STRATEGICALLY IMPORTANT METALS

The authors believe that there is merit in the UK aiming to become 'World Leaders' in resource efficiency since this will ultimately lead to more competitive product performance, less impact on the environment and a greater level of materials security in the future.

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One problem of tackling the issue of 'Strategically Important Metals' is first in trying to define what is meant by the term. One dictionary provides three definitions of 'strategic':

important or essential in relation to a plan of action,

essential to the effective conduct of war,

highly important to an intended objective

What is important to one organisation might be unimportant to another but the word strategic itself already suggests something that is important/essential and in so being will require a plan of action, or campaign, to address the potential risks or opportunities that relate to any specific metal.

In a non-military situation the objectives of organisations and nations can be difficult to define or reach consensus. Nevertheless, since the publication of the Bruntland Report, (*Our Common Future*) in 1987, there has been a recognition that we need to consider the impact of our current behaviour on the wellbeing of future generations. A trend towards more sustainable global development can be adopted from an altruistic stance or through recognition that a more sustainable use of resources will be more stable.

Given the UK Government's objective to be the 'Greenest Government ever' perhaps we can consider the sustainability of UK society as the objective and then consider metals in this context.

Recent media interest in Rare Earth Metals has prompted some to make the analogy with the concept of Peak Oil. However there is a significant difference between the use of materials for functional purposes, such as a food container made from glass, steel or aluminium and the use of fossil hydrocarbons as fuels. When fuel is utilised it is consumed in the process – it is converted into gaseous species which are dispersed into the atmosphere. However, when a food container has been utilised the material can be recovered and re-used. The relative merits of using glass, steel or aluminium for food containers is not the subject of this discussion – that is a matter for a detailed comparative life cycle assessment for all of the options relating to food packaging. If managed correctly the production of new products from secondary materials can have a lower impact on the biosphere than producing the same products from primary raw materials. Here it is also important to remember that there can be no production from secondary source unless some primary production has occurred somewhere. However the main point that we want to highlight here is that consideration must be given to the 'end-of-life' fate of materials and the best way to deal with this is to ensure that these issues are addressed at the design stage so that the recovery of resources at end-of-life can be optimised.

The average consumption rate of metals for different nations varies according to their level of industrial development. The consumption rates for developed economies are significantly higher than the least developed countries. As consumption rates increase in the fast growing BRIC economies (Brazil, Russia, India & China) the global average rate is increasing (see USGS Publication 'The Global Flow of Metals and Minerals', 2008). When the fact that the global population is still increasing is also taken into account the 'business as usual' projection is for the global demand for minerals and metals to continue to increase for the foreseeable future. This will put pressure on supply of materials and so it makes sense to analyse these trends in order to be in a position to adopt strategies that prevent resource constraints becoming a developmental constraint or a cause for disputes.

The huge expansion of the British economy following the Industrial Revolution was built on coal, enabling large increases in the development of iron and steel and the production of machines and infrastructure to support a wide range of mechanised manufacturing systems. If the supplies of the materials required were inadequate or the markets for the manufactured products were too small these were sought elsewhere on the globe. This led to the discovery of many mineral deposits that were more economic to exploit than those in the UK and many other parts of Europe. Initially, minerals were shipped to the UK (Europe) for processing but as economies in the host countries develop the tendency has been for them to move down the supply chain in order to recoup more added value. The UK has retained the production of some primary metals (Steel and Aluminium) but not as many as other economies with a strong manufacturing base (Germany, Japan, France, Sweden, etc). In the past 25 years facilities to process and produce the following metals have been shut down: primary copper, tin and other metals from complex tin ores, primary zinc and lead, ferro-manganese and other ferro-alloys, etc, and the primary capacity for producing iron, steel and aluminium has fallen over the same period.

The UK is not in a position to produce all of the metals that are required in a modern economy based on advanced technologies. However, to retain a share of global markets it is important that we retain the ability to develop new materials, to optimise the performance and utilisation of the materials in the economy. We must invest in the appropriate facilities and skills necessary to produce some of the special materials that are required to support the manufacturing industries that are based in the UK or are currently serviced by products from the UK. To build on the existing specialist knowledge that serves the aerospace, automotive, power generation, chemical and other sectors we must ensure that we encourage R&D across the materials supply chain and ensure that we train sufficient numbers of designers, scientists, engineers and metallurgists with knowledge of the principles of sustainable materials management. We also need to enhance the level of awareness in the general public of the social value of materials and how materials have played, and will continue to play, a major role in our technology based societies. The goal must be to use materials in more intelligent ways so that, in relative terms, we can achieve more with less.

This is not another scare story. We are not suggesting that we are going to run out of anything in the near future. What we are saying is that we need to monitor the quantities of all of the resources that we utilise and ensure that we implement programmes that encourage more sustainable materials management. This is a logical way of addressing global issues that arise from the impact of an increasing human population and growth in national GDPs. We must strive for continuous improvement in the way we design, manufacture utilise and reprocess materials and products. In fact there is merit in becoming 'World Leaders' with regard to resource efficiency since this will ultimately lead to better and more competitive product performance, less impact on the environment and a greater level of security with respect to materials availability in the future. However the solutions are not purely technical; we need to understand more about the environment and our interactions with all levels of the biosphere. We need to consider social cohesion and sustainability on a global scale and debate how we can develop systems that promote human wellbeing. To date technical advances have kept the predictions of Malthus and Boulding at bay. If we try to understand and address the issues that humanity may face in the future we will have a chance of addressing them but if we adopt a *'laissez-faire'* approach we are gambling with the prospects for the future and we would not be using lessons that we should have learned from history.

SHORTAGE OF RARE EARTHS

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The multi-£B market in precision surfaces (lenses, mirrors, windows, semiconductor wafers, prisms, fibres etc) underpins high-value products in numerous sectors – aerospace, semiconductor, defence, security, telecom, scientific and medical instrumentation, ophthalmic, automobile, computer, consumer durables, point-of-sale etc. The entire digital communications network depends on optical fibres and associated photonic devices. These materials all require polishing during the manufacture of the respective devices.

Polishing of precision glass and similar materials depends strategically on a particular polishing compound – Cerium Oxide. Cerium is a rare earth element extracted predominantly in China. This class of elements is in increasingly short supply worldwide, with soaring prices due to increasing demand and intervention of the Chinese government in the market. Whilst market dynamics may restore the position in time, our high strategic dependence on Cerium over numerous sectors, and the evident instability of its supply, does not present a short or long term position that is secure.

I invite the Parliamentary and Scientific Committee to take due cognisance of this situation, and recommend that the UK industrial and academic sectors should co-operate to develop effective alternatives to Cerium-based processes. This will also provide the opportunity to explore alternatives that may be technically superior, enhancing competitiveness.

SUPPORTING EXTRACTS:

Report of US Government Accountability Office, Briefing for Congressional Committee, April 14, 2010, Belva M. Martin, Acting Director , Acquisition and Sourcing Management
"Most rare earth material processing now occurs in China. In 2009, China produced about 97 per cent of rare earth oxides."
"A 2009 National Defense Stockpile configuration report identified lanthanum, cerium, europium, and gadolinium as having already caused some kind of weapon system production delay and recommended further study to determine the severity of the delays."
According to government and industry data, the future availability of materials from some rare earth elements – including neodymium, dysprosium, and terbium – is largely controlled by Chinese suppliers. China's dominant position in the rare earths market gives it market power, which could affect global rare earth supply and prices. In addition China has adopted domestic production quotas on rare earth materials and decreased its export quotas, which increases prices in the Chinese and world rare earth materials markets. China increased export taxes on all rare earth materials to a range of 15 to 25 per cent, which increases the price of inputs for non-Chinese competitors.

Bloomberg news, August 29 2010
"China cut its export quotas of rare earths by 72% for the second half of this year, according to data from the Ministry of Commerce on July 8. Shipments will be capped at 7,976 tonnes, down from 28,417 tonnes for the same period a year ago."

Paul Kingscot, Sales Director, Engis UK Ltd, Sept 16 2010
"I am getting gloomy reports about the price and availability of cerium oxide. Apparently the manufacturer of cerox has run out of raw material to process. I advise alternative polishing methods are explored as a plan 'B'"

Bloomberg news, Sept 17 2010
"Aggregate prices for rare earths have risen to $51 a kilogram, from about $15 a kilogram in April"

Bloomberg news, Oct 21 2010
"Prices have climbed sevenfold in the last six months for cerium oxide contributing to the rise in prices is an expectation of further restrictions. China will probably tighten export controls on rare earths next year"

Bloomberg news, Feb 17 2011 "The price of cerium, a rare-earth mineral used in magnets, will drop to $10 a kilogram by 2013 from more than $60 currently as additional production creates a 'vast oversupply,' a mining exploration company said"

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