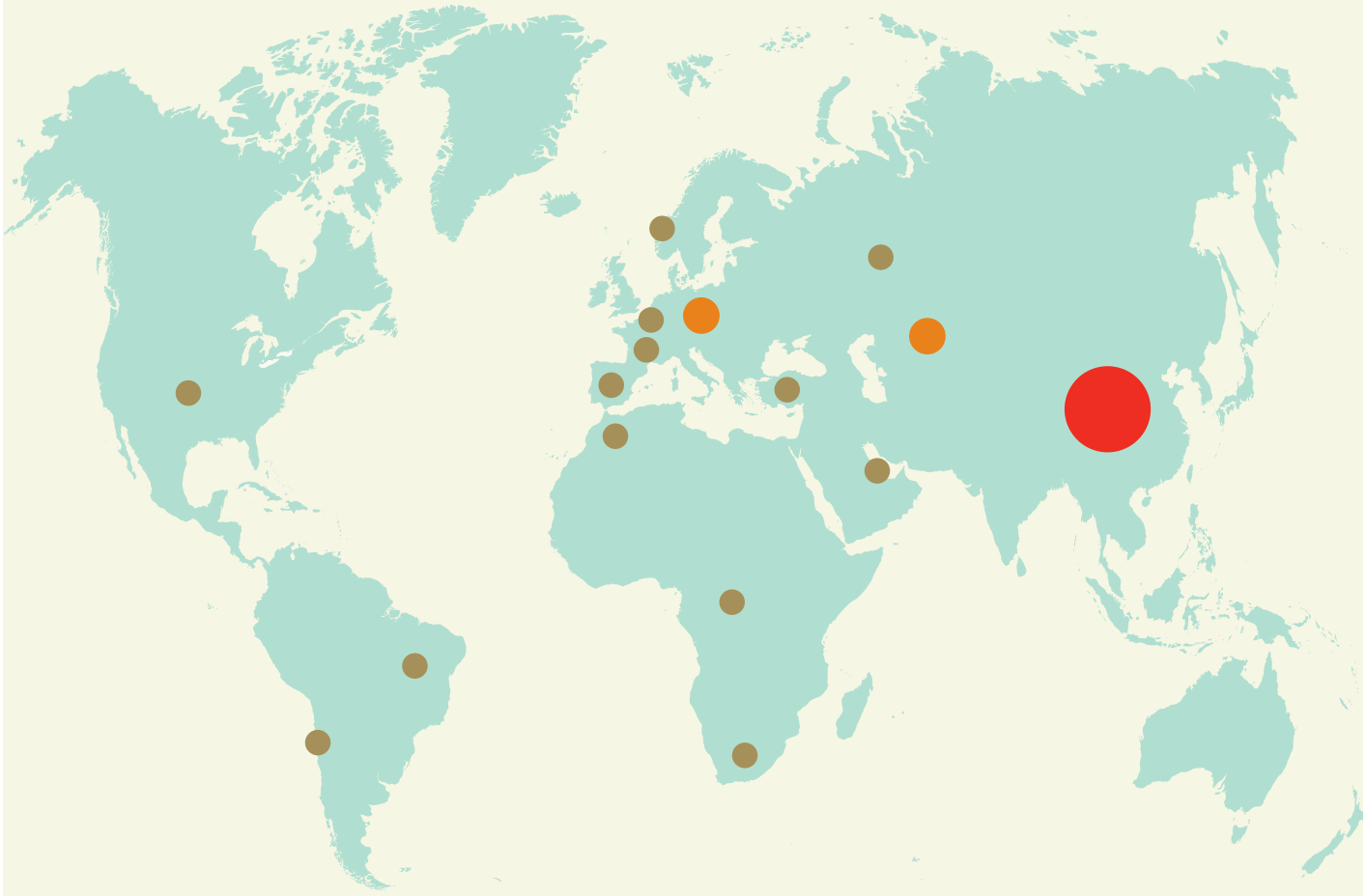
The UK is a relatively resource poor country. It is currently almost 100 per cent reliant on imports of all 24 of the materials the government has identified as being of 'high' or 'elevated' criticality, although tungsten has been mined in the UK in recent years.[4] While there are significant deposits of lithium in the south west of England, large scale mining is unlikely to deliver significant supply until at least 2030.[5]

Critical raw material mining, processing and manufacturing are often geographically concentrated and supply chains are vulnerable to geopolitical tensions. These activities also cause environmental and social harm abroad. For example, China currently dominates in the global production and processing of many critical raw materials, including rare earth elements used for wind turbines, controlling 69 per cent of production and 90 per cent of processing.[6,7] In the past, China has used its monopoly to manipulate markets to its advantage, including in the 1990s, when it undercut world prices, forcing mines in other countries to shut. In 2009, it announced restrictions on the export of rare earths which pushed up prices.[8]

Geographical concentration is strong for many critical materials. For example, the Democratic Republic of Congo mines 63 per cent of the world's cobalt and 35 per cent of tantalum, Indonesia mines at least 26 per cent of nickel, and Russia mines 42 per cent of palladium.[9] Many of these supply chains have been associated with child labour and human rights abuses, as well as water pollution.[10] These challenges are not unique to these resources, with oil and gas extraction having a long history of pollution and human rights abuses, for example in the Niger Delta.[11]

All countries are looking to secure these materials, to protect their industries and ensure their position in rapidly growing green technology markets. This creates geopolitical risks, as some countries have more control over supply chains and access to resources than others. To reach the goals of the Paris climate agreement, though, all countries need to decarbonise and so all will need to access critical raw materials, either directly or in imported products.

Top suppliers of critical raw materials to the EU, based on the number of materials for which they are the main source (2012-16 average)[12]



Number of critical raw materials for which a country is the dominant supplier to the EU

1 2 11

> “With the current concentration of critical raw material mining and processing, the world now faces a similar geopolitical risk to the 1970s.”

### A lesson from history: the OPEC crisis of the 1970s

The current geopolitical moment around critical raw materials is this generation’s equivalent to the 1970s oil crisis. In 1970, the Organization of the Petroleum Exporting Countries (OPEC) controlled just under half of all global oil production. In 1973, it imposed an oil embargo on several industrialised countries, including the UK and the US, causing oil prices to quadruple in 1974. A second oil price crisis was triggered in 1978 by the Iranian revolution, leading to a tripling of oil prices.[13]

These energy price shocks motivated some countries to try to reduce their reliance on oil imports from OPEC. For example, in 1971, Sweden relied on oil for 71 per cent of its energy. With no domestic fossil fuel reserves, the Swedish government took the strategic decision to reduce reliance on oil to protect its economy from future shocks. It invested in heat pump technology and created subsidy schemes for installations from 1978 to 1984, with many heating sector incumbents diversifying into heat pump manufacturing.[14] Today, Sweden leads the European heat pump market, has the second highest share of heat pump installations at 43 per cent of households, and has reduced its dependence on oil for energy to just 19 per cent.[15,16,17]


With the current concentration of critical raw material mining and processing, the world now faces a similar geopolitical risk to the 1970s. The UK must choose whether to take the opportunity now to increase its resilience and security, as Sweden did in the 1970s, or carry on and hope that geopolitics can be managed and supply chains will hold.

The new government has already recognised the need for a different approach, with the proposal for an ‘anti-OPEC’ clean power alliance that works together to bring down the price of renewable energy.[18] If created, this group of countries should prioritise sourcing the critical raw materials to build the technology the world needs as sustainably as possible.

# A logical approach to resilience and security

> **“The UK is particularly vulnerable to critical raw material supply chain disruptions.”**

There is another important parallel between Sweden in the 1970s and the UK in the 2020s. Sweden’s exposure to oil price risk was particularly high in the 1970s due to its lack of fossil fuel reserves. The UK is particularly vulnerable to critical raw material supply chain disruptions due to its limited geological resources, even compared to other developed nations like the US, Australia and the EU.

Developing mining in the UK with high environmental and social standards would be an important step but, even where geological potential has been identified, it requires significant further research and exploration before mining at scale could begin.[19] Also, many of the potential mining sites identified are in protected and valued landscapes in the UK, such as the Lake District, north Pennines, Cheshire and north Wales.[20] Businesses we consulted made clear that, with the potential exception of lithium, it is highly unlikely the UK could meet its demand for critical raw materials through domestic extraction alone.

Therefore, the UK cannot simply copy strategies employed by the US, Canada, Australia and others, which largely focus on increasing domestic mining and diversifying the rest of their supply.

There is an opportunity for the UK to take an alternative approach to resource security and energy independence, by focusing first on material reduction and then on circularity, to decrease its reliance on international supply chains.

Reducing the amount of critical raw materials the UK needs for the energy transition should be the top priority to avoid over reliance on risky supply chains. A significant reduction can be achieved by using these materials more efficiently, for example by increasing the use of public transport, so fewer batteries are required per person, insulating homes so less electricity is required to heat buildings and by using renewable power more efficiently.

Our previous analysis has shown that demand could be reduced by 50 per cent by 2035, compared to business as usual, for some resources like lithium.[21] Further reductions could be achieved by substituting materials, as is happening to reduce the amount of cobalt used in batteries, but care must be taken not to switch to a new critical raw material that also comes with risks.[22]

However, the UK does have domestic access to many critical raw materials, as they are building up in existing products and

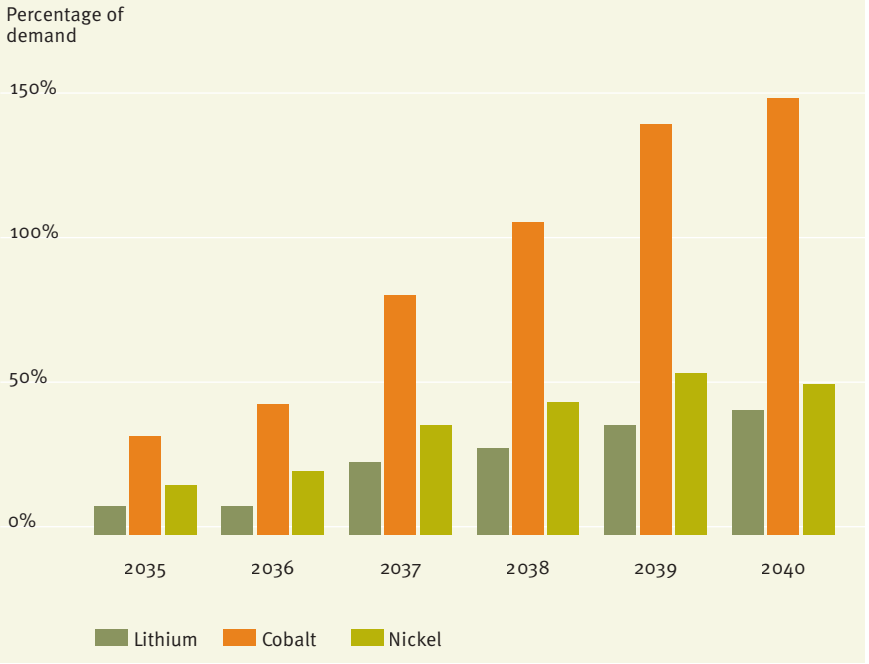
infrastructure. The businesses we spoke to pointed out that, as an importer of significant volumes of products, the UK has an advantage in this respect, compared to countries like Japan which export more finished goods than they import. This means the UK is particularly well suited to pursuing circularity. So the second priority should be to keep the materials imported in products circulating in the economy at their highest value for as long as possible, by reusing products and components and recycling them at the end of their usable life.

Reusing and recycling products, components and materials can fulfil an increasing proportion of demand as more and more technologies, like batteries and wind turbines, reach the end of life over the coming decade. For example, if domestic recycling rates for cobalt, lithium and nickel were to meet EU Battery Directive targets, 43 per cent of lithium for EV battery manufacturing in the UK could be met from recycled materials by 2040. Domestically recycled nickel could exceed 50 per cent of demand by 2040, and cobalt 150 per cent. The economic value of these materials is significant. The volume of nickel reaching end of life in 2040 from all EV batteries could be worth £536 million, lithium could be worth £146 million and cobalt £63 million.[23]

**43%**

**of lithium for EV battery manufacturing in the UK could be met from recycled materials by 2040**

Potential to meet UK EV battery manufacturing critical raw material demand from recycling




The UK is currently one of the biggest buyers of offshore wind technology.[24] Translating this into economic benefits, like job creation and investment, could bring an annual average of £17 billion to the UK by 2030, with 97,000 jobs.[25] Creating a circular economy for the offshore wind industry, including remanufacturing components and recycling materials, could generate an additional 20,000 jobs across the UK.[26] Analysis for the Coalition for Wind Industry Circularity has shown that remanufacturing just ten components for wind turbines with well established supply chains over the next ten years could create a UK market worth £9.6 billion.[27]

> “Recycling meets over half of global demand for platinum group metals.”

## Recycling precious metals is already happening in the UK

High value platinum group metals, like platinum and palladium, are used in various industrial processes and technologies, including electrolysers, fuel cells and electronic displays.

Currently, recycling meets over half of global demand for platinum group metals. Recycling rates within closed loop systems, where materials are recycled for use in the same application, are over 90 per cent, and for open loop systems, like catalytic converters used in cars, the recycling rate is around 70 per cent.[28] The UK has the world’s largest secondary refinery of platinum group metals, in Royston, Hertfordshire, operated by Johnson Matthey.[29]

The UK business case for investing in the secondary processing of these metals is already strong. Future technologies that use them, like hydrogen electrolysers and fuel cells, are now being designed to make recovery and recycling easy.

This success story demonstrates that design for recovery happens when there is an economic incentive. For other lower economic value critical raw materials, the government will need to create incentives or regulate to require reuse and recycling, as places like China and the EU are already doing. This is particularly the case where materials are only used in small quantities and where they are dispersed throughout a product, making the economic case more challenging.

# Businesses want to do more

> **“A UK industrial strategy is a potential opportunity to increase investment and resource security in the UK.”**

Amongst businesses we consulted, there was enthusiasm for material reduction and creating a more circular economy for the raw materials. The downside of exporting critical materials as waste, and then re-importing them in new components or products, potentially paying tax on them again, was emphasised by some.

They also highlighted that a UK industrial strategy focused on mid-stream processing and circularity for critical raw materials is a potential opportunity to increase investment and resource security in the UK.

The main barriers identified by businesses were:

- A lack of data and inconsistent information to be able to trace materials and their impacts through supply chains and in final products.
- The skills gap in mining and processing, with some describing an approaching ‘cliff edge’ when experienced coal miners retire from the workforce entirely.
- Uncertainty over rapidly changing technology, eg battery chemistry, which makes it risky to invest in infrastructure.
- The fact that the government has, so far, approached secondary material use as a ‘waste issue’ rather than as a ‘resources issue’ which misses opportunities and hampers effective policy development.
- The reality that critical raw materials are often only present in small amounts, dispersed through products, which makes the commercial case for recovery challenging.
- A tension between reuse and recycling, for instance a focus on recycling targets which can lead to scrapping products that could be reused.
- The current inconsistent quality and availability of recycled materials. Without government intervention, the commercial case for using such secondary materials is lacking.

> **“The UK government has lacked the appetite to intervene, compared to countries like the US and EU.”**

The businesses we spoke to said that plenty of knowledge and information exists in the private sector and trade associations but they stressed it is not joined up due to a lack of political leadership or policy development. There was a real sense that the UK government has lacked the appetite to intervene, compared to countries like the US and EU, and that, if this does not change soon, long term opportunities presented by the circular economy will be grasped by others and become unavailable to the UK.

Businesses told us that the government simply cannot wait any longer to plan and invest in circular economy infrastructure. Waiting to invest until recyclable critical raw materials become available at greater scale, once existing products and infrastructure reach the end of life, will not work. That is likely to take at least a decade, during which time other countries will have already built the infrastructure and locked in their supply chains. The UK could miss the chance to create a homegrown reuse and recycling industry to supply its own independent energy system with the materials it needs. Now is the time for bold action.

# Policy has been weak

> **“Reducing demand has been largely absent from public discourse.”**

So far, politicians from all parties have focused on the need to diversify supplies of critical raw materials. But reducing demand has been largely absent from public discourse and efforts to bring about circularity have been limited to rhetoric.

In its 2021 Critical Minerals Strategy, the previous government stated:

“An efficient circular economy of critical minerals would require increased recovery, reuse and recycling at the end of a product’s life, as well as better design and new business models for durability, resource efficiency and reuse. It would also require smarter use of critical minerals in the first place, through resource efficiency and substitution.”

However, the only policy solutions it proposed were pre-planned, waste-focused consultations on waste electricals and batteries recycling regulations.[30]

This is inadequate to meet the scale of the challenge and barely scratches the surface of what other countries are doing. For example, the EU’s new Battery Regulation includes targets for recycled content and material recovery, carbon footprint requirements and battery passports with information on chemical components to enable safe disassembly for remanufacturing or recycling.[31] Businesses expect the EU’s regulations to galvanise battery recycling by creating a price premium for recycled content.

Lack of UK policy has, in part, been due to the disparate nature of policy levers across government departments. For example, the Critical Minerals Strategy was written by the former Department for Business, Energy and Industrial Strategy (and now sits with the Department for Business and Trade), but the Department for Environment, Food and Rural Affairs (Defra) is in charge of most recycling interventions as well as producer obligations. Defra has been severely delayed in delivering promised policies on electricals and batteries.

As part of the research for this briefing, we consulted civil servants across government departments, in part to understand who has control over decisions around critical raw materials. The table on page 15 maps the responsibilities of government departments and demonstrates the dispersed nature of power over this vital topic, as well as the fact that many departments will need to work

together for a better approach. It is not a comprehensive list, and does not cover the policy levers controlled by the devolved administrations, which include aspects of transport, energy, housing, planning and taxation.[32]

Many of the civil servants we spoke to expressed concern at the lack of co-ordination and systems thinking across government and a belief that, within the civil service, it can be easy to default to working in silos without ensuring policy action is well co-ordinated.

> **“Effective cross government action on critical raw materials could be achieved, if it was made a political priority.”**

Additional barriers we heard about from civil servants include:

- Lack of innovation funding, including hesitancy to ringfence money for circularity, as the EU has done, with only short term funding pots available.
- Political short termism, which conflicts with the need for long term planning and policy.
- Concerns that investment decisions could prove to be wrong as technology shifts rapidly.
- Conflicting departmental priorities, eg the Department for Energy Security and Net Zero leads on the government’s net zero territorial emissions target, which can conflict with the desire to onshore industries. For example, building UK reprocessing plants for critical raw materials could increase territorial emissions, but could cut emissions overall and contribute to other departments’ priorities, such as industrial strategy (Department for Business and Trade) and resource security (Defra).
- Long delays, for instance in collecting evidence, investigating technology and implementing policy.

Despite these concerns, there was also a strong feeling that the situation could change rapidly, and effective cross government action on critical raw materials could be achieved, if it was made a political priority.

## Which departments have the power to influence critical raw materials policy?[33]

| | Department for Business and Trade | Department for Energy Security and Net Zero | Department for the Environment, Food and Rural Affairs | HM Treasury | Cabinet Office | Department for Transport | Ministry of Housing, Communities and Local Government | Foreign, Commonwealth and Development Office | Ministry of Defence |
|---|---|---|---|---|---|---|---|---|---|
| Demand reduction | + | + | + | + | + | + | + | | |
| Supply chains, trade | + | + | | | + | | | + | + |
| International partnerships, eg G7, G20, UN COPs | + | + | + | | + | | | + | + |
| Tax policy | | | | + | | | | | |
| Product and building standards | + | + | + | + | | + | + | + | + |
| Waste regulations, eg producer responsibility | | | + | | | | | | |
| Procurement tools, including non-price factors in CfDs | | + | | + | + | + | | | + |
| Industrial strategy | + | + | | | | | | | |
| Data | + | + | + | | + | + | + | + | + |
| Research and innovation | + | + | + | + | | + | + | + | + |
| Investment and infrastructure | + | + | + | + | + | + | + | | + |

| | |
|---|---|
| Lead department | + |
| Department with some powers | + |

# Five steps to resource and energy security

With a strong political champion for critical raw materials, the new government could accelerate policy for material reduction and circularity and build energy independence in a future dominated by renewables. This will be necessary to drive cross government buy-in and collaboration across all the relevant departments.

Based on our discussions with businesses and civil servants, as well as the third sector and experts in geopolitics, we have drawn up the following five step plan for UK resource security and energy independence.

## 1. Make access to responsibly mined critical raw materials an international priority

- This should be a diplomatic priority of the Foreign, Commonwealth and Development Office and part of international climate negotiations. Access to critical raw materials will be a crucial part of diplomacy around clean energy. The UK should champion circularity and material reduction to ensure all countries have access to the supplies they need and that countries disadvantaged by previous energy revolutions are not disadvantaged by this one.
- The UK should use its position in the Material Security Partnership, a group of 14 countries pushing for investment in responsible critical raw material supply chains, to take a lead on global action for a circular economy for these resources.
- The UK should only import from the highest environmental, social and governance (ESG) mining operations, and push for meaningful international standards. It should also press for ambitious product design standards in international fora, that enable easier and safer disassembly, reuse, repair and recycling. Businesses were clear that better design standards are vital to unlock greater circularity and improve the viability of recovering critical raw materials.

## 2. Gather the data

- Require scope 3 emissions reporting and wider environmental and social due diligence data on supply chains.
- Introduce product passports, starting with batteries, as the EU has done, so that, amongst other benefits, data on chemical and material content is available to secondary users.
- Create the promised National Materials Datahub now, to track stocks and flows of materials through the economy, starting with critical raw materials.
- Commission a review of the material needed and circular economy opportunities of the energy system, including for wind turbines, batteries and solar panels. This should involve:
  - the material needs to meet energy ambitions, according to different pathways;
  - a criticality assessment of those materials;
  - assessment of the resources available within existing infrastructure and decommissioning timelines;
  - evaluation of the infrastructure requirements and market development opportunities for reuse, recycling and remanufacturing for specific materials, products and parts

  Much of this data already exists for some sectors, such as the automotive industry, but there is a need to synthesise across sectors to inform investment decisions. Location of infrastructure should also be a consideration, as siting primary manufacturing and secondary recovery together will often improve the economic case, as well as environmental outcomes.

## 3. Integrate demand reduction and circularity into industrial strategy and climate policy

- Public procurement should require reused or recycled content in products. The government is a major procurer of technologies, eg defence. In addition, non-price factors in contracts for difference could be used to require reused or recycled content in wind turbines and solar panels, and the Crown Estate could introduce similar requirements into seabed leasing decisions for offshore wind.
- Policy levers across departments should be employed to reduce demand for critical raw materials; for example, by offering incentives to purchase smaller cars, such as a weight tax on vehicles with engines over a certain size.[34] Japan has introduced insurance and parking benefits for smaller cars.[35] Public transport should be encouraged and increased.[36] Incentives should be offered for car sharing through car clubs.[37] Smarter electricity grids should be developed with

demand side flexibility to reduce energy wastage.[38] Energy use in buildings should be reduced through faster rollout of energy efficiency improvements, and other measures like heating and cooling standards for new builds.[39]

- Existing powers in the Environment Act should be used to accelerate circularity, including setting targets for recycled content in products like batteries, and improving design regulations to require durability and ease of disassembly.

## 4. Build skills in mining and metals processing

- A quantitative assessment of the future workforce skills needed and a gap analysis of education and training provision should be conducted. Businesses identified a skills gap in the sector, as the workforce previously trained through the coal industry is now reaching retirement age, and young people do not see mining and metals processing as an attractive career.[40]
- A plan is needed to fill skills gaps, including dedicated, funded apprenticeships, T-Levels or Higher Technical Qualifications in mining and metals related skills. These should be available to workers of all ages, including those with relevant skills who are moving away from jobs in industries such as oil and gas.
- More should be done to improve the visibility of these careers and the communication of their importance to achieving net zero, to attract young people to the industry.

## 5. Secure investment

- The National Wealth Fund and the UK Infrastructure Bank should be directed to invest in line with industrial strategy, including in the infrastructure needed to collect, store, dismantle, reuse, remanufacture and recycle products containing critical raw materials.
- The 'valley of death', where new products or services struggle to reach commercialisation, should be bridged. The UK has strong R&D, including in recycling technologies, but struggles to capture subsequent economic benefits.[41] Innovation support, moving from demonstration to commercial roll-out, should be targeted at recycling innovations for critical raw materials as a strategic priority.
- Private investment in circular businesses should be supported by a new approach to financial risk, recognising the risks in current linear business models and fairly assessing new circular business models. The Sustainable Finance Platform of the Netherlands central bank is developing proposals to integrate circularity into financial risk models. As a first step, it has created a risks scorecard to assess circular investment opportunities.[42] Proposals like these should be considered by the Bank of England for inclusion in UK financial guidance.

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**Mission critical**
Safeguarding resources for UK energy security

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