

UK Minerals Forum

The future of our minerals

November 2014



A summary report

THE UK MINERALS FORUM

The UK Minerals Forum (UKMF) draws together key stakeholders to debate and inform Government and the public on the prudent use, sustainable management and supply of UK minerals. It has a broad membership (see back cover) drawn from industry, regulators, environmental groups and Government, and holds regular sessions designed to research and report on critical issues. The Forum is a key contributor to the CBI Minerals Group's Living with Minerals conference series.

Given concerns over the UK's ability to meet its future minerals needs, the UKMF has set up a working group to

explore the impacts of potential future scenarios on the social and economic well-being of the nation as a whole.

In order to identify drivers for the future, it has first taken a backward look at trends in minerals production in the UK over the last 40 years¹.

It has then gone on to seek views from different minerals sectors and has run a workshop to explore the consequences of three different future scenarios^{2,3}. From all that, it developed the recommendations contained in this summary report for consideration by Government, regulators, NGOs and by the industry itself.

SUMMARY

An adequate and resilient supply of minerals is essential to the growth of the UK economy and the well-being of the population in terms of security of energy supply, renewal of infrastructure and increased climate change resilience.

While we have had the luxury of being able to take availability of minerals for granted in the past, future supplies are by no means guaranteed and this report highlights a number of issues that need to be considered. They include global competition for raw materials and investment concerns within the industry arising from uncertainty about the future relationship of the UK with the EU. The future of our energy minerals is a particularly pressing issue, with a current question mark over the potential of unconventional energy resources.

Long-term continued access to minerals is considered crucial if the UK is to achieve sustainable economic growth and rebalance its economy towards production and manufacturing.

Positive action must now be taken by Government as well as by statutory regulators, NGOs and the industry to ensure continuity. We believe there is a need for a policy, regulatory and fiscal framework that encourages sustainable production while balancing economic, social and environmental priorities.

With goodwill and determined effort, it is surely possible to conserve what is essential in our landscapes, habitats and cultural heritage while meeting UK demand for minerals over the 35 years to 2050.



Photo: Kier Mining

¹ Trends in UK production of minerals. Future Minerals Scenarios for the UK Working Group. February 2014. www.ukmineralsforum.org.uk

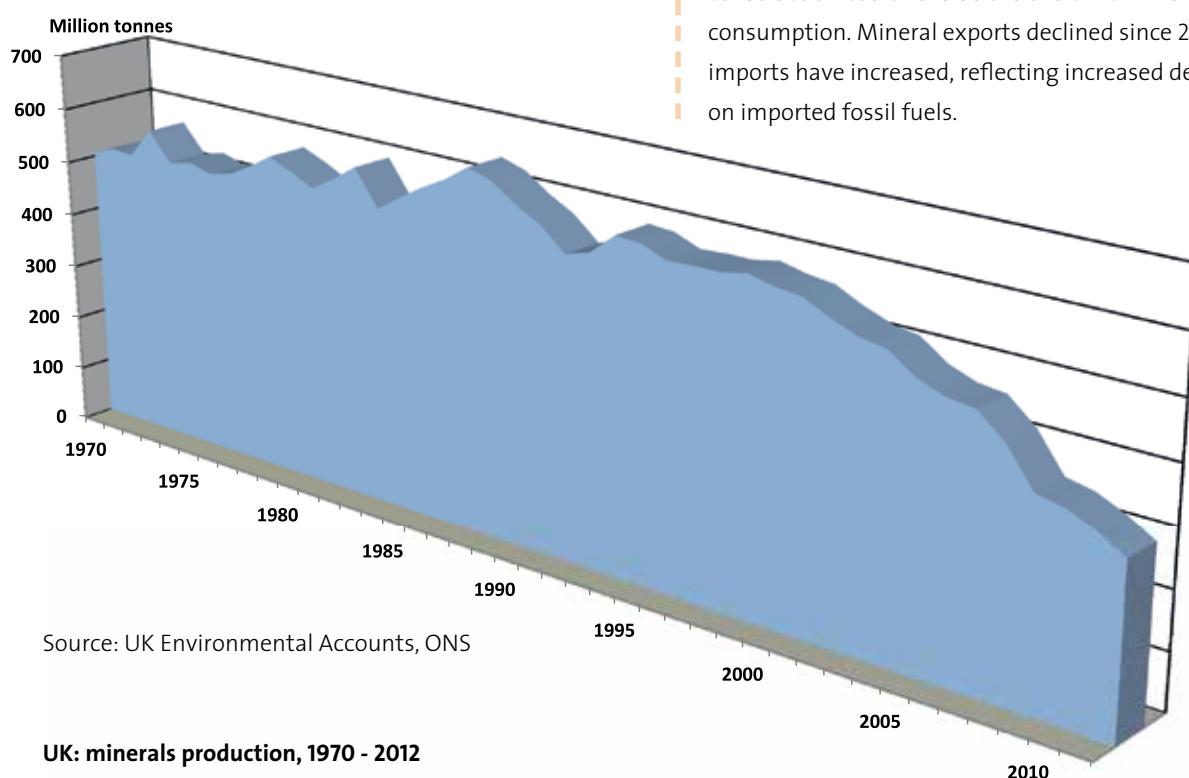
² Future Minerals Scenarios for the UK. Report from the scenarios workshop. November 2013. Waverley Management Consultants Ltd. www.ukmineralsforum.org.uk

³ Future minerals scenarios for the UK. Future Minerals Scenarios for the UK Working Group. July 2014. www.ukmineralsforum.org.uk

PRODUCTION TRENDS

We are fortunate to have substantial indigenous resources of many of the minerals we need. We have taken a backward look at production over the last 40 years, during which major changes have taken place in the fortunes of each of our extractive sectors. Our aim is to assess whether the past enables us to identify drivers for the future.

UK minerals production increased until the late 1980s but then declined, markedly so since 2000. This was mainly due to falling fossil fuel output and then the effect of the recent recession on construction minerals. Over the longer term, the data may indicate under investment in housing and infrastructure and the lost value resulting from importing manufactured mineral products. Moves to re-balance the economy through increased investment in construction could reverse the overall fall in UK minerals consumption. Mineral exports declined since 2002 while imports have increased, reflecting increased dependency on imported fossil fuels.



There is no doubt that UK's resource security and its longer term access to mineral supplies from both domestic and overseas sources will remain a key issue for many years to come.



The carbon issue

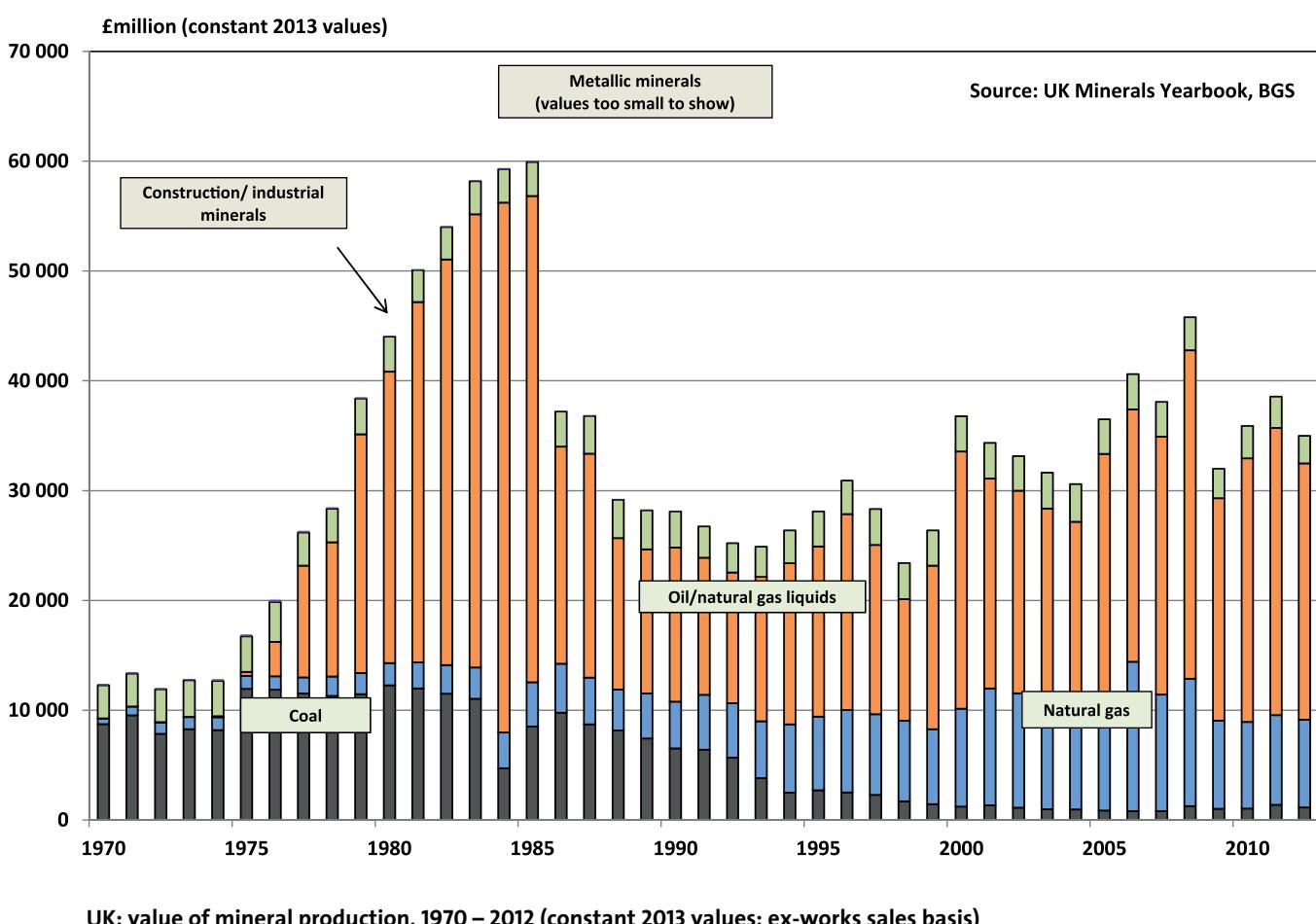
The UK is in transition towards a low-carbon economy with the aim of achieving a UK greenhouse gas emissions target for 2050 that is 80% below the 1990 baseline. This has considerable ramifications for the minerals industry, notably for fossil fuels used in electricity generation and for other energy intensive industries such as ceramics, glass, chemicals, cement, lime and plaster products, all of which are consumers of minerals principally sourced in the UK. The cumulative energy tax regime

and, for example, the Carbon Floor Price applied only in the UK, is proving very challenging and placing these industries potentially at an energy cost disadvantage which may threaten their international competitiveness and ultimately their ability to supply UK markets. An increasing dependency on mineral imports (especially coal and mineral-based manufacture) has effectively exported our carbon footprint to our trading partners, with prospects for the problem to be further exacerbated.

Value of minerals output

Minerals extraction and processing is an important primary industry. Mining and quarrying (including oil and gas extraction) contributed about £34,000 million in 2012. With declining oil and gas production from the UK Continental Shelf, the contribution to the national

economy will fall in the long term though this may be offset by alternative energy sources. The true value to the economy of indigenous minerals production is, however, derived from downstream industries and employment.



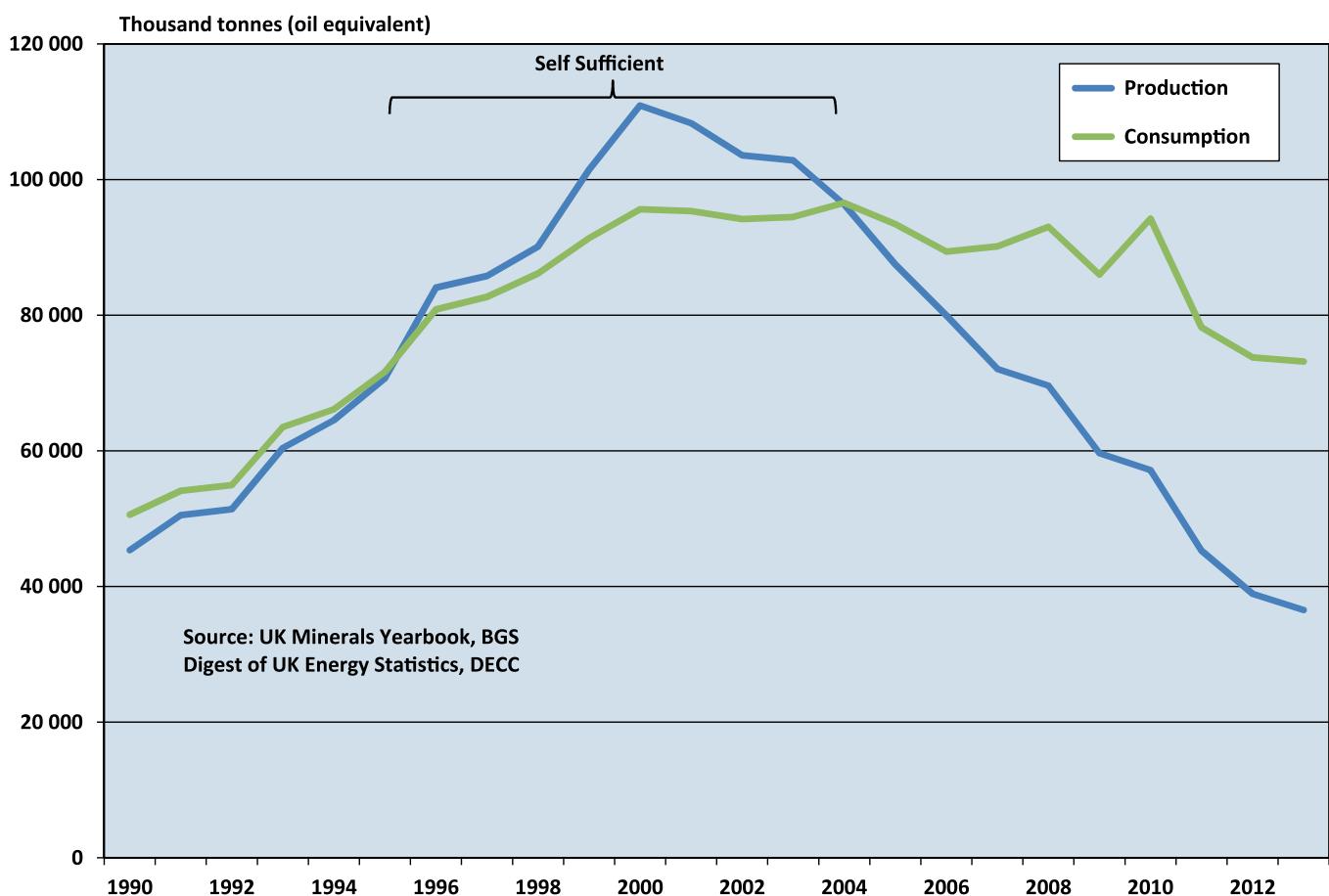
Energy minerals

The discovery of natural gas in 1965 and oil in 1970 meant that UK emerged as a major world producer of hydrocarbons. The value of **oil** production soon overtook that of coal and peaked at £48.6 billion (in real terms) in 1984. With rising prices, it was still worth £23 billion in 2012. Oil production peaked at 137.6 Mt in 1998 but has subsequently declined to 40.6 Mt in 2013.

Natural gas grew rapidly in the late 60s and early 70s though few would then have predicted it would become the favoured fuel for electricity generation, rising from 1% in 1990 to 40.5% in 2010 though falling back to 23% in 2013 because of price rises. It overtook coal in its value in 1993. Rapid depletion of reserves since the 1990s means that UK will become increasingly dependent upon imports unless other forms of gas extraction such as shale gas prove viable and environmentally acceptable.

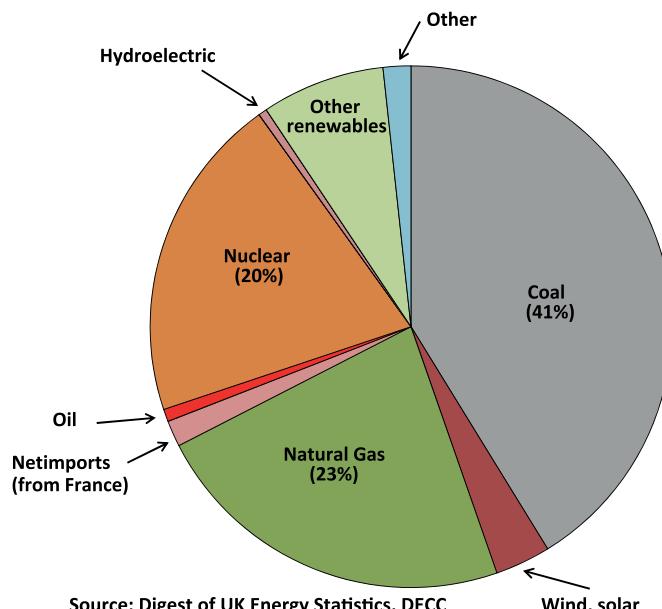


Photo courtesy |Gas Energy



UK: production and consumption of natural gas, 1990 – 2013

UK deep-mined **coal** production has been in decline since its peak of 292 Mt in 1913 and the nation became a net importer following the miners' strike of 1984. Concerns over security and diversity of energy supply have not halted the decline and today only three major deep mines still operate. Surface mining has proved to be cost-effective and overtook deep mining in 2007, and with total identified resources estimated at 839 Mt in 2012, production could be sustained if economically and environmentally viable. Total UK coal consumption in 2013 was 60.4 Mt, of which some 49 Mt were imported. Coal then supplied some 41% of total fuels for electricity generation, but while it will continue to play an important role for the next 20 years, its long-term future will depend upon development of carbon capture and storage technologies.



UK: electricity generation by fuel type, 2013

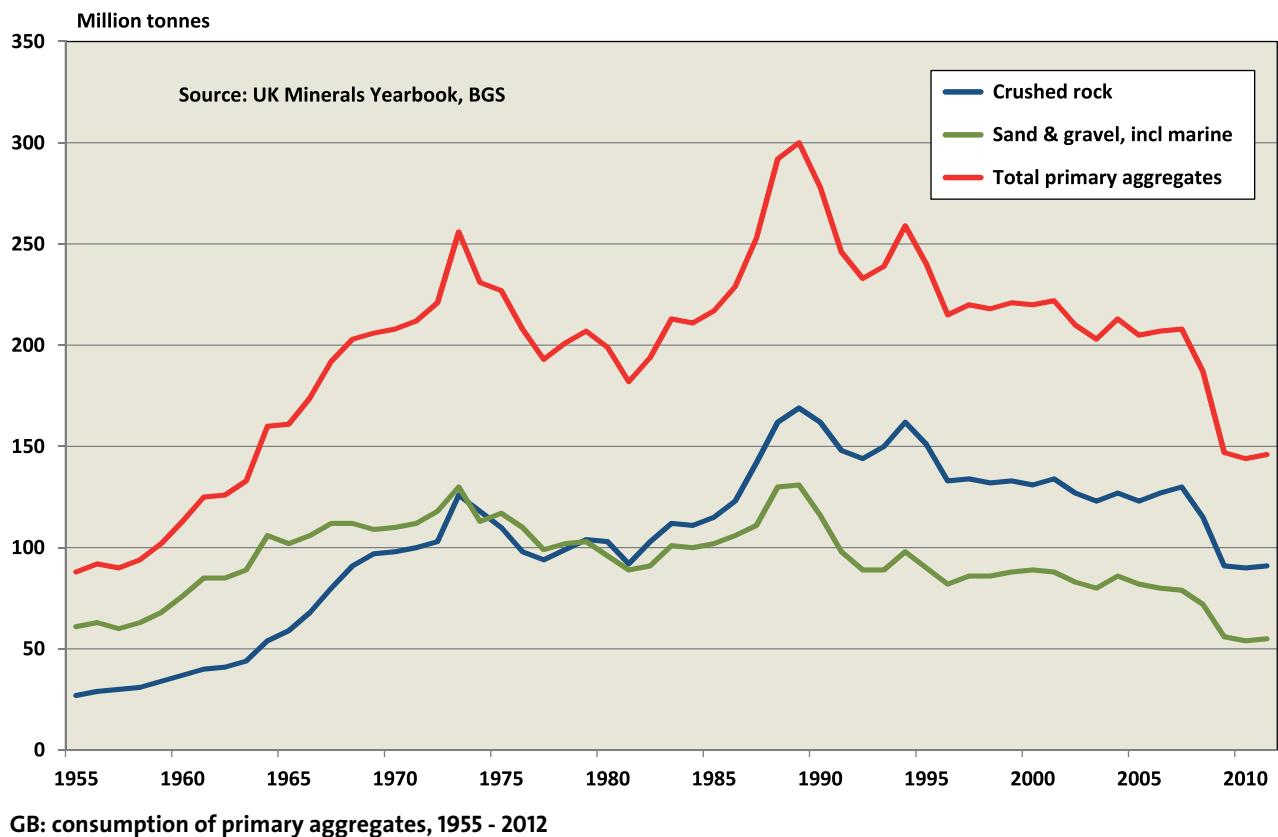
Construction minerals

Aggregates represent the largest material flow in the economy, with some 29% coming from recycled and secondary sources, 5% from marine dredging and the remainder from land-won quarrying of crushed rock (44%) and sand and gravel (22%). The market has declined dramatically since the mid-1990s with the downturn from 2008 taking production to levels not seen since the 1960s (133 Mt primary aggregates in 2012). However, there has been a significant improvement in the aggregates market since early 2013. Aggregates remain the basic raw material for all construction and it is widely accepted that some form of quantitative assessment of future requirements is essential as part of a managed aggregates supply system. There is abundant evidence of a long-term decline in reserves, particularly of sand and gravel, indicating a potential supply issue if production continues to outstrip rates of replenishment.

Brick clay is the essential raw material for one of the most visible elements of the built environment and the UK has large resources. The significant fall in production from 18 Mt in 1974 to some 4 Mt in 2012 correlates with the decline in the manufacture of clay bricks. The initial reduction was due to the advent of blocks to replace bricks in the inner leaf of cavity walls. More recently fewer and smaller houses and increasing use of timber-framed prefabricated construction have contributed. Increasing pressure for new homes driven by population increases should result in an uplift though the full effect on demand

for clay bricks remains to be seen. Whilst UK production of bricks has increased since 2012, brick imports are also increasing, reflecting a shortfall in current UK productive capacity. Investment to restore capacity lost during the recent recession will be necessary. This will require a longer term firm market and secure energy at internationally competitive prices.

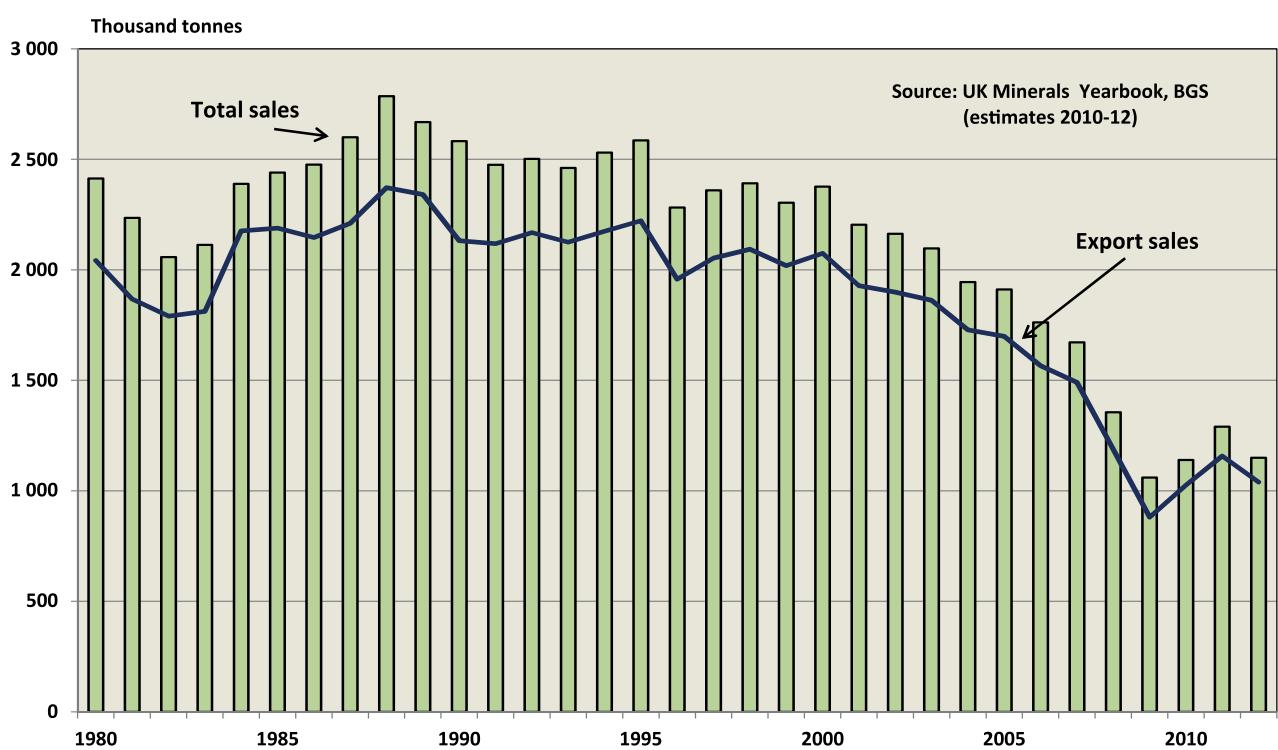
Cement is the essential constituent of concrete and mortar, and is produced by heating together limestone or chalk with clay / mudstone at very high temperatures. Cement production has declined from some 18 Mt in 1974 to around 8 Mt today, due in part to the reduction in concrete-intensive civil engineering projects. Other impacts have come from growth in imports, the introduction of blended cements which use alternative raw materials, and the demise of the more energy intensive "wet" process which used chalk in favour of limestone. The production process is, by its nature, energy intensive but operators have made great strides in reducing CO₂ through the use of alternative waste fuels and secondary raw materials. The industry has been hard hit by the recession but domestic production and imports have increased recently. Cement manufacture could, however, easily be driven overseas by higher energy costs and penalties on carbon emissions, the result being the loss of a secure source of this critically important construction material (and the associated jobs), whilst exporting carbon emissions.



Industrial minerals

The UK is the world's third largest producer of **kaolin**, which was previously known as china clay and is produced mainly in Cornwall but also in Devon. Kaolin has for many years been UK's most important mineral export after hydrocarbons. UK production peaked at 2.8 Mt (dry tonnes) in 1988 but has since fallen markedly to about 1.15 Mt in

2012 as the UK's dominant producer, Imerys, consolidated its paper-coating production in Brazil due to lower energy costs. It is a prime example of a major producer being discouraged from continuing UK production by energy costs and taking the option to invest elsewhere.



The UK is a leading world producer of high quality **ball clays** used in the manufacture of whiteware ceramics - sanitaryware, wall and floor tiles and tableware. Production is located in Devon and Dorset. Over half of global sanitaryware contains some UK ball clay. Production has been on a rising trend for some years and peaked at over 1 Mt between 2005 and 2008 with 80% exported. It is one of the very few UK minerals where future planning stretches well into the future.

Silica sands contain a high proportion of silica and their properties make them essential for glassmaking and a wide range of other industrial and horticultural applications. UK production has declined from approaching 7 Mt in 1974 to about 4 Mt today due to the decline in heavy manufacturing and its impact on the foundry industry. To date, demand for glass sand has held up well but could be affected if energy costs rise relative to those in other countries. Hydraulic fracturing for shale gas/oil could offer a significant new market.

While a mixture of **gypsum & anhydrite** is still used in cement manufacture, production of anhydrite as a source of sulphur for fertiliser and sulphuric acid was brought to an end by cheap sulphur on world markets and the last UK mine closed in 1975. Natural gypsum for plaster, plasterboard and cement making has historically been mainly extracted by mining in the UK, peaking at around 3.7 Mt in 1973 and again in 1988. The amount extracted in the UK has since declined appreciably because of the use of desulphogypsum derived from flue-gas desulphurisation at coal-fired power stations and also due to the recession.

Cheshire is the main centre for **salt** production, accounting for about 80% of UK output of 6.1 Mt in 2012. Its end-uses include being a chemical feedstock, an important ingredient in food manufacture / preservation and, as rock salt, for winter road maintenance. The chemicals it produces are vital to downstream industries, notably chlorine as an intermediate in production of plastics and polymers such as PVC, nylon and polyurethane. Continued long term salt production for this market will depend upon the future competitive strength of this important sector, with energy costs having a bearing on its survival.

The UK has emerged as a major producer of **potash** over the past 40 years with the development of the Boulby mine in north Yorkshire. Production there hit a record 1.04 Mt of refined potassium chloride in 2003 for use mainly as a fertiliser, though it has since fallen back to around

0.9 Mt tonnes. Cleveland Potash has recently accessed and started to produce from extensive deeper reserves of polyhalite for which new markets are being developed. Proposals by another company for a new mine to the south are currently being considered. If the plans come to fruition the UK could become a major world exporter of potash for decades to come.

Limestone has a wide variety of applications in addition to its primary use as the principal source of crushed rock for construction and as an essential raw material in cement. But some types of limestone and chalk are also valued for their high chemical purity and whiteness. **Industrial** and **agricultural carbonates** are important in iron and steelmaking, sugar refining, glass making, as fillers in various products, to reduce soil acidity and flue gas desulphurisation in coal-fired power generation. For some uses, notably steelmaking, water treatment and numerous chemical and environmental processes, limestone and dolomite require high temperature calcination to produce industrial and dolomitic lime. As with cement and brick manufacture, that is energy intensive with a similar set of challenges. Total industrial carbonates production peaked at around 11.5 Mt in the late 1990s, but had fallen to about 7.5 Mt by 2012. Most of the markets in UK manufacturing are now mature or in decline, but about 20% of industrial lime (mainly dolomitic) is exported.

Fluorspar is the most important and only UK source of the element fluorine, most of which is used in the manufacture of hydrofluoric acid. Output has declined from 235,000 tonnes in 1975 to 26,420 tonnes in 2010 when mining ceased, recent output coming mainly from the Southern Pennine orefield in the Peak District National Park. The future of the industry has been in doubt on two occasions as its owners retrenched due to foreign competition. Now owned by British Fluorspar, operations resumed in 2013 with an output of some 65,000 tonnes of fluorspar and 10,000 tonnes of barytes.

Barytes is principally used as a weighting agent in drilling fluids used in hydrocarbon exploration to which its fortunes have been linked. The UK is not self-sufficient and some 88,000 tonnes was imported in 2012. The major source comes from the Foss mine near Aberfeldy in Scotland though, as above, some now comes from the fluorspar operation in the Peak District. Plans for a new mine near Aberfeldy were refused in 1996 on the ground that the economic benefits did not outweigh the environmental disadvantages. A world class deposit needed by UK industry may thus never be developed.

Other minerals

The UK has a long history of metal mining including iron ore and a wide range of non-ferrous metals. Iron ore mining effectively ended in 1980 with closure of the works at Corby in Northants. Meanwhile, UK's last tin mine in Cornwall closed in 1998. The UK does still however, continue to attract interest in metallic minerals and a tungsten-tin deposit near Plymouth which was previously worked in the last war is currently being revived with production starting in 2015. Two small **gold** operations are now in operation at Omagh in Northern Ireland, and plans for another in Scotland have been delayed due to volatility in gold prices. Minor production of **lead** has accompanied the fluorspar production in the Peak District.

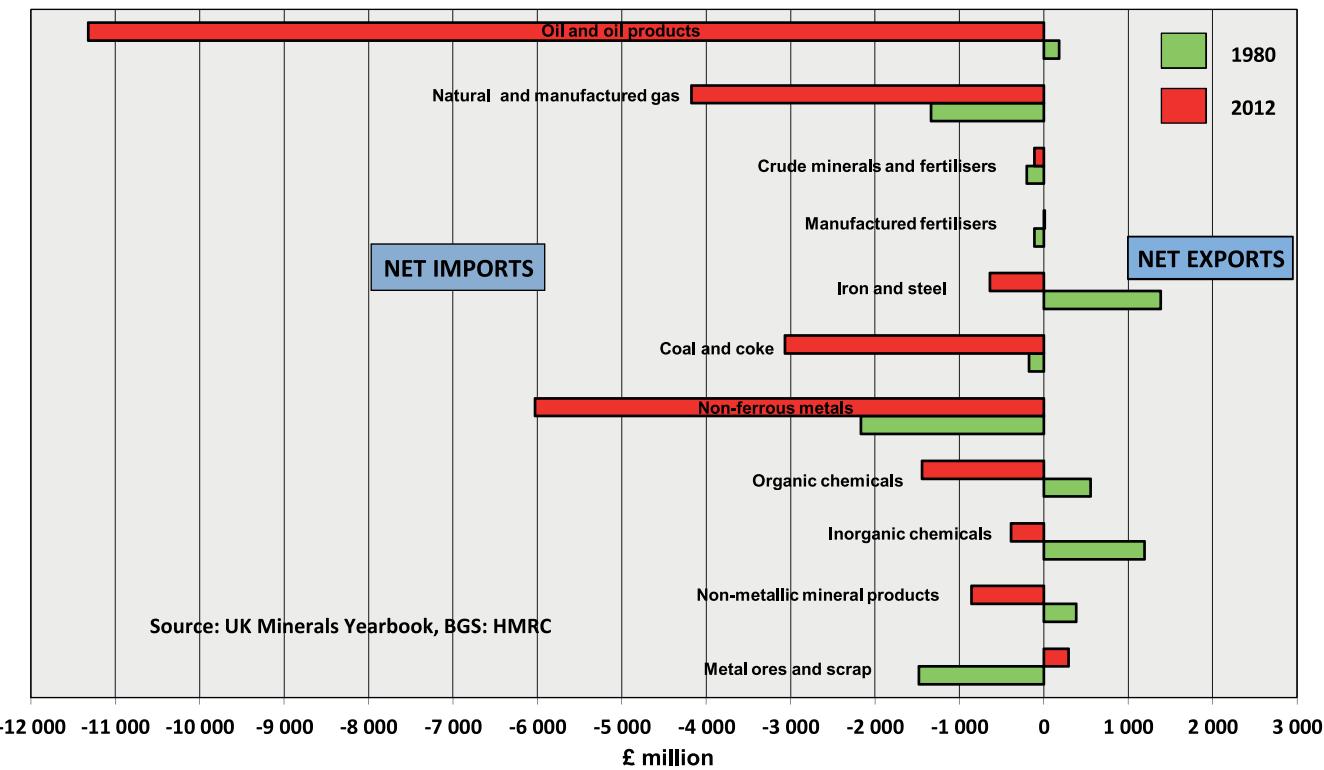


Photo: Paul Deakin. © M-J Drilling Fluids UK Ltd

Foreign trade

UK has become increasingly dependent upon imports of minerals and minerals-based products, particularly energy minerals and metals. The switch from being a long-term net exporter of energy minerals to a major importer has been particularly rapid, a trend that will not be reversed. Metal ores and scrap is one sector in which the balance of trade has improved, possibly due to improved recovery

and recycling of secondary metals coupled with a decline in suitable home facilities to process them for domestic use. Other concerns about security of supply rest on energy minerals and also on more exotic metals, such as rare earths, where production is confined to a few countries such as China.



UK: balance of trade in minerals and minerals-based products, 1980 – 2012 (constant 2013 values)

ISSUES

Need

Adequate and resilient supplies of minerals are essential to the future of the UK and pivotal to the growth of the economy and the well-being of the population. Without them we would have no energy and no materials from which to build our homes and infrastructure. Minerals are also fundamental to the manufacture of a wide range of industrial and consumer goods, and provide the means for improving the fertility of our farmland for food production.

While an expansion in renewable energy, increased use of recycled materials and industrial by-products, and improved resource efficiency all have key parts to play

in the years ahead, there will be a continuing need for newly-extracted minerals.

Internationally, the UK is facing increasing global competition for raw materials driven by the growing world population, rising incomes and expectations. In the global economy, mineral supply cannot be guaranteed and may become more challenging through increasing geopolitical uncertainty and the risk of supply disruption. At home, population and household growth, infrastructure renewal and the need to improve resilience and adapt to climate change will continue to be important drivers for minerals.

Resources

The varied geology of the UK and its continental shelf has contributed much to our national wealth throughout history. Our land mass may be small but we are fortunate that it has an abundance and diversity of indigenous mineral resources.

They are valuable national assets which can only be worked where they occur, and sometimes that may be in protected landscapes. The fact that minerals exist in a particular location is, however, no guarantee that they can be extracted. The latent value can only be released if it is economically viable and environmentally acceptable to do so and if there is an efficient and proportionate regulatory process for planning and environmental consents.

While oil and gas and construction minerals now dominate in terms of tonnage and value, domestic coal production still makes an important contribution to our energy mix. Many of the UK's minerals also support downstream, value-added industries and some also serve important export markets.

The UK is nevertheless deficient in metallic minerals, some of which are critical for new digital and low-carbon technologies, notably the rare earths found in China. We are also now increasingly short of oil and gas and economically viable coal. However, the UK's mineral potential still attracts interest, with the ongoing evaluation of the nation's shale hydrocarbon potential.

Recycling

Re-use and recycling is an integral part of sustainable resource management and improving resource efficiency. While the UK leads Europe on the level of its use of recycled and secondary aggregates, recycling is more difficult where minerals are valued for their chemical properties e.g. there are no alternatives to potassium-bearing minerals as an essential in plant nutrient.

While most properties of metals are not destroyed in use and can be recycled, a particular challenge arises with the lack of suitable reprocessing facilities in the UK which

results in many secondary metals being exported for re-use. Integrated supply chains that include recycling can be an important element in security of supply.

There are also some security of supply issues with secondary materials with question marks, for example, over the long-term availability of blast furnace slag from iron making and pulverised fuel ash (from coal-fired power stations) which are both used in blended cements, and notably desulphogypsum from coal-fired power stations.

Drivers of demand



UK: drivers for future minerals supply

Future demand for minerals and the products that come from them will be affected by a number of external factors. Major drivers of change include:

- ❖ **Growth in the economy** – while there remain uncertainties, there are predictions that the longer-term outlook for the UK is favourable and by 2060 it is forecast to have the largest population in Europe;
- ❖ **The security and cost of energy supplies** – energy underpins a successful economy but the UK has moved rapidly from energy self-sufficiency and surplus

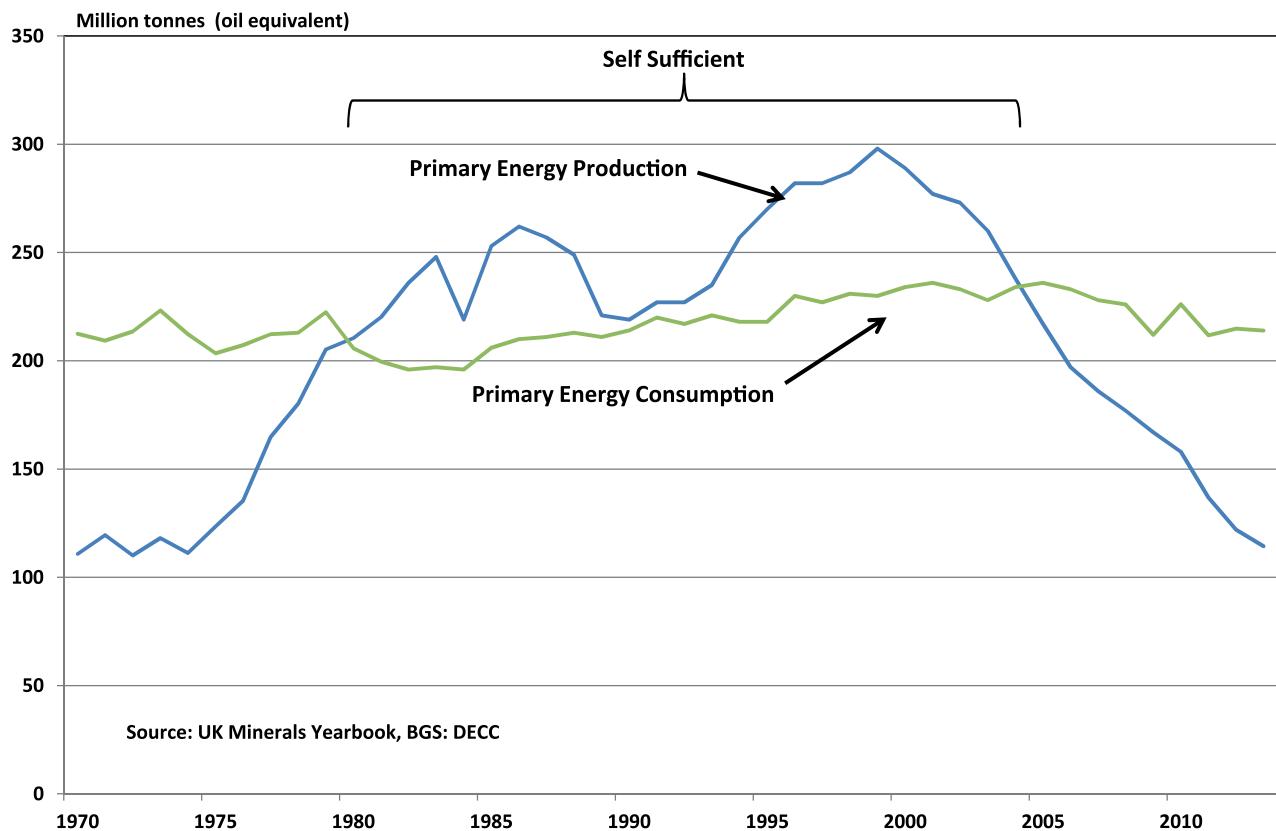
to increased reliance on imports of oil, gas and coal. The need for secure and resilient supplies cannot be overstated;

- ❖ **Future investment** in construction and infrastructure – it is now recognised that successive governments have under-invested with a detrimental effect on economic growth. Much now depends upon implementation of the National Infrastructure Plan and on investment in flood and coastal protection and responding to the needs of population growth;

- ★ **Evolving technology** – improvements aimed at extracting materials with reduced impact, improving existing operations, creating resource efficiencies, extending materials substitution and reducing energy costs must be a continuing feature of the industry;
- ★ **The balance between the benefits of minerals extraction and the associated impacts on the environment and society** – the difficulty in finding environmentally acceptable mineral sites occurs

nationwide but the industry has a good reputation for restoration and an ability to create new landscapes that are of value. Importing minerals transfers the impacts of extraction and carbon emissions to other countries.

- ★ **The political (and regulatory) framework within which the minerals industry operates** – a clearly defined and stable minerals policy is essential.



UK: production and consumption of primary energy, 1970 – 2013

(Production includes biofuels and renewable energy; consumption excludes embedded energy contained in UK imports).



GROWTH SCENARIOS FOR 2050

Our assessment is based on differing influences on three potential scenarios from the geo-economic landscape, the geopolitical landscape, the economic outlook and the environmental outlook.

1: Green UK - taking a decisive and ambitious approach to the environment

Under this scenario cyclical growth would be low with some stagnation. While pushing for free markets and open borders, there would be some political instability.

Self-sufficiency in minerals would be maximised, with recycling maximised in order to lower consumption of primary minerals. Careful and strategic management would be required to ensure a supply of minerals with focused policy and regulation. Energy intensive industries would tend to go into decline.

With the industry facing increased costs and competition, UK production would reduce as imports flowed in. Energy generation would face challenges with the prospects of gaps and blackouts. Government would face a difficult transition while for the population, the cost of living would increase with more Government control and less choice.

On the positive front, some export opportunities would increase and society would enjoy a sense of shared purpose.

2: UK powering growth - operating within free markets and open borders generating strong cyclical growth

Free markets and open borders would generate strong cyclical growth and the economy would be the largest in Europe. While the nation would be geopolitically stable, short termism would prevail with a progressively reactive approach to environmental issues.

Demand for minerals would increase and whilst it would be undertaken, there would be less of a drive towards recycling. Supply would be market driven and governed by cheapest price, security of supply would be fragile. While there would be no overall strategy for mineral and energy supply, energy intensive industries would tend to grow.

The risks of this scenario would be that barriers to production would increase. Infrastructure would be weaker and public response would be unfavourable, posing political challenges for Government to maintain the status quo. Environmental risks would increase as would individualism, with resulting society tensions.

Strong demand would, however, mean big rewards with plenty of funding to build a stronger society.

3: Insular UK - resource security overrides other issues, maximising use of domestic resources

Under this scenario the UK would face economic stagnation and volatility with geopolitical instability due to controlled markets and closed borders. Resource security would override other issues with the state maximising use of domestic resources and an increasingly reactive approach to the environment.

The UK would be required to maximise self-sufficiency in minerals, with high levels of recycling efficiency and policy needed to optimise production of indigenous minerals. Security of supply would, as a result, be fragile. Government would be under-resourced and often in fire-fighting mode, with no public participation in planning. Energy-intensive industries might stabilise or decline.

With investment reduced and declining demand, production would be compromised and exports reduced. The UK would be politically and economically isolated with social unrest and challenging demographics. Quality of life would fall, with a sense of insecurity as the UK became marginalised.

On the positive side, markets might become more predictable with opportunities for increased production. Government would have greater control over resources, and communities might feel more empowered as the UK became more self-reliant.

CONCLUSIONS

A steady and resilient supply of minerals is essential (rather than optional) to support the UK economy and the lives of the UK population in the years to 2050. While renewable energy, recycling and resource efficiency all have an important part to play, there will be a continuing need to extract primary minerals. We have to plan more effectively than in the past to make that possible.

Globally, the UK will face increasing competition for raw materials as populations, incomes and expectations all rise. But in a global economy supply cannot be guaranteed and access will be more challenging. Geopolitical uncertainty is likely to be an issue as will the risk of supply uncertainty due to the concentration of some important minerals in specific countries such as China.

Closer to home, there is uncertainty about our relationship with the EU which could impact on mineral prices and availability. This in turn may affect future investment in the minerals supply chain, particularly as the UK's minerals sector is now largely foreign owned and able to divert investment elsewhere.

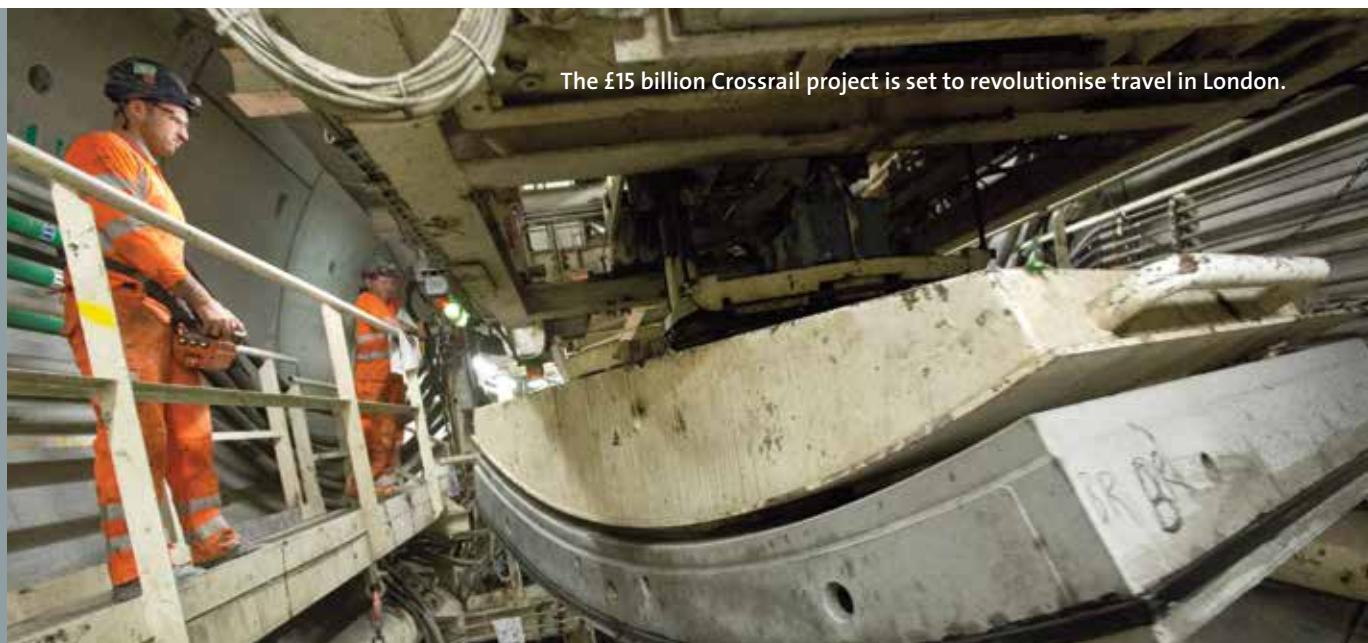
The UK is not self-sufficient in a number of key minerals, notably metallic minerals and increasingly energy minerals; oil, gas and economically viable coal. The future potential to access unconventional fuels in the UK, notably shale gas, is as yet unknown and requires significant further investigation.

However, the UK has adequate resources to sustain the economic production of many non-energy minerals and

their downstream products, particularly for construction use, to 2050 and beyond. Long-term access to supplies of these materials is crucial if we are to achieve sustainable economic growth and rebalance our economy more towards production and manufacturing. While population and household growth is driving the need for more homes, we also need to renew our infrastructure, develop low carbon power generation and enhanced flood protection. We must also resolve the apparent conflict between energy and carbon pricing policies that may discourage investment in the products we need to meet these objectives whilst exporting our carbon footprint (and jobs) elsewhere. Responding to these drivers will be a matter of national urgency over the 35 years to 2050.

The need to access minerals must, however, be balanced against the adverse impacts on the environment. So far, the UK has generally been able to maintain adequate and steady supplies of the minerals it needs within a highly protective environmental framework. It is hoped that this will continue to be the case over the period towards 2050.

All the stakeholders involved in UK minerals extraction - industry, environmental organisations, central and local government and the other regulators - need to work together in taking a long-term view of future minerals supply, by contributing to the development of a minerals strategy as an integral part of the UK's wider industrial strategy.



RECOMMENDATIONS

The work of the UKMF has reached a point where we believe we are in a position to make five key recommendations about the future of minerals in the UK:

1: Create a national long-term vision and strategy for UK minerals supply as an integral part of the UK's future industrial strategy

The minerals industry wants to work with policy makers and other stakeholders to develop a strategy that acknowledges future risk and uncertainty and sets a broad framework for future minerals supply.

2: Take concerted action to help policy makers and the public understand the importance of minerals supply to the economy and to society

The nation needs policy and legislation that responds to social, environmental and economic change through enabling the long term production and supply of minerals. While accepting the need for minerals in principle, many people are unwilling to accept the reality of mineral working and fail to recognise the diverse benefits obtained from high quality restoration.

3: Ensure effective review and monitoring by all parties in delivering an agreed minerals strategy and adjusting it in response to emerging events

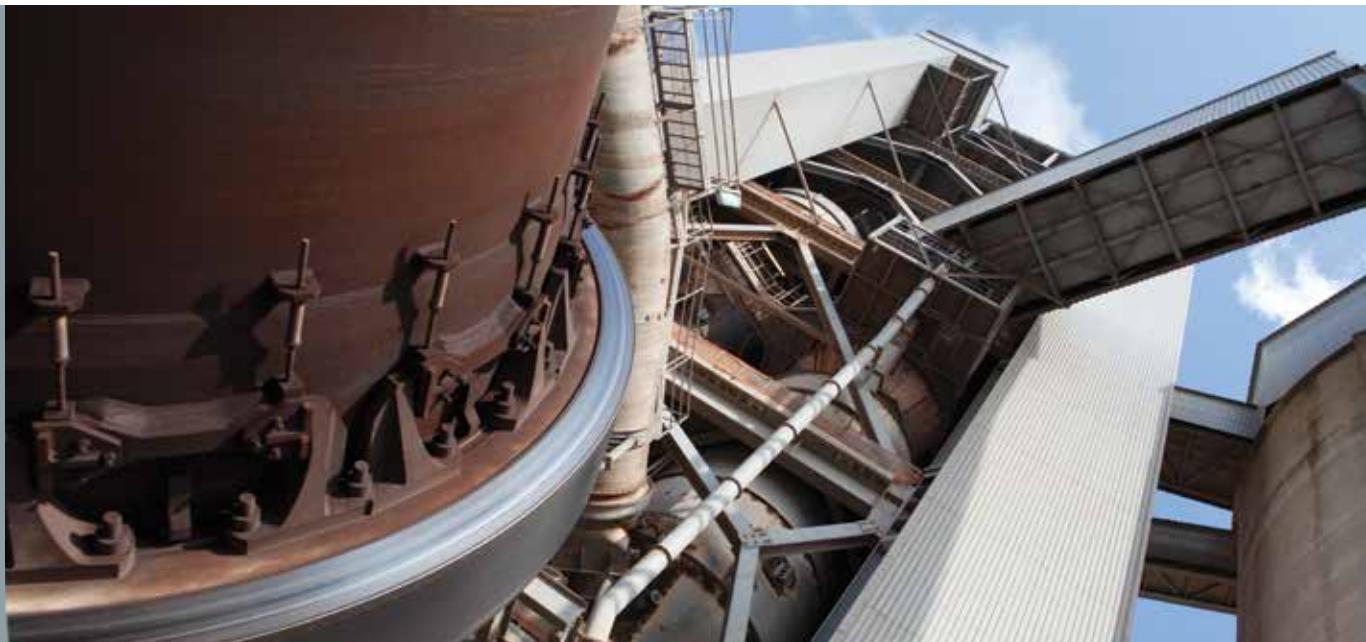
It is important that Government and its agencies have access to high quality, impartial information in order to facilitate foresight and endorse future decision-making. Government, regulators and the industry must all contribute and react as events intervene and new trends emerge.

4: Continue collaboration between Government and industry to deliver the vision that is developed.

The industry is ready to play its part. Government in turn must develop its own capacity and expertise and respond with sustained data collection, monitoring and, where necessary, adjustments to regulation, taxation and other policies.

5: Boost the resilience of the UK minerals industry

The strategy and subsequent policy framework needs to enhance and support the industry's resilience to adapt and survive.



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Photo: Stanton Bonna



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