Strategically important metals

Fifth Report of Session 2010–12

Volume I: Report, together with formal minutes, oral and written evidence

Additional written evidence is contained in Volume II, available on the Committee website at www.parliament.uk/science

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The Science and Technology Committee

The Science and Technology Committee is appointed by the House of Commons to examine the expenditure, administration and policy of the Government Office for Science and associated public bodies.

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The Reports of the Committee, the formal minutes relating to that report, oral evidence taken and some or all written evidence are available in printed volume(s).

Additional written evidence may be published on the internet only.

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The current staff of the Committee are: Glenn McKee (Clerk); Ed Beale (Second Clerk); Farrah Bhatti (Committee Specialist); Xameerah Malik (Committee Specialist); Anthony Walker (POST Intern); Andy Boyd (Senior Committee Assistant); Julie Storey (Committee Assistant); Pam Morris (Committee Assistant); and Becky Jones (Media Officer).

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# Contents

## Report

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Summary</strong></td>
<td>3</td>
</tr>
<tr>
<td><strong>1 Introduction</strong></td>
<td>5</td>
</tr>
<tr>
<td>Why metals?</td>
<td>5</td>
</tr>
<tr>
<td>The inquiry</td>
<td>6</td>
</tr>
<tr>
<td>Structure of the report</td>
<td>7</td>
</tr>
<tr>
<td><strong>2 Background</strong></td>
<td>8</td>
</tr>
<tr>
<td>What are strategically important metals?</td>
<td>8</td>
</tr>
<tr>
<td>Metals terminology</td>
<td>9</td>
</tr>
<tr>
<td>How important are strategic metals to the UK?</td>
<td>11</td>
</tr>
<tr>
<td>Metal management</td>
<td>12</td>
</tr>
<tr>
<td>Resource information</td>
<td>12</td>
</tr>
<tr>
<td>A role for Government</td>
<td>13</td>
</tr>
<tr>
<td>Non-metals</td>
<td>15</td>
</tr>
<tr>
<td><strong>3 Trade and geopolitics</strong></td>
<td>16</td>
</tr>
<tr>
<td>Metals supply</td>
<td>17</td>
</tr>
<tr>
<td>Are metals running out?</td>
<td>17</td>
</tr>
<tr>
<td>National monopolies</td>
<td>18</td>
</tr>
<tr>
<td>Demand for metals</td>
<td>21</td>
</tr>
<tr>
<td>Market responsiveness</td>
<td>22</td>
</tr>
<tr>
<td>Stockpiling</td>
<td>23</td>
</tr>
<tr>
<td>Trading metals</td>
<td>25</td>
</tr>
<tr>
<td>Speculation in the metal markets</td>
<td>25</td>
</tr>
<tr>
<td>Market dominance</td>
<td>26</td>
</tr>
<tr>
<td>REACH legislation</td>
<td>26</td>
</tr>
<tr>
<td><strong>4 Social and Environmental Impact of Metal Extraction</strong></td>
<td>29</td>
</tr>
<tr>
<td>Raising global standards</td>
<td>30</td>
</tr>
<tr>
<td>Regulation</td>
<td>30</td>
</tr>
<tr>
<td>Voluntary schemes</td>
<td>33</td>
</tr>
<tr>
<td>Getting a fair deal for developing countries</td>
<td>35</td>
</tr>
<tr>
<td>“Conflict metals” in the Democratic Republic of Congo</td>
<td>36</td>
</tr>
<tr>
<td><strong>5 Metal Use Efficiency</strong></td>
<td>39</td>
</tr>
<tr>
<td>The life cycle approach and product design</td>
<td>39</td>
</tr>
<tr>
<td>Recycling strategic metals</td>
<td>43</td>
</tr>
<tr>
<td>Meeting demand with recycling</td>
<td>43</td>
</tr>
<tr>
<td>WEEE legislation</td>
<td>47</td>
</tr>
<tr>
<td>Exporting metal waste</td>
<td>49</td>
</tr>
<tr>
<td><strong>6 Domestic extraction</strong></td>
<td>52</td>
</tr>
<tr>
<td>Exploiting potential reserves</td>
<td>52</td>
</tr>
</tbody>
</table>
Strategically important metals

Impact of domestic extraction 54
UK planning law 56

Conclusions and recommendations 59

Formal Minutes 65
Witnesses 66
List of printed written evidence 67
List of additional written evidence 67
List of Reports from the Committee during the current Parliament 68
Summary

Strategically important metals comprise the rare earth elements, the platinum group elements and other main group elements of importance to the UK. Of particular importance are those specialist metals that are vital to advanced manufacturing, low-carbon technologies and other growing industries.

Supply risks to strategically important metals have been a focus of recent media attention. The perception of scarcity of certain minerals and metals may lead to increased speculation and volatility in price and supply. For this reason, there is a need for accurate and reliable information on the potential scarcity of strategic metals.

We heard that most strategic metal reserves are unlikely to run out over the coming decades. In practice, improved technology, the use of alternative materials and the discovery of new reserves are likely to ensure that strategic metals are accessible but there may be price implications. There are, however, concerns about supplies to UK users. The fact that China currently supplies over 97% of the world’s rare earth elements has highlighted the risk of monopolies and oligopolies in strategic metals. China recently imposed export quotas. We are also concerned by reports of hedge funds buying up significant quantities of strategic metals. Furthermore, the increasing global demand for strategically important metals from emerging economies and new technologies will be a significant factor affecting their price, and therefore availability in the future.

In order to meet the growing demand for strategically important metals, there may be a need to exploit lower grade minerals, much of which can be found in developing countries outside China. Although there will be a significant environmental and monetary cost, there is an opportunity for developing nations to benefit from mining revenues. Fair royalties on mining sales will equip governments with funds that could be used to help improve social and environmental conditions. Broader action on improving the social and environmental impact of mining needs to be taken internationally.

There is a need for the Government to be “joined up” on resource issues. In particular, the Government needs to clarify which department leads in the provision of information on strategic metal resources and how this information is updated and shared across government and then disseminated to businesses. The provision of such information will help businesses prepare for any potential future resource risks.

We also found that there is a lack of information available on the strategically important metals contained in finished and semi-finished imports, as well as the amounts and locations of strategic metals in the national waste stream. We recommend that the Government conduct a review of metal resources—finished and semi-finished goods and waste—in the UK. This will help to identify routes to the recovery of strategic metals, and will also empower the private sector to realise the economic potential of recovery and recycling.
We are pleased that the metal recycling industry in the UK is recycling 90%, by weight, of collected waste and that substantial quantities of platinum, rhodium, palladium, gold and silver are being recovered, mainly from recovered waste electrical and electronic equipment. However, it is of great concern to us that some strategic metals, which are often in products in small quantities, are likely to be lost in the 10% not being recycled.

These small quantities of strategic metals might be more effectively recycled by embracing a “cradle-to-cradle approach” whereby products are designed for disassembly. These products can then be returned to manufacturers at the end of their useful life for resource recovery. We have been given examples of the financial benefits to manufacturers that have tried this approach. We would like to see widespread use of this approach in UK manufacturing, and intelligent product design is key to its effective implementation.

We heard concerns that the UK was exporting large quantities of scrap metal and that the export of scrap and waste electrical and electronic equipment was environmentally damaging. Given that scrap metal and waste electrical and electronic equipment are a potential resource for the UK, it seems nonsensical to be exporting them abroad. The Government should be actively working towards minimising the export of these materials.

Finally, there are unexploited deposits of various strategic metals in the UK but, in many areas, it is unclear whether extraction is economically viable. It is important that the Government invests in the necessary research, to ensure that future domestic mining has the least possible environmental impact. The Government needs a comprehensive and up-to-date understanding of potentially valuable domestic mineral resources. We are concerned, however, by reports that uncertainty and delay in the planning process is preventing some mining companies from even considering prospecting for reserves in the UK. We recommend that the Government classify mines, in particular those containing strategic metal reserves, as nationally significant infrastructure, under the Planning Act 2008.
1 Introduction

Why metals?

1. Metals are essential for the quality of life that modern society is accustomed to. They are key raw materials for advanced manufacturing, low-carbon technologies and many other industries. In November 2010, the Government published its plans for economic growth in the paper, *The path to strong, sustainable and balanced growth*. This paper identified five specific challenges in “getting behind” British business and improving the UK’s performance, two of these challenges were:

- consolidating existing strengths in [...] advanced manufacturing to drive export growth;
- supporting new and expanding industries where the UK has the potential to become a world leader including in low-carbon technologies.

Ensuring a stable supply of metals and other raw materials will be key to addressing these challenges.

2. Metals are present in varying but finite quantities in the Earth’s crust and are distributed unevenly. There is concern that some metals may run out in the coming decades. Supply risks to metals have also been a focus of recent media attention. Multiple factors affect the supply of metals. For example, in September 2010, China—which supplies over 97% of a group of metals known as the rare earth elements (REEs, see paragraph 14), which are essential for many high-tech products—reportedly stopped exports of REEs to Japan in response to the arrest of a Chinese trawler captain in disputed waters of the South China Sea. Metal supply shortages, for example due to geopolitical or economic issues, could have a significant impact on the industries using them and hence the economies of countries reliant on those industries. The increasing economic power and global influence of transition economies such as Brazil, Russia, India and China (BRIC) has heightened concerns over competition for scarce resources.

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1. HM Treasury & Department for Business, Innovation and Skills, *Path to Strong, Sustainable and Balanced Growth*, November 2010
2. HM Treasury & Department for Business, Innovation and Skills, *Path to Strong, Sustainable and Balanced Growth*, November 2010, para 1.75
5. “Japan protests over Chinese boats near disputed islands”, *BBC online*, 25 October 2010
The inquiry

3. The Government’s plans for growth and, more broadly, concerns about the security of supply of strategic metals prompted this inquiry; in particular we were interested in the potential impact on those who required strategic metals in the UK.

4. On 11 November 2010 we made a call for written evidence on the following questions:

- Is there a global shortfall in the supply and availability of strategically important metals essential to the production of advanced technology in the UK?
- How vulnerable is the UK to a potential decline or restriction in the supply of strategically important metals? What should the Government be doing to safeguard against this and to ensure supplies are produced ethically?
- How desirable, easy and cost-effective is it to recover and recycle metals from discarded products? How can this be encouraged? Where recycling currently takes place, what arrangements need to be in place to ensure it is done cost-effectively, safely and ethically?
- Are there substitutes for those metals that are in decline in technological products manufactured in the UK? How can these substitutes be more widely applied?
- What opportunities are there to work internationally on the challenge of recovering, recycling and substituting strategically important metals?

5. We received 22 written submissions and held three oral evidence sessions between January and March 2011:

- On 26 January, we took evidence from two panels of witnesses. First: Professor David Manning, Secretary, Professional Matters, Geological Society; Dr Bernie Rickinson, Chief Executive, Institute of Materials, Minerals and Mining; and Dr Mike Pitts, Industry Technology Division, Royal Society of Chemistry. Second: Ian Hetherington, Director General, British Metals Recycling Association; Sophie Thomas, Trustee, the Design Council and Founding Director, Thomas Matthews Ltd; Tony Hartwell, Knowledge Transfer Manager, The Environmental Sustainability Knowledge Transfer Network; and Louis Brimacombe, Head of the Environment & Sustainability Research Team, Tata Steel.

- On 16 February, we took evidence from: Charles Emmerson, Senior Fellow, Chatham House; Dr Jonathan Di John, Lecturer in Political Economy, School of Oriental and African Studies; Anthony Lipmann, Managing Director, Lipmann Walton & Co Ltd and former Chairman, Minor Metals Trade Association; and Charles Swindon, Chair of the Trade and Lobby Committee, Minor Metals Trade Association.

- On 2 March, we took evidence from two panels of witnesses. First: Professor Robert Watson, Chief Scientific Adviser, Department for Environment, Food and Rural Affairs (Defra); and Professor David Clary, Chief Scientific Adviser, Foreign & Commonwealth Office (FCO). Finally, Rt Hon David Willetts MP, Minister of State for Universities and Science.
6. We would like to put on record our thanks to those who provided written or oral evidence to this inquiry.

**Structure of the report**

7. In chapter 2 we provide background information on the definition of strategic metals, the issues around metal scarcity and the Government’s policies on metal use and consumption in the UK. Chapter 3 covers issues affecting the trade in strategic metals. Chapter 4 looks at the social and environmental impacts of mining overseas. Chapter 5 investigates the potential for recycling and reuse of strategic metals in the UK. Finally, chapter 6 looks at exploration for and extraction of strategic metals in the UK.
2 Background

What are strategically important metals?

8. Of the 94 naturally occurring elements 72 are metals and, since the Bronze Age, metals have been integral to the lives of people living in the UK. Today society depends on metals for nearly everything: from bulk metals, such as iron for construction and copper for delivering electricity, to rarer, specialist metals that are used for their, often unique, properties in high technology applications. For example, cobalt is the “base of most medical implants”; indium is used to make clear transistors for use in touch screens and liquid crystal displays; neodymium is alloyed with iron and boron to make high strength magnets essential for modern electric motors and wind turbines; lithium is the key component in modern batteries; and the list goes on.

9. Clearly, metals are important. Two recent reports (one by the European Commission, the other by the US Department of Energy) on materials security rated metals on their “critical” importance, characterising criticality as a combination of importance and security/scarcity. In this inquiry, we sought to identify the criteria by which a particular metal is defined as being strategically important to the UK.

10. In its written submission, the Environmental Sustainability Knowledge Transfer Network (ESKTN) pointed to the subjective nature of “importance”:

   One problem here is how strategically important metals are defined. In the past this term may have referred to metals with critical roles in military applications. A broader approach would consider materials that are important to the performance of […] advanced systems, machines or new technologies.

11. The Geological Society of London stated that in defining what is strategically important, “economic importance is not the only factor—environmental protection, national security and other benefits may also be significant”. We explored the problem of defining strategically important metals in oral evidence with a number of witnesses. However, it was apparent that while importance and availability were key themes, there was no single definition of the term “strategic”. What is strategically important to one user may not be strategically important to others. That is, while a metal’s availability or security of supply could be similar for many organisations within the UK, the importance placed on that metal would vary depending on the extent to which it is used by each organisation.

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7 Q 10 [Dr Rickinson]
8 “Ten years to save the touchscreen”, New Scientist, 27 October 2010
9 Q 10 [Dr Rickinson]
10 Ev 47 [University of Strathclyde and University of Oxford]
12 Ev 47, para 6
13 Ev 52, para 5
14 Qq 2–6, 35–37
12. For the purpose of this inquiry we therefore have had to take a broad definition and we took strategically important metals—hereafter referred to as strategic metals—to be those that may be of importance to any user within the UK. With, however, the Government’s policy of consolidating existing strengths in advanced manufacturing to drive export growth and supporting new and expanding industries, our inquiry has focussed more on the specialist metals such as cobalt, indium, neodymium and lithium with specific technological applications.

**Metals terminology**

13. We were aware that in some of the written and oral evidence we received, there appeared to be some interchangeable usage and confusion of the terms rare earth element (REE) and strategic metal. In particular, the bulk of the Government’s written submission to this inquiry focussed on issues concerning REEs.

14. REEs are a group of 17 metals comprising:

- the 15 elements in the “lanthanide series” of the periodic table, that is lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium and lutetium; and
- the two transition elements, yttrium and scandium.

They are sometimes referred to as rare earth metals (REMs) or simply as rare earths (REs). Though their name would suggest otherwise, they are not actually rare. The name comes from their seeming scarcity when first discovered in the late 18th century and finding reasonable concentrations of them that are economically extractable is quite rare. In most materials security assessments, REEs are considered as a single resource because they often occur together in the Earth’s crust and have similar chemical properties.

15. The confusion in metal terminology became apparent when we were questioning Rt Hon David Willetts MP, Minister of State for Universities and Science. When asked to clarify whether he was referring specifically to the “rare earths” as described above, or whether he was using the phrase to describe “scarce minerals”, he responded: “I am referring to the particular elements in about the middle of the periodic table. What I found quite useful as a layman, as the simplest guide [...] is the Chemistry World chart”. The chart described by the Minister is shown below. The highlighted elements he referred to include some “rare earth elements” (scandium, yttrium and neodymium—shown in the

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15 See, for example: Qq 166-68 [Rt Hon David Willetts MP].
16 Ev 39, paras 8-43
17 This is as defined by the International Union of Pure and Applied Chemistry (IUPAC). Some definitions also include the Actinide series.
18 “Rare Earths: Elemental Needs of the Clean-Energy Economy”, *Scientific American*, 13 October 2010
20 Q 167
Serious threat in the next 100 years

Rising threat from increased use

Limited availability, future risk to supply

Source: Chemistry Innovation Knowledge Transfer Network

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Rising threat from increased use

Limited availability, future risk to supply

Rare earth elements: scandium, yttrium, lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium and lutetium

Platinum Group metals: ruthenium, rhodium, palladium, osmium, iridium and platinum

**Table 1: Strategically important metals**

<table>
<thead>
<tr>
<th>Antimony</th>
<th>Beryllium</th>
<th>Chromium</th>
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<tr>
<td>Cobalt</td>
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<tr>
<td>Gold</td>
<td>Hafnium</td>
<td>Indium</td>
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<tr>
<td>Lithium</td>
<td>Magnesium</td>
<td>Nickel</td>
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<td>Niobium</td>
<td>Rhenium</td>
<td>Tantalum</td>
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<tr>
<td>Titanium</td>
<td>Tungsten</td>
<td>Vanadium</td>
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</table>

16. There are in fact many strategic metals other than REEs: for example, the European Commission report, Critical raw materials for the EU, defines 14 critical materials, one of which is the group of REEs.\(^{21}\) The focus of the Government’s written evidence on REEs, in our view, misses a whole range of strategic metals. The list below gives an indication of some of the metals that have been drawn to our attention during this inquiry as those of strategic importance to the UK:

**Table 1: Strategically important metals**

Antimony, beryllium, chromium

Cobalt, gallium, germanium

Gold, hafnium, indium

Lithium, magnesium, nickel

Niobium, rhenium, tantalum

Titanium, tungsten, vanadium

**Rare earth elements:** scandium, yttrium, lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium and lutetium

**Platinum Group metals:** ruthenium, rhodium, palladium, osmium, iridium and platinum

\(^{21}\) EC Raw Materials Supply Group, *Critical Raw Materials for the EU*, July 2010, p6
17. We are concerned that much of the Government’s response to this inquiry focussed on rare earth elements when there are clearly a number of other strategic metals that are important to the UK. Furthermore, we are concerned by the interchangeable usage and confusion of the terms rare earth element (REE) and strategic metal. In order to ensure the formulation of appropriate policy and support for UK metals users, the Government must use clear terminology. In our view strategically important metals comprise the rare earth elements, the platinum group elements and other main group elements of importance to the UK, such as those identified in Table 1. The rare earth elements are only one very specific group of metals, therefore the term “rare earths” must not be used to describe all of the above.

How important are strategic metals to the UK?

18. Having defined strategic metals the next question is how important are they to the UK. Dr Jonathan Di John, Lecturer in Political Economy at the School of Oriental and African Studies, explained why the UK economy was not as reliant on strategic metals as some:

Countries that use these metals more intensively, such as Japan and Germany, are more vulnerable, because if you look at the industrial structure of those countries they are much more intensive users than the UK.22

19. This was a view echoed by Nicholas Morely, Director of Sustainable Innovation at the sustainability consultancy, Oakdene Hollins.23 Others took a different view. Major manufacturing companies in the UK rely on strategic metals as raw materials in their products and the view of the Institute of Materials, Minerals and Mining (IOM3) was that “the UK is as vulnerable as other countries, e.g. Japan, the USA and those in the EU that have advanced technology industries”.24 The Minor Metals Trade Association (MMTA) stated that “the UK is one of the world’s leaders of advanced technologies that consume [strategic metals]”.25

20. Key manufacturing sectors in the UK rely on a range of metals. Jet engine manufacture requires about 40 different metals.26 The automotive industry requires a number of strategic metals: for example, the UK is a world leader in the manufacture and development of catalytic converters, which require Platinum Group metals.27 We also heard from the Aerospace and Defence Knowledge Transfer Network that aerospace and defence manufacturing sectors depend on a number of strategic metals, as do manufacturers of high-grade alloys of steel.28

21. The Government has acknowledged the importance of some strategic metals to its future plans for the UK:

22  Q 80
23  Ev w2, para 2.1
24  Ev 44, para 2.2.1
25  Ev 69, para 1
26  Q 82 [Mr Swindon]
27  Ev w30, para 18 [Research Councils UK]
28  Ev w10
Rare earth elements [...] are integral to the transition to a low carbon manufacturing economy and are also important to other key UK industry sectors such as transport, defence and security. A stable supply will be important for achieving the transition to a green economy, securing green growth and re-balancing the economy towards high value-added manufacturing.29

22. Research Councils UK (RCUK) concurred:

The technology required to deliver the government’s plans to build a “green manufacturing” sector e.g. solar cells, depends on the availability of some strategically important metals.30

RCUK added that “there is an enormous projected growth in the demand for lithium for electric vehicle batteries, including Nissan’s plans to manufacture them in the UK”.31

23. Dr Bernie Rickinson, Chief Executive of IOM3, stated that “there are a number of materials that underpin wealth for the UK and strategy for the Government that really need evaluating”.32

24. There is some disagreement about the vulnerability of the UK to metal shortages, especially in comparison to more intensive users such as Japan and the USA. However, there are important sectors of the UK economy that already rely upon a wide range of metals at stable prices. Furthermore, a stable supply of metals will be important in the transition to a low carbon economy. We are pleased that the Government recognises the importance of metals to the green economy, securing green growth and re-balancing the economy towards high value-added manufacturing.

Metal management

25. Having accepted that strategically important metals have a vital part to play in the future of the UK economy, we considered what role the Government should have in ensuring and managing supplies of these metals.

Resource information

26. Professor Robert Watson, Chief Scientific Advisor to the Department for Environment, Food and Rural Affairs (Defra), stated:

We believe that [Defra’s] job, primarily, is to provide information to the private sector as to whether some of these resources are rare, are getting rarer and whether there are issues such as price volatility, et cetera.33
27. This was the aim of the recent Defra report, *Review of the Future Resource Risks Faced by UK Business and an Assessment of Future Viability*, but in the report’s own words, “this project marks a beginning rather than an end”.

The Defra report stated that:

Government and UK business would benefit from the development of a shared evidence base on resource issues [...] The development of a shared database would also help to develop business and government understanding of resource risks in the future. Doing so would facilitate partnership working between the two parties to find solutions to the benefit of both.

28. When asked if there were plans within Defra to repeat and expand the work on risks to resources, Professor Watson replied:

Whether we will do exactly this study again or not, I do not know, but it is an issue that we will keep a watching brief on, along with the EU, so that we can continuously update what the needs of our British industry are and we can advise them as to what we know about resource scarcity.

29. However, despite this and other recent reports on resources Dr Mike Pitts, from the Industry Technology Division of the Royal Society of Chemistry (RSC), was concerned about a lack of information on metal resources:

One of the things that companies would like the most [...] is some understanding of what material will be critical in future, because they get surprised sometimes by the changes in availability [...] good quality information is what [UK companies] need to [help them] know what might surprise them in the future [...] we need to know what is coming in, what is going out and what might be a future threat. The picture is really not as clear as it should be.

Dr Rickinson, IOM3, added that he thought it was timely for a “re-audit [...] and an in-depth analysis of those materials in the broadest sense that are important for the UK economy”. RCUK stated that “the UK currently has a world-class capability to monitor and analyse global mineral production, consumption, trade and reserves”.

A role for Government

30. While acknowledging the role of Defra in providing information on resource management, Professor Watson was not clear whether Defra had formal responsibility to decide when a metal becomes strategically important to the UK.

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36 Q 109
37 Qq 14, 32
38 Q 18
39 Ev w30, para 16
40 Qq 114, 122
31. Tony Hartwell, Knowledge Transfer Manager of the ESKTN, pointed out that:

There is not really a central agency in the UK that is responsible for managing resource inputs into the UK. So there is not one department that is responsible for that. Maybe that is something we could consider [...] it would make sense to have an agency for materials.41

32. Responsibility for metals supply is not the exclusive responsibility of Defra. We established that the Foreign and Commonwealth Office (FCO) and the Department for Business, Innovation and Skills (BIS) shared the work. We therefore explored how coordinated the responsibilities for strategic metals were within Government. Professor Watson, Defra, responded to the suggestion that there ought to be a single public body responsible for providing information on metals and resources that:

Clearly, we need to be joined up. The private sector needs to be informed, and we need to be informed by the private sector as to what they see their resource needs are likely to be now and in the future as they see whole new product lines coming on base. We, in the Government, ought to be able to make sure that we can at least provide information to them as to whether there is either scarcity or a question of access and price volatility.42

33. We were particularly concerned about the impact of metal supply risks to small and medium enterprises (SMEs). The Minister stated that “so far, BIS is not aware of this being a particular issue affecting SMEs”.43 However, the Defra report acknowledged that:

While […] larger organisations and companies are aware of the resource risks […] the awareness of SMEs has not been gauged. Engaging with SMEs and raising their awareness is important as a lack of information could leave them unprepared for resource supply issues, potentially affecting the efficiency of the whole supply chain to which they belong, as well as their own profitability.44

34. We conclude that it would be beneficial to industry if the Government were to clarify which departments have responsibility for strategic metals. The Government acknowledged its role to provide resource information to the private sector: it is reasonable to expect that this information include which metals are of strategic importance to the UK. We seek clarification on which department decides which metals are of strategic importance to the UK, which department provides high-quality information on resources, how regularly this information is updated and how this information is shared across Government and disseminated to businesses. We agree with the conclusion in the recent Defra report on resource risks that a shared database would develop business and Government understanding of resource risks in the future. We invite the Government to set out a timetable for developing such a database and explain what arrangements would be made for publishing all or part of it.

41  Qq 39–40
42  Q 123
43  Q 155
44  AEA Technology, Defra, Review of the Future Resource Risks Faced by UK Business and an Assessment of Future Viability, January 2011, p 11
Non-metals

35. While strategic metals were the focus of this inquiry, many of the written submissions we received highlighted the need to investigate the importance of non-metallic elements that are crucial inputs to various sectors. For example, Dr Pitts, RSC, told us about the finite nature of helium and its importance in medical imaging:

   we are losing [helium] irreversibly from the atmosphere. That is the only element we are going to definitely run out of at some point in the future. [...] If there were no liquid helium, it would be very hard to use MRI [magnetic resonance imaging] scanners.\(^{45}\)

Another example brought to our attention was phosphorus.\(^ {46}\)

36. We note the strategic importance of certain non-metals and as it is outside of the scope of this inquiry, we may choose to return to this in the future. However, in responding to this report, we invite the Government to explain how it will ameliorate the risks posed by the potential scarcity of helium.

\(^{45}\) Qq 6, 10

\(^{46}\) Ev 52, para 5 [Geological Society of London] and Ev 57, para 4 [Royal Society of Chemistry]
3  Trade and geopolitics

37. There are significant threats to the supply of strategic metals. The report on *Materials Scarcity* by the Resource Efficiency Knowledge Transfer Network (REKTN, now the Environmental Sustainability Knowledge Transfer Network—ESKTN) identified the following eight threats to assess the security of supply of a material:

i. Global consumption levels

ii. Lack of substitutability

iii. Global warming potential

iv. Total material requirement (how much material is dug from the ground to produce a given quantity of metal)

v. Scarcity

vi. Monopoly supply

vii. Political instability in key supplying regions

viii. Vulnerability of key supplying regions to climate change.47

38. It was the view of Wolf Minerals Ltd, a mining company developing a tungsten reserve in Devon, that for the supply of strategic metals “the UK economy has relied for decades on the *laissez-faire* concept that other nations will provide”.48 Some concerns have been expressed about this attitude: for example, Nicholas Morley, Director of Sustainable Innovation at the sustainability consultancy, Oakdene Hollins, attributed supply issues of some strategic metals to “what might now be seen in hindsight as a naïve belief in the permanency of free markets for [businesses] raw materials”.49

39. Free markets are markets in which goods and services are exchanged at a price agreed mutually by the producer and consumer. In a free market, changes in supply and demand result in a change in the prices of goods and services. Supply and demand are therefore important factors in the trading of strategic metals, and we investigate them in this chapter. However, the trade in strategic metals is affected by other factors—for example legislation—that we also discuss.

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48  Ev w18, para A2.3

49  Ev w2, para 1.5
Metals supply

Are metals running out?

40. Key to the operation of the market is supply. As we have noted, metals naturally occur in minerals within the Earth’s crust. Minerals are extracted from the ground and processed to purify the desired metal. A metal “resource” is the total amount of a metal in the Earth’s crust, while a metal “reserve” is the metal present in minerals with sufficient metal concentrations that make it economically viable to extract. Metal reserves are distributed unevenly across the world.

41. The estimated reserves of strategic metals vary. For example, at current consumption rates, indium reserves will last for 13 years and platinum will last for 360 years. However, in its written submission, the Royal Society of Chemistry (RSC) explained that despite the removal of vast quantities of metals from the ground over the past 50 years, “reserve levels have remained largely unchanged” due to improved technology, the discovery of new reserves and price increases leading to the exploitation of lower grade minerals. Research Councils UK stated that “much of the concern over physical exhaustion of geological reserves of strategically important metals is likely to be misplaced, though there are no grounds for complacency”.

42. This view was supported by Anthony Lipmann, Managing Director of Lipmann Walton & Co Ltd and former Chairman of the Minor Metals Trade Association (MMTA). When asked whether he thought there was a shortage of strategic metals he said “no. I do not […] in practice, you just dig deeper”. Mr Lipmann’s view was that dwindling supplies resulted in increased prices, which in turn facilitated the extraction of metals from previously uneconomic resources (lower grade minerals). Higher energy costs are a particularly significant factor in the exploitation of lower grade minerals to extract a metal, and thus in their financial viability. The corollary is that the supply of metal is vulnerable to increases in energy costs.

43. Digging deeper will also come with a higher environmental impact. Higher environmental impacts and energy use are in themselves undesirable and Mr Morley pointed out that “the increasing environmental impact of mining, extraction and purification [are] likely to lead to limits in production before absolute scarcity became significant”. The desirable improvements in social and environmental standards of mining activity will also lead to an increase in the price of a metal. Social and environmental impacts are discussed in detail in chapter 4.

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50 Ev S2, para 6
52 Ev S8, para 8
53 Ev w28
54 Qq 71–72
55 Ev 46, para 2 [Environmental Sustainability Knowledge Transfer Network]
56 Ev w4, para 6
57 Q 21 [Dr Pitts]
44. Most strategic metal reserves are unlikely to run out over the coming decades. In practice, improved technology, the use of alternative materials and the discovery of new reserves are likely to ensure that strategic metals are accessible. There will, however, be significant environmental and monetary cost associated with the exploitation of lower grade minerals.

National monopolies

45. To achieve efficient resource use, a principle of free market economics is that there are a number of producers competing to supply consumers; this sets a market led price. However, where monopolies (supply controlled by a single company or nation) and oligopolies (supply controlled by a small number of entities) dominate a market place, they can distort the market price to benefit themselves. The RSC pointed out that:

Metal deposits are unevenly distributed across the globe [...] this is of particular concern for the UK, as only 5% of the known worldwide metal reserves are found in Europe.58

46. The uneven distribution of metal resources favours the emergence of supply monopolies and oligopolies as some metal reserves are found in only a few countries.59 There are a number of national monopolies and oligopolies in metals markets, for example: China produces over 97% of the world’s rare earth elements;60 Brazil accounts for 92% of niobium extraction;61 62% of chromium is extracted in South Africa and Kazakhstan;62 and cobalt production is dominated by the Democratic Republic of Congo.63

47. It is not just the geographical distribution of reserves that can cause supply monopolies and oligopolies. They also arise because of economic and political factors. Differences in comparative advantage, and regulatory frameworks, between countries with metal reserves mean that production costs can vary significantly. Consumers of strategic metals tend to buy from the nation offering the lowest price, which can lead to the reduced economic viability of metal production in nations with higher production costs.64 Production can then become highly concentrated in the single nation with the lowest costs.

48. The ESKTN explained the problems posed by monopolies and oligopolies in supply and trade:

UK manufacturers would like equal access to metals. If this is the case then, even if the price is high, availability is roughly equal for all users and so there is fair competition. However if the supply of a particular mineral or metal is controlled by a

58 Ev 58, para 10
59 Ev w23, para 9 [Natural History Museum]
60 Ev w39, para 15 [Dr Hatch]
61 Ev w23, para 9 [Natural History Museum]
62 Ev w10, para 2.1 [Aerospace and Defence Knowledge Transfer Network, Materials and Structures National Technical Committee]
63 Ev w11, para 2.2 [Aerospace and Defence Knowledge Transfer Network, Materials and Structures National Technical Committee]
64 Judith Chegwidden, POST seminar, Critical minerals: Rare earth metals and beyond, 12 January 2011
small number of entities (be they countries or companies) there is a risk that they may exploit their monopoly/oligopoly to control the market or favour certain clients.65

49. In a free and competitive market, the location of reserves overseas should of itself pose no threat to the UK. However, monopolies and oligopolies inhibit competition, reducing the benefits of free trade and leaving the market open to higher prices and unpredictable changes in price.

**China and the rare earth elements**

50. In any discussion of monopolies and oligopolies in the metals markets, China and its control of rare earth element (REE) supplies is frequently cited. The Geological Society of London stated that “global production of REEs is located at a small number of mines in China, although there are known reserves elsewhere, and every prospect of finding more”.66 The Institute of Materials, Minerals and Mining (IOM3) were of the opinion that there were some “mines [outside China] that were recently closed because of low cost competition from China”.67

51. As China currently supplies over 97% of the world’s REE raw material, Chinese export quotas are the dominant limitation to supply of REE raw material around the world. However, the amounts of REE raw material that come directly from China to the UK are not large. We heard that a company called Less Common Metals are the only UK based user of REEs in their raw form.68

52. REE use in the UK was described by Dr Gareth Hatch, Founding Principal of Technology Metals Research:

> very little REE raw material is presently used to produce components in the UK. It is in the use of semi-finished and finished goods such as permanent magnets and other components, and the devices and systems created from them, that companies in the UK generally interact with the rare-earths supply chain.69

REE products are also used in oil refining and Dr Mike Pitts, from the Industry Technology Division of the RSC, told us that “they are used in about every consumer product you can think of in electronic equipment. You are all carrying some around in your briefcases, I assure you”.70 China does not, however, dominate, nor restrict, supply of downstream goods which incorporate REEs.71 Dr Hatch noted that, in terms of trade, the use of REEs in finished goods was less problematic than using them in their raw form

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65 Ev 46, para 3  
66 Ev 52, para 7  
67 Ev 44, para 2.2.2  
68 Q 82 [Mr Lipmann]  
69 Ev w39, para 13  
70 Q 9  
71 Rare Earth Metals, POSTnote 368, Parliamentary Office of Science and Technology, January 2011
because Chinese export quotas do not apply to semi-finished or finished goods that are produced in China.\textsuperscript{72}

53. Rt Hon David Willetts MP, Minister of State for Universities and Science, confirmed that, because the UK was not a primary manufacturer of goods requiring raw REEs, the UK was in a better position than, for example, Japan:

at the moment we tend to be rather further down the chain than Japan. We tend to buy and import products, which can be components that we are doing further work on, but we tend to import products and components where an intermediary country has itself bought the Rare Earths and done the first set of work on it. So we are in a slightly different relationship to the supply chain than Japan is.\textsuperscript{73}

54. There are international forums where pressure can be applied to nations to remove impediments to free trade, such as the World Trade Organisation (WTO), the G-20 and the Organisation for Economic Co-operation and Development (OECD).\textsuperscript{74} Indeed, the Minister stated that "there is currently an investigation of the [...] case involving Chinese export quotas [on REEs] there are [also] issues here that could well come up in a WTO context".\textsuperscript{75}

55. One problem arising from the monopoly of supplies by a single nation—highlighted by the Government in its written submission—is that "emerging economies are aiming at reserving their resource base for their exclusive use".\textsuperscript{76} Dr Jonathan Di John, Lecturer in Political Economy at the School of Oriental and African Studies, considered the REE export quota reduction a part of standard industrialisation policy by China. He explained that many countries use this to fuel their transition to a developed economy:

One of the reasons why, [...] and they might disguise it in the form of environmental concerns and smuggling concerns, is that they would like [...] to force, or at least provide a lot of incentives, for firms to locate in China [...] It’s a foreign direct investment strategy and an industrial strategy. Every country that is wealthy today has done it in the past [...] this is something that is part of an historical continuity of countries trying to catch up.\textsuperscript{77}

56. Charles Emmerson, Senior Fellow at Chatham House, agreed with Dr Di John’s analysis:

China is industrialising rapidly and it has a strong domestic demand for many of these minerals. It may be that [...] rather than politics or any broader strategic intent, which is behind conceivable curtailment of supplies to countries such as the UK and, indeed, other advanced economies in the future.\textsuperscript{78}

\textsuperscript{72} Ev w40, para 18
\textsuperscript{73} Q 157
\textsuperscript{74} Qq 82,135 [Mr Swindon, Professor Clary]
\textsuperscript{75} Q 171
\textsuperscript{76} Ev 39, para 6 [BIS]
\textsuperscript{77} Q 85
\textsuperscript{78} Q 74
57. However, Dr Hatch pointed out that industrial policy was not the reason given by China for their export restriction: “ostensibly these [quotas] were put in place by the authorities to allow for the shut-down of inefficient, polluting mines and to allow for environmental remediation”.79

58. We do not, however, ignore or wish to devalue the environmental impact of the mining of strategic metals. Differences in national social and environmental legislation are one of the reasons why there are large differences in the production costs of certain strategic metals.80 Levelling the global playing field of social and environmental legislation might stimulate competition and prevent national monopolies developing by narrowing the global range of production costs. It was recognised by the Minister that environmental impacts in China were significant and that “mining [REEs] is a nasty, dirty and environmentally risky business and the environmental regulations in China may be less onerous than in many other countries”.81 We will return to the subject of environmental impact in chapter 4.

59. Monopolies and oligopolies in strategic metals distort the market. They can arise because of a variety of reasons, including economic, political, geographic and environmental issues. China’s reduction in export quotas of rare earth element raw materials is an example of this and restricts a free market in metals. We invite the Government to set out in its response the outcome of the investigation into Chinese export quotas, as described by the Minister. We consider that, to maximise the benefits of free trade, the Government should ensure that restrictions in the trade of strategic metals are discussed at an international level, through forums such as the WTO, G-20 and the OECD.

**Demand for metals**

60. Increasing demand causes prices to increase. In its written submission to this inquiry Research Councils UK (RCUK) pointed out that "there is rapidly increasing demand [for metals] from emerging economies such as Brazil, Russia, India and China”.82 The Society for Chemical Industry noted that:

> the well established major general increase in the consumption of metals which began in the last century, shows no sign of abating and is likely to be exacerbated by high volume emerging economies.83

61. Demand for strategic metals is likely to increase not only from emerging economies but also from emerging technologies. The Government told us:

> The UK operates in a global market and largely requires the same materials as other developed economies, and as the world economy moves towards high technology
Strategically important metals and low carbon manufacturing, competition for strategic metals and resources in general will increase.84

62. RCUK quantified some of the increases in demand from new technology projected for several strategic metals:

Demand for gallium in emerging technologies may increase by a factor of more than 20 between 2006 and 2030. For indium, germanium and neodymium, the factors are 8, 8 and 7, respectively, over the same period.85

63. The increasing global demand for strategic metals from emerging economies and new technologies will be a significant factor affecting their price, and therefore availability. Assessment of future demand will be essential to assessing the potential scarcity, risk to supply and future price of strategic metals. Assessments of future demand should be part of the shared database we have proposed.

Market responsiveness

64. Anthony Lipmann, of Lipmann Walton & Co Ltd and the MMTA, gave an example of how changes in supply and demand affected the price of rhenium, a metal essential to the manufacture of single crystal turbine blades in jet engines. He said that rhenium “was worth $300 a kilo in 1996” and that in “August 2008 it reached $10,000 a kilo”.86 He explained that despite the increase in price there was still sufficient supply because rhenium was used more efficiently, was recycled and the price stimulated investment in mining activity.87 Restrictions of supply or increases in demand will cause prices to increase and are likely to stimulate investment into reserves that are competitive at the new price. However, the view of the Geological Society of London was that, while global metals production levels could respond to price, “the long lead time from the instigation of an exploration programme by a company to mine production—typically at least 10 years (with success far from certain)—severely restricts market responsiveness”.88

65. Dr Pitts, RSC, pointed out that “it takes something between six to fifteen years to either reopen or start up a mine to produce”.89 The ESKTN agreed:

The supply of metallic minerals and global markets tend to respond to the demand [...] however the processes involved in discovering and developing a new deposit or substitute material can take many years so there is a lag in the response to demand which tends to result in shortages and price peaks90

66. While the evidence we received showed that there was a time lag between demand and supply and that this would lead to price increases in the short-term, Mr Lipmann was
confident that the market would respond: “mining houses, metal merchants and everyone involved in the cycle wants to make money and they will invest in it. They will bring forward metals by their investments.”

67. The costs of strategic metals may be only a small fraction of the total costs of making a product and may not be felt by a consumer in the price of end products. For example, despite the price increase in rhenium from $300 a tonne to $10,000 a tonne over 12 years, Mr Lipmann pointed out that Rolls Royce are still making engines. Dr Di John, School of Oriental and African Studies, concurred:

The share of the cost that these metals constitute in terms of the production process is much less than, say, oil was. While there will be a lag, the effects of any dramatic increase in price is likely to be of much less effect in terms of production costs.

68. On the question of companies hedging against supply risks and price increases, Charles Swindon, Chair of the MMTA Trade and Lobby Committee, said that “prudent large manufacturers do plan five years ahead, will pay premiums and will pay the price for what they need”.

69. Paying a premium may be an option for large businesses but for an SME this may not be possible. While the Minister stated that he was not aware of any resource issues facing SMEs, the Defra report stated that “the awareness of SMEs has not been gauged” and that “a lack of information could leave them unprepared for resource supply issues, potentially affecting [...] their own profitability” (see paragraph 33).

70. Changes in supply and demand can lead to significant fluctuations in the prices of metals. While this may not be a problem for end users or large companies we are concerned that small and medium enterprises (SMEs) could suffer from unexpected large and rapid price increases. The Government must ensure that mechanisms are in place to reach out to SMEs across the country, a role previously fulfilled by the Regional Development Agencies. We recommend that the Government consult with SMEs using strategic metals to ascertain: (i) their awareness of resource supply issues; (ii) how SMEs may be affected by supply issues; and (iii) what information on resource supply SMEs need to enable them to prepare for changes in the market and maximise profitability.

Stockpiling

71. We heard that some companies retain stockpiles of strategic metals to alleviate changes in the market. Indeed, the EC report identified stockpiling of metals as one method to

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91 Q 80  
92 Q 75  
93 Q 80  
94 Q 82  
95 Q 155  
97 Ev w31, para 24 [Research Councils UK]
Strategically important metals mitigate supply restrictions.\textsuperscript{98} The US maintains a stockpile of metals, albeit reduced in size in recent years, that are considered critical for defence.\textsuperscript{99} Japan currently maintains a stockpile of metals that are important for manufacturing industries.\textsuperscript{100} In the past the UK has maintained a stockpile of strategic metals and Dr Chapman, former advisor to the Department for Trade and Industry (DTI), told us:

HM Government formerly had a small stockpile of strategic minerals. It was set up by the DTI in 1983 and its abolition was then announced in November 1984. In fact the last sales were not made until 1996.\textsuperscript{101}

72. Stockpiling, possibly at an EU level, was presented to us as a possible option to alleviate metals supply issues but there would be a cost both in terms of purchasing stocks and storing them.\textsuperscript{102} Dr Chapman explained that the reason for the reduced size of the US stockpile was due to its high cost.\textsuperscript{103} RCUK also drew our attention to the high cost associated with stockpiling.\textsuperscript{104} Mr Morley, Director of Sustainable Innovation at the sustainability consultancy, Oakdene Hollins, stated:

stockpiling at an EU level, similar to what occurs in Japan has been proposed, but is generally not preferred in free market economies such as the UK. Also the timescale over which it could operate (typically months rather than years) is not sufficiently long to address some of the speciality metal supply issues.\textsuperscript{105}

73. When we questioned Professor Robert Watson, Chief Scientific Advisor to Defra, on the role of Government and stockpiling of resources, he saw:

the Government’s role is in helping to provide information. What you are also suggesting is that the larger companies have more the ability not only to bulk purchase but to stockpile. I don’t see that there is a role for Government in stockpiling.\textsuperscript{106}

74. Stockpiling is an unattractive option because it is expensive but it may be necessary if the market fails because of sustained market manipulation by a monopoly supplier. The Government should keep this policy under review.

\textsuperscript{98} EC Raw Materials Supply Group, \textit{Critical Raw Materials for the EU}, July 2010
\textsuperscript{99} Ev w1, para 2.1 [Dr Chapman]; Q 35 [Tony Hartwell]
\textsuperscript{100} Ev w31, para 24
\textsuperscript{101} Ev w1, para 2.2
\textsuperscript{102} Ev w41, para 29 [Dr Hatch]
\textsuperscript{103} Ev w1, para 2.1
\textsuperscript{104} Ev w31, para 24
\textsuperscript{105} Ev w2, para 2.2
\textsuperscript{106} Q 128
Trading metals

Speculation in the metal markets

75. A recent communication from the EC, *Tackling the Challenges in Commodity Markets and on Raw Materials*,\(^{107}\) set out the concerns that the EC had about the linkages between financial markets and commodity markets. The communication outlined measures, policies and directives that are coming into force. It also described the change in commodity markets over the past decade:

Markets are experiencing the growing impact of finance, with a significant increase in financial investment flows into commodity derivative markets in recent years. Between 2003 and 2008, for example, institutional investors increased their investments in commodities markets from 13 billion euro in 2003 to between 170 and 205 billion euro in 2008 [\(...)\] While the debate on the relative importance of the multiple factors influencing commodities prices is still open, it is clear that price movements across different commodity markets have become more closely related and that commodities markets have become more closely linked to financial markets.\(^{108}\)

76. In the UK some metals are traded on exchanges while others are traded directly between buyer and seller.\(^{109}\) Mr Swindon, MMTA, explained the consequences of the closer links between financial and commodities markets:

It is well known that hedge funds have moved into all commodities, whether it is gold or energy [\(...)\] they have also moved not just into exchange traded instruments, as traded on the London Metal Exchange, but there is evidence that they have moved into more strategic metals, which are only traded between counterparties, including Rare Earths. If it is perceived that the rate of return over the next 10 years is going to be much greater by investing in very small quantities of rare metals, that is a risk.\(^{110}\)

Ian Hetherington, Director General of the British Metals Recycling Association (BMRA) agreed that one of the reasons for recent price volatility of copper is that hedge funds are buying up “vast quantities”.\(^{111}\)

77. Mr Emmerson, Chatham House, explained that perceptions could drive speculation and that there has been a “flare up in perceptions of scarcity around certain minerals”. He added that:

[Perceptions] may drive price but it is dangerous and we have to make clear that transparency, market mechanisms and open international frameworks are the key to

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\(^{107}\) European Commission Communication, COM(2011) 25

\(^{108}\) As above

\(^{109}\) Q 74

\(^{110}\) As above

\(^{111}\) Q 37
building in [...] long term “resilience” as opposed to risk management, which is an approach that is often taken in this area.\textsuperscript{112}

78. The perception of scarcity of certain minerals and metals may lead to increased speculation and volatility in price and supply. There is a need for accurate and reliable information on scarcity of metals. This concern underlines the recommendation we have made, that the Government should establish and regularly update a shared database to provide such information. We are also concerned by reports of hedge funds buying up significant quantities of strategic metals. We recommend that the Government investigate whether there are increasing levels of speculation in the metals markets and, if there are, their contribution to price volatility and whether markets that allow high levels of speculation, with associated price volatility, are an acceptable way to deliver strategic commodities to end users.

\textbf{Market dominance}

79. We heard that there were large companies dealing metals within the UK and an allegation was made by the MMTA that a company through a subsidiary may be behaving in an anti-competitive manner:

on the London Metal Exchange there are four very large companies that own the very warehouses that people deliver metal into, J.P. Morgan is one of them. They own a company called Henry Bath. They are, therefore, a ring-dealing member of the exchange and they also own the warehouse. That is restrictive. They were also reported, at one point, to have had 50\% of the stock of the metal on the London Metal Exchange.\textsuperscript{113}

80. We would be concerned if the ownership of metals storage warehouses by a dominant dealer on the London Metals Exchange were to be anti-competitive. We would also be concerned if a dealer who had the resources to own over 50\% of stock on the London Metals Exchange impeded the correct functioning of the market.

81. \textbf{We use this report to bring the alleged activities of large dealers on the London Metals Exchange to the attention of the Office of Fair Trading. We would be concerned if a dealer were undermining the effective functioning of the market and we look for assurance that the market is functioning satisfactorily.}

\textbf{REACH legislation}

82. The market is affected by regulation. Under the European Council Registration, Evaluation, Authorisation and Restriction of Chemical substances (REACH) regulation, an importer or manufacturer of a chemical substance, in quantities over one tonne, may have to register it with the European Chemicals Agency (ECHA).\textsuperscript{114} The aim of the REACH regulation is to:

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\begin{itemize}
\item \textsuperscript{112} Q 85
\item \textsuperscript{113} Q 81 [Mr Lipmann]
\item \textsuperscript{114} UK REACH Competent Authority, \textit{REACH—The Basics}, January 2009
\end{itemize}
improve the protection of human health and the environment through the better and earlier identification of the intrinsic properties of chemical substances. At the same time, REACH aims to enhance innovation and competitiveness of the EU chemicals industry.\textsuperscript{115}

83. The Cobalt Development Institute told us that Government needed to “ensure that regulatory matters, such as REACH, are applied in a proportional and sustainable way.”\textsuperscript{116} The MMTA elaborated:

In Europe at present, whilst on the one hand the EU are looking to promote strategic raw materials in REACH they are simultaneously creating \textit{de facto} import tariffs which are destroying the industry for strategic raw materials in Europe. REACH [...] legislation adds bureaucratic costs to every strategically important metal produced or imported into Europe in quantities of over one tonne per year. REACH, unintentionally, has been a highly destructive regulation.\textsuperscript{117}

84. Registration of a substance includes submitting a dossier of information on the substance. The “\textit{de facto} import tariffs”, which the MMTA refer to, are registration fees to the ECHA and the cost of putting together the dossier of information required under REACH.\textsuperscript{118} The Government stated that the fees for a company to register with the ECHA ranged from £120–£31,000.\textsuperscript{119} This registration fee does not include the cost of producing the dossier of information on the substance.

85. Anthony Lipmann, of Lipmann Walton & Co Ltd and the MMTA, explained what his company (an SME importer of various strategic metals) had to register with the ECHA, in compliance with the REACH regulation. To import a metal, his company either had to “spend a lot of money” to join a consortium, or purchase a letter of access (LOA).\textsuperscript{120} In the case of titanium, the LOA to import up to 1,000 tonnes cost his company €40,000.\textsuperscript{121} Mr Lipmann made the point that his company only needed to import 100 tonnes of titanium but still had to pay €40,000 and that “if you translate that across the 20 elements that I trade, it is untenable”.\textsuperscript{122} Mr Lipmann considered that the REACH regulation “creates monopolies, which in turn create manipulation, which create high prices”.\textsuperscript{123}

86. There is a trade off between the social and environmental benefits of the REACH regulation and its impact on free trade through a potential reduction of competition in the metals markets. Mr Swindon, from the MMTA, said that there was a need for information to be more accessible.\textsuperscript{124}

\textsuperscript{115} “REACH”, European Commission webpage: http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm/
\textsuperscript{116} Ev w37, para 2
\textsuperscript{117} Ev 69, para 1
\textsuperscript{118} Ev 43 [Defra supplementary evidence]
\textsuperscript{119} As above
\textsuperscript{120} Q 107 [Mr Lipmann]
\textsuperscript{121} Q 73 [Mr Lipmann]
\textsuperscript{122} As above
\textsuperscript{123} As above
\textsuperscript{124} Q 103
87. The Minister’s view was:

that the REACH regulations are, on balance, helpful [...] The regulations provide a common framework across a whole range of potentially hazardous materials applied consistently across Europe. We think that it is in the best interests of British industry to have one consistent framework.125

88. The Government explained how importers could join together in registering substances with the ECHA:

REACH provides for manufacturers and importers of a substance to join together in Substance Information Exchange Forums in order to share data, avoid duplication of any new testing, and prepare a joint registration. However, in addition manufacturers of some substances have set up consortia to manage the data gathering, although these are not a requirement of REACH. Letters of access to unofficial consortia cannot be policed by REACH although they would, of course, be subject to competition law.126

The Government added that “letters of access [...] are a commercial matter between those in the consortia who have had to incur costs in generating the data and those seeking to use the data for their own products/purposes. Such arrangements [...] could be investigated if there was sufficient evidence of anti-competitive practices”.127

89. It appears that, if a company is not prepared or able to register a substance with the ECHA directly, it should join a Substance Information Exchange Forums, to register a substance. However, the Health and Safety Executive (HSE) publication, REACH—The Basics, explains that importers importing a chemical substance in quantities of less than 1,000 tonnes need not register until 2013.128

90. It appears that there may be, amongst some small companies, a misunderstanding of the REACH regulations and that consortia are being used to register metals when this may not be required. We recommend that the Government reassess the information and advice available to small companies about REACH regulations, in particular information about the most cost-effective means of registering strategic metals. We also recommend that the Government examine whether these regulations have become an unnecessary expensive burden inhibiting the market in strategically important metals.

125 Qq 159–160 [Mr Willetts]
126 Ev 44 [Defra supplementary evidence]
127 Ev 74, para 5 [BIS supplementary evidence]
128 UK REACH Competent Authority, REACH—The Basics, January 2009
4 Social and Environmental Impact of Metal Extraction

91. Half of the world’s top ten worst pollution problems are mining related.\textsuperscript{129} Material is dug from the ground and then often crushed and processed to extract the desired metal. Processing can use large volumes of water and chemicals which need containment. Once the metal has been extracted there are often large volumes of solid waste, known as tailings, which can contain harmful substances associated with the metal in the ground.\textsuperscript{130} Professor David Manning, Secretary for Professional Matters at the Geological Society of London, gave the following example:

shale is taken out of the ground, it is treated with acid in vats and then the materials are leached out and taken away for refining. The important thing is that there is a huge amount of residual material left because we are seeing mining of a material that is quite low in concentration, even though the ore metals are abundant in these particular deposits. So there are huge amounts of waste. There is the use of acids. There is the potential of natural radioactivity associated with the rare earths in particular. So there is a whole accumulated set of issues even before it leaves the mine to go through to wherever the output of the mine is treated.\textsuperscript{131}

92. Mining for metals is often also dependent on large amounts of energy and, if the energy is generated using fossil fuels, has a large carbon footprint. Research Councils UK (RCUK) stated that “around 3% of total global energy demand is used solely to crush rock for mineral extraction”.\textsuperscript{132} There can also be significant social costs associated with mining activities. People may be displaced from new mining sites; mines can be dangerous environments, exemplified by the intensely reported mining accidents in Chile and New Zealand last year;\textsuperscript{133} and violence and conflict can be driven by control of metal resources in nations such as the Democratic Republic of Congo.\textsuperscript{134}

93. Many of the witnesses to this inquiry expressed the need to minimise social and environmental impacts of mining activity.\textsuperscript{135} However, Professor Manning, Geological Society of London, pointed out that:

there are, undoubtedly, going to be environmental costs. You cannot deny that in any mining operation. You have to make sure that those [environmental costs] are

\textsuperscript{129} The Blacksmith institute & Green Cross International, \textit{The World's Worst Pollution Problems: The Top Ten of the Toxic Twenty}, 2008

\textsuperscript{130} Ev w30, para 9 [Geological Society of London]

\textsuperscript{131} Q 21

\textsuperscript{132} Ev w30, para 12

\textsuperscript{133} “Celebrations as last trapped Chile miner is rescued”, \textit{BBC Online}, 14 October 2010, www.bbc.co.uk/news/; “Blast at New Zealand mine killed 29 men instantly, inquest told”, \textit{The Independent}, 28 January 2011

\textsuperscript{134} Ev w31, para 28 [Research Councils UK]

\textsuperscript{135} For example, Ev w30, paras 12–13 [Research Councils UK]; Q 83 [Mr Swindon]
acceptable. Then it comes down to how you define what the acceptable environmental burden is that mining might impose.136

94. The “acceptable environmental burden” is set by national legislation. However, the globally distributed nature of metal reserves means that mining activity comes under widely varying regulatory regimes and, as the Geological Society of London pointed out, “standards in some countries have been low”.137 Tighter regulations are likely to lead to increased prices as “there is an associated price with better management of tailings, radioactive waste and human welfare”.138 We heard from several witnesses that the environmental and social costs of mining should be included in metal production costs. For example, Dr Mike Pitts, from the Industry Technology Division of the Royal Society of Chemistry (RSC), stated that:

we are not really costing properly the use of virgin material [...] the full costs of taking it out of the ground [should be included] because that is usually displaced in another country. It would be the energy cost and the environmental impact of mining the material in the first place. That has to be taken into account.139

He also pointed out that:

Once you get to a certain low grade of ore in mining some of these materials, the environmental impact goes up because it is harder and harder to get to that. Although economics might say, “If the price rises, we can get to more inaccessible grades”, there is a concomitant rise in the environmental impact.140

95. The global nature of metal reserves and production means the UK Government cannot directly regulate the environmental and social costs of extraction and production of a metal used in the UK. However, there have been a number of avenues suggested to us that may improve the ethical standing of metal production across the world and these are covered in this chapter.

Raising global standards

Regulation

96. The vast majority of mining for metals occurs outside the UK, and indeed beyond the borders of the EU. RCUK explained that:

A serious challenge to [ethical] improvement is the rise of mining enterprises based in large emerging economies, but operating world-wide, which can adhere to different ethical standards to those established in developed economies.141
However, the Mineralogical Society pointed out that:

the UK is still a global centre for mining finance and home to two of the world’s largest mining companies (Rio Tinto and Anglo American). There are many other mining and exploration companies and mining consultancies, of a range of sizes, based in the UK. They are working worldwide on a range of resources including critical metals.\textsuperscript{142}

97. Mining companies registered in the UK are subject to UK corporate law and according to Anthony Lipmann, Managing Director of Lipmann Walton & Co Ltd and former Chairman of the Minor Metals Trade Association (MMTA):

Companies are attracted to Britain to list […] on our stock exchange. These are the companies where a light has to be shone on them through the Companies Act 2006 to make sure that they bring up the level of their practice in sub-Saharan Africa.\textsuperscript{143}

98. The Companies Act 2006 requires that a company must produce a Business Review as part of its accounts. The Business Review “must, to the extent necessary for an understanding of the development, performance or position of the company’s business, include”, amongst other things, information about environmental matters (including environmental impact), company employees and social and community issues.\textsuperscript{144}

99. In April 2010, the Corporate Responsibility Coalition (CORE) published the report, \textit{The Reporting of Non-Financial Information by FTSE 100 Companies}, finding:

The most reported area of environmental information was ‘emissions, effluent and waste’, which includes CO\textsubscript{2} emissions; this information is often required by other regulation and so is more readily available. Yet even here, only one third of companies surveyed reported quantitative information and 18% did not mention the issue at all.

[...]

The disclosure of high-quality social information was better than that of environmental information. Over 90\% of companies provided quantitative or qualitative indicators of social performance—or at least identified social issues. However this is largely accounted for by the reporting of labour issues, which includes health & safety. If labour issues are excluded, then social issues were quantified in only 39\% of reports, with 13\% identifying no non-labour social issues at all. Of the other categories of social issue, the area of human rights was least well-served, with just 25\% providing measures of some sort.\textsuperscript{145}

100. The CORE report concluded that the Government needed to review, amongst other things, the specification of Key Performance Indicators and provision of official guidance

\textsuperscript{142} Ev w21, para 8
\textsuperscript{143} Q 88
\textsuperscript{144} Companies Act 2006, section 417
\textsuperscript{145} Corporate Responsibility Coalition, \textit{The Reporting of Non-Financial Information by FTSE 100 Companies}, April 2010, p 8
for reporting non-financial information. The report also recommended that “the government should establish a monitoring mechanism for the Companies Act, if it is to be implemented rather than ignored”.

101. The potential for companies to locate themselves abroad in order to avoid the burden of British regulations or additional monitoring arrangements must also be considered. This was a concern raised Rt Hon David Willetts MP, Minister of State for Universities and Science, who stated that he “would be reluctant to see UK specific regulations”.

102. We agree with the Minister that action on improving the social and environmental impact of mining needs to be taken internationally. We consider, however, that the operation of existing legislation, in particular the Companies Act 2006, could be improved to ensure that the social and environmental impacts of companies listed in the UK and operating outside of the UK are fully reported. We are concerned by suggestions that the Companies Act 2006 is being ignored rather than implemented. We invite the Government to explain what guidance is given to companies for reporting social and environmental information, what measures are currently being taken to monitor whether the information provided in companies’ business reviews is fit for purpose and what action is being taken against companies that are not complying with the guidance.

Unilateral action

103. We explored the extent to which the UK could take unilateral action by asking the Minister whether the Government should ensure that UK listed extraction companies “meet sufficient social and environmental standards in their overseas mining activities”; he responded:

This is the kind of area where I think action is best taken internationally. We are looking at ways in which we can work with our partners on this and agree standards in the extractive industries globally. I would be more wary of a particular burden on a company that happens to have its headquarters located in London and if a company’s headquarters were located somewhere else it would escape the burden. These issues are best tackled with other countries alongside us.

104. However, other nations are already acting on this. The signing into US law on 21 July 2010 of the Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act) saw the US lead the way in holding companies to account by requiring oil and mining companies to disclose revenues they pay to governments. The Dodd-Frank Act also requires companies to provide information on their use of conflict minerals (see paragraph 123).
105. We note the similarities between section 1504 of the Dodd-Frank Act in the US and the Private Member’s Bill, *Resource Extraction (Transparency and Reporting) Bill*, which is due for its second reading in the House of Commons on 17 June 2011. The Bill aims to:

require certain companies engaged in oil or gas extraction, and other mining activities, to disclose the type and total amount of payments made to any national government, or any company wholly or partly owned by a national government; and for connected purposes.\(^{150}\)

106. We accept that international regulation is the best way to ensure that UK listed extraction companies meet sufficient social and environmental standards in their overseas mining activities. The Government should advise the House when and where it proposes to raise these issues in international forums.

**Voluntary schemes**

107. There are other methods to promote good social and environmental practice in the mining industry. Mining companies can demonstrate their corporate and social responsibility by joining international organisations that require adherence to particular standards of mining. The Extractive Industries Transparency Initiative (EITI) is an international body of members, including governments and companies, that promotes transparency in mining, primarily by requiring publication of all payments and revenues a government receives from an extraction company.\(^{151}\) We heard from RCUK that:

Inter-governmental agreements (such as the UK-led Extractive Industries Transparency Initiative) and the rise of corporate responsibility initiatives amongst the western mining sector (such as the Global Mining Initiative) have made major advances in improving the social and environmental impact of mining in the developing world.\(^{152}\)

108. The problem with voluntary schemes is reaching those nations and companies that are operating in a socially and environmentally damaging way. We heard from Dr Jonathan Di John, Lecturer in Political Economy at the School of Oriental and African Studies, about the complex political and economic factors reasons why some nations will not sign up to these initiatives:

The challenges of achieving a good governance agenda and a transparency agenda in mining are going to be formidable. We have the Extractive Industry Transparency Initiative, the EITI. The World Bank championed this for the Chad-Cameroon pipeline and it fell apart. As to one of the reasons why it fell apart, one has to keep in context how political stability is maintained in a country. Historically, and certainly in sub-Saharan Africa, it was often maintained by bargains between different types of elites, to give them incentives not to rebel against the state. These bargains tended to take the form of giving huge economic privileges and rents to various regional elites.

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\(^{152}\) Ev w31, para 27
Under state intervention it was quite easy to do that because the state had big patronage machines. Through state-owned enterprises they could control and fix multiple exchange rates, give cheap credit and so on and so forth.

In the era of economic liberalisation, a lot of the hands of the state are tied. For instance, privatisation removes many of the patronage opportunities that public enterprises [allow]. With financial deregulation there is less control of the financial sector, so the patronage levers of elites to maintain stability are much more restricted now than they were in the past. So you are likely to see things like secret mining deals and the tolerance for tax evasion. We are seeing those other ways to give elites rents beginning to emerge. The problem of maintaining political stability doesn’t go away just because you have liberalised economically. I think that it will be a formidable challenge to implement a good governance agenda in these very poor countries because of the nature of the way elite bargains need to be constructed. [...] We must ask whether, historically, good governance has been the means by which countries have maintained political stability. If you look back in history, the answer is very troubling: regimes have hardly maintained institutions that resemble anything like “good governance”.

109. Another organisation that promotes social and environmental good practice is the International Council on Mining and Metals (ICMM): a professional organisation of mining companies and associations, led by a council of the Chief Executive Officers of the member companies. The Environmental Sustainability Knowledge Transfer Network (ESKTN) told us:

With regard to ethical sourcing the leading mining companies based in the UK participate in the sustainable mining programmes and policies of the International Council for Mining and Metals (ICMM). However there are potential problems with “invisible imports” because of the difficulties ensuring the traceability of metals incorporated in the parts or components of machines and equipment.

110. There are also labelling schemes that may be useful to trace a metal’s origin although, as explained above, the origin of metal components in goods can be difficult to trace. For example, the Fairtrade Foundation have begun a fair-trade scheme for gold and an Ecolabel for the EU is being developed. The Natural History Museum stated that:

It may be possible to implement a “certificate of origin” scheme that could track minerals along the supply chain from mine to market. Industry-led efforts in this field include pilot schemes by the Electronics Industry Citizenship Coalition and the International Tin Research Institute. The Kimberley Process, set up in 2003,
addresses the trade in so-called blood diamonds and is the most high-profile of this type of initiative.\textsuperscript{157}

111. However, we heard from Professor David Clary, Chief Scientific Advisor to the Foreign and Commonwealth Office (FCO), that once a metal was “released” it was likely to be very difficult to trace its origin.\textsuperscript{158}

112. The Extractive Industries Transparency Initiative and the International Council on Mining and Metals are constructive initiatives, helping to address the imbalance in national social and environmental regulations. We encourage the UK Government to help grow their membership through channels of international diplomacy and business networks.

113. Where labelling schemes are possible, to trace a metal’s origin from mine to market, we conclude that the Government should support and encourage their use.

\section*{Getting a fair deal for developing countries}

114. Many strategic metals are produced in the developing world.\textsuperscript{159} Mining contracts in the developing world have been subject to the International Monetary Fund’s (IMF) Structural Adjustment Policies (SAPs). Dr Di John, School of Oriental and African Studies, gave us an in-depth analysis of the effect that SAPs can have on government revenues in countries where they were implemented:

In terms of social cost, from a developing country perspective, I have done some work on the political economy of tax regimes in sub-Saharan Africa, and in particular mining tax laws. The current situation is that in many sub-Saharan African countries a lot of strategic metals were nationalised and very poorly managed. Many of these countries ran into very heavy debt crises, and they were, in some sense, forced in their structural adjustment programmes, to privatise. An example is the copper industry in Zambia.

In return for that privatisation, there was a very investor-friendly deal to companies to revitalise the copper mines in Zambia, for example. In the 2000s Zambia was receiving a 0.6\% royalty on copper. That is, basically, peanuts. The IMF originally endorsed that but now is coming round to saying that these countries need to get a much better deal from mining in general. The tax proceeds from mining would far outweigh any amount of increase in aid from which they would be able to benefit during commodity booms, which they are not. Zambia gets virtually nothing from the commodity boom in terms of fiscal resources.\textsuperscript{160}

Mr Lipmann, of Lipmann Walton & Co Ltd and the MMTA, corroborated Dr Di John’s analysis:

\footnotesize{\textsuperscript{157} Ev w24, para 15 \hfill \textsuperscript{158} Q 138 \hfill \textsuperscript{159} Ev w10 [Aerospace and Defence Knowledge Transfer Network]; Ev 57 [Royal Society of Chemistry] \hfill \textsuperscript{160} Q 83}
Zambia exports 700,000 tonnes of copper. That is $7 billion today. That is before the by-products of silver, tellurium, selenium, gold and cobalt, which [come] from copper as well, and all the other things. Yet Zambia does not see anywhere near that [...] That is because of the huge tax breaks that were given, under pressure from the IMF.161

115. A royalty of 0.6% on copper mined in Zambia is clearly very low; this was raised to 3% in 2007.162 An increase in royalties may help governments to regulate and improve the social and environmental impacts of mining operations, Dr Di John, School of Oriental and African Studies, continued:

I think we are likely to see a move in which the IMF promotes an increase in the royalty rate, especially in poor countries, because, in some senses, that is very consistent with the social corporate responsibility movements, not just in the OECD countries but in less developed ones. I would see a movement towards a high royalty rate in mining generally, even in poor countries.163

116. Charles Swindon, Chair of the MMTA Trade and Lobby Committee, cautioned against raising royalties too far.164 This could be a disincentive to business and a restriction on free trade. We note, however, the normal royalty on metals and minerals for most countries in the Southern African Development Community—a group of 15 nations of which Zambia is one—is around 6%.165 This is similar to levels proposed in the US for mining on federal land in the 2012 federal budget.166

117. Given that many of the world’s strategic metals reserves are located in the developing world, there is an opportunity for developing nations to benefit from mining revenues. Fair royalties on mining sales will equip governments with funds that could be used to help improve social and environmental conditions. We recommend that the Government, through the UK’s representation at the IMF, promote IMF Structural Adjustment Policies that give a fair deal on royalties from mining to developing nations.

“Conflict metals” in the Democratic Republic of Congo

118. The situation in the Democratic Republic of Congo (DRC) is extreme and highlights the risks to the stability of the country associated with the extraction of metals from artisanal or small-scale mines.

119. RCUK stated that:

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161 Q 84
163 Q 83
164 Q 84
Although formalised extraction by large enterprises is the familiar face of mining in the west, informal artisanal and small-scale mining (ASM) is a major extractive activity in the developing world. Of the listed critical metals, only tantalum-niobium (sometimes known as ‘coltan’ [columbite-tantalite]) is produced in any quantity by ASM. The long-running civil war in the Congo is, in part, caused by conflict over control small-scale coltan mines.167

120. Mining for metals (niobium, tantalum, cobalt, gold, tin and tungsten) in the DRC provides a livelihood for many of its citizens yet sustains, and is in part responsible for, the civil war. Mr Lipmann, of Lipmann Walton & Co Ltd and the MMTA, explained why:

Tantalite has one particular problem, which is that you can take it out with a bucket and a spade. It is artisanal. It doesn’t lend itself to huge companies. All the problems in eastern Congo and western Uganda are because it is so easy to mine. People are mining at the point of a gun. That is why the war lords are able to have that power.168

121. Once material is extracted it needs to be passed to multinational companies to be processed and exported to manufacturers; this is the point at which international regulation comes into play. Internationally, there are measures in place to hold companies to account for their activities overseas. The Organisation for Economic Co-operation and Development (OECD) has responsible business conduct guidelines for multinational enterprises, enforced at the national level by National Contact Points (NCP).169 Requests can be put to the NCP to investigate complaints against multinationals not following the guidelines. Amongst other complaints in relation to the conduct of multinationals in DRC, in 2007 Global Witness filed a complaint to the NCP against Afrimex (UK) Ltd, a UK based minerals company. The NCP upheld the allegations against Afrimex that it had initiated demand for minerals from a conflict zone and paid taxes and mineral licences to RCD Goma,170 a rebel group credited with grave human rights abuses.171 The investigation of the complaint is now concluded and the NCP made recommendations to Afrimex. However, Global Witness has noted that “no follow up steps are taken to monitor […] adherence to the […] recommendations”.172

122. The OECD regulations require action to investigate a producer that has been the focus of concerns over its practice. However, in the US, companies are also required to provide information on their use of conflict minerals. Under the Dodd-Frank Act, companies must produce a detailed report on conflict minerals that they use, defined as columbite-tantalite (niobium and tantalum), cassiterite (tin), gold and wolframite (tungsten) or their derivatives, originating from the DRC or an adjoining country.173 Mr Lipmann stated:

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167 Ev w31, para 28
168 Q 88
169 “UK NCP – Steering Board”, BIS Website, www.bis.gov.uk/policies/
172 As above
The laws which have come in, such as the Dodd-Frank from the US about conflict-zone minerals, are actually changing the situation on the ground. That is where law is beginning to help.¹⁷⁴

123. However, some mining organisations from the region take a different view. As the Dodd-Frank Act requires companies purchasing metals in countries neighbouring the DRC to declare them, gold mining companies in Tanzania, and the Tanzanian Government, fear they will lose business as a consequence of the Act. Reuters Africa reported:

Mining firms see a possible 10 percent reduction in demand for gold from the country as a result of the Dodd-Frank legislation and a loss of more than 2,000 jobs in the sector. [...] Tanzanian Deputy Minister for Energy and Minerals, Adam Kighoma Ali Malima, said the U.S. legislation would have serious ramifications for the country’s economy.

[...]

TCME [The Tanzania Chamber of Minerals and Energy] said Tanzania’s annual gold export earnings could fall by $75 million and lead to a reduction of around $200 million in foreign direct investment (FDI) due to an expected reluctance to develop new mining projects.¹⁷⁵

124. Artisanal mining presents specific challenges in conflict areas such as the Democratic Republic of Congo. The OECD guidelines are in place to hold companies to account for their actions overseas. We are concerned, however, that there is limited follow up in cases where allegations of inappropriate conduct have been upheld. The Government should work with the OECD to ensure that guidance for the follow up of investigations is in place and available to all National Contact Points.

125. In the US, under the Dodd-Frank Act, companies are also required to produce a detailed report on conflict minerals that they use. We recommend that the UK Government evaluate whether similar legislation be introduced in the UK to improve the social impact of mining in conflict areas.

¹⁷⁴ Q 88

5 Metal Use Efficiency

126. Resource use efficiency is the cornerstone of long-term sustainability. The 3R concept of “reduce, reuse, recycle” is widely used to highlight ways of minimising waste.176 This concept will be key to maximising the efficient use of strategic metals.177 Efficient use will help to minimise demand for strategic metals, which may, in turn, reduce the social and environmental impact of metal extraction. Nicholas Morley, Director of Sustainable Innovation at the sustainability consultancy, Oakdene Hollins, stated that:

Speciality metals typically have high embodied energy, and where manufactured in countries with carbon-intensive energy systems, high embodied carbon. They also have large volumes of resources associated with their extraction and refining. Hence techniques to increase their resource efficient use are recommended.178

127. The Government explained to us what it is doing to drive resource efficiency:

The UK is looking at targeted measures to encourage, incentivise and enable improved resource efficiency through the Review of Waste Policies, the new strategic steer for Defra’s resource efficiency delivery body, WRAP, the Natural Environment White Paper, and through the Roadmap to a Green Economy being developed by Defra, BIS and DECC. It is also important to continue working with Businesses and Trade Associations to raise awareness, and spread best practice.179

128. Defra co-ordinate waste policy through the Waste and Resources Action Programme (WRAP) whose vision is a “world without waste, where resources are used sustainably” and whose remit is to “help businesses and individuals reap the benefits of reducing waste, develop sustainable products and use resources in an efficient way”.180

The life cycle approach and product design

129. A product goes through many phases in its life. Raw materials are extracted and processed; a product is designed and manufactured, then packaged, distributed and purchased by a consumer. At this stage it enters the “product use” phase. At the end of its useful life, it can end up in storage before entering the waste stream. In the waste stream, the product can be incinerated or go to landfill. Alternatively it can be reused or go through some form of reprocessing to extract useful raw materials, which may then be used to create new products.

130. On a product’s environmental impact, Louis Brimacombe, Head of the Environment and Sustainability Research Team at Tata Steel, stated:

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177 Q 43 [Mr Brimacombe]
178 Ev w3, para 3.1
179 Ev 42, para 26 [BIS]
we need to emphasise more and more the whole product life cycle. You can make decisions about end of life, which might have a marginal effect or even a detrimental effect on the use phase. Whichever way you look at it these days, roughly 60% of the environmental impacts of something is in the use phase, be it automotive, buildings and so on. We need to be careful that any kind of guidance or regulations takes that into account. There are tools such as life cycle assessment to assist with that kind of evaluation. That is a good thing. Life cycle assessment tends to look at environmental issues, carbon and water footprinting and so on.\footnote{Q 57}

In its written submission the British Standards Institute said:

> The recovery and recycling of metals from discarded products should only take place when it has been established that incorporating the metals in the products, and recovering and recycling them at the end-of-life stage is the most sustainable option available. Other options may include using other materials, or adopting other end-of life options.\footnote{Ev w35, para 3.1}

131. Life cycle analysis is necessary to establish whether a particular resource efficiency measure causes a product to have a higher overall environmental impact through unintended consequences in another phase of that product’s life cycle. This is important for strategic metal efficiency measures, as the metals are often present in very small quantities in the products that contain them. For example, Tony Hartwell, Knowledge Transfer Manager at the Environmental Sustainability Knowledge Transfer Network (ESKTN), pointed out that there was only about 50 milligrams of tantalum in a mobile phone and roughly the same quantity of other high value materials.\footnote{Q 44} In its written submission, the Government said that “currently, re-use and re-manufacture of components rich in [many] strategically important metals would be preferable to recycling on a cost and environmental basis”.\footnote{Ev 41, para 25 [BIS]} This was because strategic metals can be difficult and very labour intensive to isolate from a product. Professor Robert Watson, Chief Scientific Adviser to Defra, added that Defra was “working with WRAP to look at the issue of product design in the first place, the life expectancy of the product and then the potential for recycling”.\footnote{Q 144} He said that “a lot of work” needed to be done on product design.\footnote{As above}

132. Sophie Thomas, Trustee of the Design Council and Founding Director of Thomas Matthews Ltd, stated that “the way we recover things at the moment is not as innovative and technologically efficient as the way we are designing our electronics—our goods”.\footnote{Q 55} Recovery of materials, in particular strategic metals, from goods is very tricky and will require intelligent and innovative design practices to be cost effective and to not adversely affect a product’s environmental impact over its whole life cycle. The Royal Society of
Chemistry (RSC) provided us with an example of how innovative design was beginning to improve material use efficiency:

Orangebox is an office furniture design company setting a good example. Their business model encompasses a cradle-to-cradle approach to product design. Incorporating an end-of-life pick-up recycling service, the entire production process is designed to have minimal energy impact. Orangebox have been supported by Chemistry Innovation Knowledge Transfer Network, an organisation that brings together designers, businesses, chemists and engineers to promote cradle-to-cradle product design. This pioneering approach needs to be extended to other businesses.  

133. This resource efficiency success story has been promoted by successful knowledge transfer networks. The cradle-to-cradle approach is also being used in the Netherlands by Philips, the large electrical manufacturing company. Mrs Thomas explained:

Crucial partnerships were set up within manufacturing systems, including waste manufacturers like Van Gansewinkel, a large waste manufacturing group in the Netherlands, who are now working closely with Philips. They are setting up [...] “cradle to cradle” groups, looking at the whole process of a closed loop system, because Philips could tell them exactly what was in their product and they could then work out how it was collected at the end of life. If there is a design product like, for instance, a coffee maker that they send to the recovery plant, and which is a closed loop product, they needed to know that they could easily recover all the materials in it and they could have accreditation for the quality of those different separated materials afterwards making it gradable so that it would go back up into the loop to be re-made into another coffee maker. The design of the components and their recovery was made much simpler through this design process.

134. This approach is gaining ground in the UK. Ian Hetherington, Director General of the British Metals Recycling Association (BMRA), explained that:

We are now starting discussions with the automotive manufacturers on advance battery packs because the design of the battery pack in the cars we are going to be seeing in the next 10 years is absolutely critical to the means and effectiveness by which we can extract the critical metals from those battery packs. Those discussions are going on. They are very receptive to it and we are looking here at a closed loop, so, hopefully, by the time we are seeing the volumes of these materials coming through on to the end of use market we will have those processes in place.

135. We consider that design of products is crucial to maximising the recovery of materials from a product at the end of its useful life. Therefore, as explained by Mr Hetherington, BMRA, what happens to a product at the end of its life must be considered in the early phases of a product’s design and development. However, this is often not the case. Dr Mike Pitts, from the Industry Technology Division of the RSC, stated that:
The people taking the vehicles apart aren’t necessarily connected up with the people making the components in the first place, who would really like to get those materials back [...] there is no way that a car speaker manufacturer, from the way we manage our vehicle waste at the moment, is ever going to see those speakers again, much as they would like to.191

136. If a manufacturer never sees its product again after it has left the shelves, then there is no incentive to consider spending money on design for its disassembly. The Design Council emphasised, however, that if a company takes its products back at the end of their life, for every £100 spent on design the company sees a return of £225. Mrs Thomas, Design Council, explained:

Take the example of Xerox, the evidence suggests that they have redesigned their machines so that they can take bits back and directly use them in other products. They estimate they can get their products to have up to seven lives within each recovered component and this process is twice as profitable as manufacturing in the first instance [...] because they have a recovery system in place they get back their materials, they have managed not to have to bring in raw materials for that. That was a result of the design decisions. They designed and built them so that they could pull them apart easily. Also, their designers were in touch with their waste manufacturing people, so it was a completely closed loop.192

137. Two key challenges facing innovative design for product disassembly and material recovery are: encouraging manufacturers to take back products at the end of their useful life; and, connecting manufacturers with waste processing companies to achieve the most efficient recovery methods. Dr Pitts, RSC, explained that long distributive supply chains also cause problems as it is difficult keep track of the materials and get them back to their original manufacturer in an economic way.193 Mrs Thomas stated that to encourage this, a huge amount of incentive needs to be built in and that:

designers tend not to be clued up on policy. A huge amount of communication is missing. Relationships with British Standards, where we are assisting with new sustainable design guidelines, have great potential [...] new conversations with manufacturers, designers, recovery and recycling facilities. That is where the power is and having the Government there and legislation in place is really key.194

138. Mrs Thomas was impressed by a recent visit to the Netherlands where she considered the Dutch were making significant progress in reducing waste and achieving design of goods for disassembly.195 Mrs Thomas said that:

good, strong central government laws and local municipal laws [...] helped make sure that the chain of custody, knowledge and experience of all the people came together to create very innovative ways of designing and recovery of materials. We could learn

191  Q 22
192  Qq 57–58
193  Q 22
194  Q 57
195  Q 39
a lot from them here. And it showed that a mixture of these things brought the ideal environment for innovation. There was a big push from Government there, including [a] landfill ban.196

139. The most effective method for materials to be recovered from goods is for the producers of those goods to have them returned at the end of their useful life. This will foster innovative design, communication with waste managers and other stakeholders. Using a cradle-to-cradle approach to return products to manufacturers at the end of their useful life is an effective means of managing scarce resources, including strategic metals, efficiently. We have been given examples of the financial benefits to manufacturers that have tried this approach. We would like to see widespread use of this approach in UK manufacturing, and intelligent product design is key to its effective implementation. It is essential to build networks and facilitate communication between manufacturers, waste processors and designers. The work of the knowledge transfer networks in achieving this should continue to be supported by the Government. The Government should encourage the incorporation of sustainable design thinking into the manufacturing and waste processing sectors, thereby fostering a cradle-to-cradle approach.

**Recycling strategic metals**

140. While we see recovery as preferable to recycling, we cannot disregard recycling. Recycling rates of many strategic metals are lower than for the more widely used, bulk metals.197 For example, Research Councils UK (RCUK) stated that “recycling rates for elements such as Gallium, Indium, Tantalum and Rare Earths are currently less than 1%”.198 Dr Rickinson, IOM3, stated that “the UK could develop itself incredibly well within the field of recycling”.

**Meeting demand with recycling**

141. Due to the current low rates of strategic metal recycling, any improvement in recycling rates would help to provide new supplies of strategic metals at a time when demand is increasing. This has been identified as a strategy for mitigating supply risks in the recent EU report.200

142. Chatham House stated that “in the long-term, genuine issues of physical scarcity apply” to reserves in the ground.201 However, Mr Hartwell, ESKTN, explained:

> We don’t consume metals. When we use oil, we burn it and it is destroyed, but, with metals [...] we dissipate them to a greater or lesser extent [...] it goes into the technosphere and is available for future use.202

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196 Q 39
197 Ev w32, para 33 [Research Councils UK]
198 As above
199 Q 11
200 Critical Raw Materials for the EU, Raw Materials Supply Group, EC, July 2010
201 Ev 72
Dr Pitts, RSC, agreed that “you can’t create or destroy elements”. He warned, however, that “the way we are managing most elements is really bad, and we are dispersing them in the environment in a way that makes them harder and harder to recover”. For example, when recycling large volumes of scrap material there may be small quantities of valuable strategic metals present that are difficult to recover. Louis Brimacombe, Head of the Environment and Sustainability Research Team at Tata Steel, told us that little effort is put into screening scrap steel for scarce materials. He explained that:

Scrap management is about optimising the through value[...] The scarce materials, from a steel industry perspective, is fairly low on the agenda. For niobium, for example, which is in some high strength steels, it is in tiny amounts. If you are referring to trying to recover low volume materials you wouldn’t go to the steelworks to try and recover rare earth metals. It is probably better done by the equipment dismantlers and scrap merchants at source.

Mr Brimacombe acknowledged, however, that through clever and efficient processes, low volume materials can be recovered. He explained that “if you have low niobium alloy steels in the scrap, you can factor that into your processing to achieve the required new alloy”. We recommend that where economically viable processes exist to extract or re-use strategic metals from scrap materials, these processes be encouraged by the Government.

143. Strategic metals are also being dispersed by users discarding old goods and waste materials, which often end up in landfill. Professor Watson, Defra, stated that “obviously, we are trying to move much closer to a zero-waste society”. Charles Swindon, Chair of the MMTA Trade and Lobby Committee, believed that using the word “waste” was a misnomer and that products at the end of their life ought to be viewed as a resource. Illustrating this point, Mrs Thomas, Design Council, stated that “there is about as much gold in one tonne of computer scrap as there is in 17 tonnes of gold ore”.

144. Mr Hartwell, ESKTN, stated that “we don’t import a lot of these special metals directly. They are in the computers and the equipment we purchase and support. In a way, we could look at that as a potential resource”. In 2009 UK householders purchased 1.25 million tonnes worth of electrical and electronic goods. This presents a significant strategic metal resource in the future. Rt Hon David Willetts MP, Minister of State for
Universities and Science, agreed that “as more and more old computers, IT equipment and mobile phones are chucked out, they are a potential resource”. However, RCUK explained that:

The upper limit on what is available for recycling is determined by what comes back from society; the ceiling on this is what we consumed 40 to 60 years ago. By way of illustration, global consumption of copper in 1970 was approximately 8 million tonnes per annum. Five million tonnes was from mining, with 3 million tonnes from recycling. In 2008 global copper consumption was about 24 million tonnes, of which 8 million tonnes are derived from recycling, with the remaining 16 million tonnes from primary production.

145. The demand for copper has not yet been met by recycled, or “secondary”, copper. With the continuing increase in global demand for copper primary production remains the main source of supplies. This is also the case for other metals, RCUK explained:

Even if recycling rates […] were much higher, we must recognise that the strategically important metal ‘resource’ currently residing in the anthropogenic environment is very small compared to that needed to meet predicted demand from manufacturers of electric vehicles, wind generators, solar panels and digital devices.

146. Mr Hetherington, BMRA, agreed, “the volumes of strategic metals […] occurring in the end of life supply chain at the moment are very limited” but he said that the lifespan of many products containing strategic metals was likely to be less than those containing copper, somewhere in the order of 10–16 years.

147. Although demand for strategic metals is likely to increase, the UK may be in a position to meet some demand with recycling. The UK has the capability to exploit the strategic metal resource in products at the end of their useful life. The Research Councils “are investing in research looking at the long-term sustainable use of materials”. For example, “NERC [Natural Environment Research Council] are proposing a major £15m initiative on Resource Recovery from Waste”.

148. One drawback to exploiting strategic metal resources was highlighted by RCUK:

Assessing the further potential contribution of recycling to meeting demand within the UK is hampered by lack of figures on imports of strategically important metals contained in finished and semi-finished goods. This makes it difficult to quantify the

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214 Q 162
215 Ev w32, para 32
216 Ev w32, para 33
217 Q 43
218 As above
219 Q 11 [Dr Rickinson]
220 Ev w32, para 30
221 As above
amount of strategically important metals residing in society which may become available as a “resource” for recycling.222

149. The lack of information extends beyond simply the import of strategic metals in finished and semi-finished goods. The Construction Materials Group of the Society of Chemical Industry stated that:

We need a national review of metallic wastes in the UK, quantifying the amounts and locations of each metal in the national waste inventory and then to identify routes to their recovery. Once we understand the nature of the problem, we will be in a position to address it. At present a large, but unknown quantity of metals are neither in use, nor in the recycling circuit.223

150. Dr Pitts, RSC, added that:

It would be helpful for companies to have something akin to the Stern report for resources, putting an economic value on the linear economy as it stands, where we dig things out of the ground, add value to them and discard them.224

151. Professor Watson, Defra, acknowledged there is a role for Government to provide “information as to the cost of these products [containing strategic metals] and the potential for recycling”.225 He added:

One needs to let the market work, basically. As long as the private sector has all the relevant information about what the current and potential future demand is and they can think through how you would produce a product and what the potential for recovery and recycling is, that is the role of Government basically, and then one will let the market work.226

152. Several witnesses considered that the market could encourage more efficient use of resources. As we have noted, Anthony Lipmann, Managing Director of Lipmann Walton & Co Ltd and former Chairman of the MMTA, stated that rhenium “was worth $300 a kilo in 1996 [but] in August 2008 it reached $10,000 a kilo, [...] price is like a beam of light that lights a way on a subject. Then everyone starts to recycle”.227 Dr Pitts, RSC, agreed:

Behaviour change does come with changes in price. I have heard much anecdotal evidence in the last few days where companies, because the price has risen, have started to do internal recycling where they had not done that before.228

153. The Government acknowledged that recycling was, in many cases, a costly process229 but the impact of changes in price was recognised: “to be cost-effective in Japan, the price

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222  Ev w32, para 34
223  Ev w26, para 8
224  Q 14
225  Q 146
226  As above
227  Q 75
228  Q 32
229  Ev 41, para 25 [BIS]
of rare earth metals would have to rise 10-fold, but with further price rises likely, the likelihood of more [rare earth] recycling increases". 230

154. Assessing the potential contribution of recycling strategic metals to meeting demand within the UK is hampered by a lack of information. This includes a lack of information on the strategic metals contained in finished and semi-finished imports, as well as the amounts and locations of strategic metals in the national waste stream. We recommend that the Government conduct a review of metal resources—finished and semi-finished goods and waste—in the UK. This should include an estimate of the market value of these resources. It would also be valuable to assess the movement of these resources into and out of the UK. Provision of such information will not only identify routes to the recovery of strategic metals, but will also empower the private sector to realise the economic potential of recovery and recycling.

**WEEE legislation**

155. We were told that even when prices of metals were high this in itself was insufficient to stimulate the market for recycling. RCUK explained intervention by government was sometimes required: “In general, the free market has so far been ineffective in encouraging recycling and resource efficiency. Policy and related economic instruments have proved more effective”. 231

156. One of the main interventions by government has been the 2002 European Commission Waste Electrical and Electronic Equipment (WEEE) Directive which was designed to increase the recycling and re-use of electrical and electronic waste by creating free of charge collection of e-waste for consumers. 232 The Minister told us that the Government backed “the principle of the WEEE regulations”. 233

157. Mr Hetherington, BMRA, explained how the regulations were operating:

> Currently, we are recovering substantial quantities of platinum, rhodium and palladium, along, with gold and silver, mainly from recovered waste electrical and electronic equipment. Recovery rates from materials that actually get to UK recyclers are very high. We are hitting over 90% of all materials that are recovered and reused. The difficulty comes from collecting the stuff in the first place. The rates of collection are low. 234

158. This raises two issues. First, despite the fact that by weight, 90% of collected waste is recycled, strategic metals, which are often in products in small quantities, are likely to be lost in the 10% not being recycled. Mr Hetherington, BMRA, also highlighted the need to

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230 Ev 42, para 27 [BIS]
231 Ev w32, para 31
233 Q 162
234 Q 43
use more “sophisticated models” for the collection of WEEE.\textsuperscript{235} Secondly, there is a need to improve collection of waste electrical and electronic equipment.

159. The directive set a collection target of four kilograms of waste per person per year. It is estimated that two thirds of WEEE is going uncollected.\textsuperscript{236} This prompted the EC to re-visit the legislation in December 2008.\textsuperscript{237} The poor collection rates were recognised and, to rectify this, the EC proposed to change the targets from an absolute weight per person per year to a proportion “equal [to] 65% of the average weight of electrical and electronic equipment placed on the market over the two previous years in each Member State.”\textsuperscript{238}

160. The Society of Chemical Industry suggested that the Government improve collection of WEEE by using “both carrot and stick” by, for example, imposing fines on people discarding metal waste while also providing a VAT discount on new phones when consumers traded in old ones.\textsuperscript{239} The Minister explained that the WEEE directive has a framework of collective producer responsibility.\textsuperscript{240} This means that the cost of recovery, recycling and re-use are absorbed collectively by all producers, therefore an individual producer has no specific incentive to make their products easier to recycle or re-use. The Minister added that the Government is “working with industry stakeholders to see if we could get a system of individual producer responsibility which might improve the incentives”.\textsuperscript{241}

161. In addition to improving collection rates, another option would be to extend the WEEE directive. Currently it covers domestic but not commercial or industrial electrical and electronic waste.\textsuperscript{242} The Society of Chemical Industry said that “to increase the recycling of metals generally, a strategic review of the efficiency with which industries and local authorities deal with their waste inventory is needed”.\textsuperscript{243} Mr Hetherington, BMRA, recommended that “the WEEE regulations should be expanded to cover industrial and commercial waste”.\textsuperscript{244}

162. We are pleased that the metal recycling industry in the UK is recycling 90%, by weight, of collected waste and that substantial quantities of platinum, rhodium, palladium, gold and silver are being recovered, mainly from recovered waste electrical and electronic equipment. However, it is of great concern to us that some strategic metals, which are often in products in small quantities, are likely to be lost in the 10% not being recycled.

\textsuperscript{235} Q 44
\textsuperscript{236} “Recast of the WEEE directive”, European Commission Website, 22 March 2011, http://ec.europa.eu/environment/
\textsuperscript{237} As above
\textsuperscript{238} As above
\textsuperscript{239} Ev wz26, para 9
\textsuperscript{240} Q 164
\textsuperscript{241} As above
\textsuperscript{242} Q 44
\textsuperscript{243} Ev wz26, para 7
\textsuperscript{244} Q 56
163. We are satisfied that the Government is working with industry stakeholders to see if implementation of the WEEE directive could be improved with a system of individual producer responsibility. We consider that the Government should continue to work with key stakeholders to identify other means of improving WEEE collection rates. In addition, we recommend that the Government work with EU partners to carry out a cost-benefit analysis of extending the WEEE regulations to cover commercial and industrial waste.

**Exporting metal waste**

164. Within the waste industry, metal recycling is exceptional, as the BMRA explained: “the recycling of metals is generally cost effective and it is notable that BMRA members buy every ton of ‘waste’ metal that they process, unlike any other part of the waste industry”. Mr Hetherington, BMRA, stated that the largest WEEE processing facility was in Newport and that “the UK is a major importer of waste electrical and electronic equipment”.

165. However, other organisations expressed concern that the UK was exporting large quantities of scrap metal, including bulk metals, such as iron, copper and aluminium, as well as some specialist metals, such as tungsten. Given that these waste materials are a potential resource (see paragraph 144) for the UK, it seems questionable to be exporting them abroad. Dr Rickinson, IOM3, explained that this was because there were few places left to process scrap metal in the UK. For example, IOM3 explained the reason for exporting copper out of the UK:

> the logistic network to collect and segregate copper scrap is in place within the UK, but the downstream investment to remove the polymer and other sheath materials from the copper and then to remelt and cast this is not in place. Commercial and environmental concerns are important here. Insulated cable can be granulated and the plastic coating removed from the copper to use both materials in a controlled recycling loop. By contrast, an easier solution is to burn the plastic coating off the copper cable directly in the melting furnace. This creates environmental issues which, within the UK, would be expensive to overcome.

166. The environmental problem created by burning away the plastic coating is therefore being exported elsewhere. IOM3 suggested that “no melting facilities are available in the UK due to the high investment cost required to satisfy all legislation [e.g. environmental] and to make a commercial return”. IOM3 added that there were, however, some alternatives to burning the plastic coating in order to separate out the copper.
167. The export of metals for recycling elsewhere was also viewed by others as environmentally damaging. Mr Hartwell, ESKTN, described it as being akin to “exporting carbon credits” due to the energy saved re-melting scrap compared to extracting metal from the ground. There have also been reports in the media highlighting the negative social impacts of waste electrical and electronic equipment that is being exported for processing abroad. Mr Swindon, MMTA, stated that he had “seen grannies in their 80s in the freezing cold in China taking apart these pieces of scrap metal”. The Society of Chemical Industry added that:

the ethics of recycling are occasionally very poor indeed […] the export by sea of huge quantities of metals has ethical implications in that their initial ‘reprocessing’ in India, China and the Philippines is often crude and environmentally damaging [...] we have a legislative framework in place which, by and large, prevents ethically unsound practice in the UK, but once out of our control becomes very difficult to manage.

168. Given that scrap metal and waste electrical and electronic equipment are a potential resource for the UK, it seems nonsensical to be exporting them abroad. The Government should be actively working towards minimising the export of these materials. We are also concerned that the export of scrap metal and waste electrical and electronic equipment abroad for recycling is, in effect, exporting our environmental problems elsewhere. We recommend that, where exporting has to take place, the Government engage with the governments of the countries importing these materials to encourage higher environmental standards and adequate working practices for those processing the goods material.

Illegal export of WEEE

169. By law, WEEE should be processed in the EU. WEEE that is exported illegally is often labelled as second hand equipment for re-use. A recent European Commission report on waste management highlighted concern about the illegal export of scrap within and from the EU:

More than 10,000 joint inspections on waste shipments were carried out […] demonstrating that about 19% of transfrontier shipments of waste were in violation of the waste legislation […] illegal export of waste is a continuous problem which is by essence difficult to quantify.

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252  Ev w27, para 14 [Society of Chemical Industry: Construction Materials Group]
253  Ev 50, para 26
255  Q 101
256  Ev w27, para 10
257  European Commission report on the thematic strategy on the prevention and recycling of waste, COM(2011) 13
170. In the UK we note that in November 2010 a group of individuals were charged with the illegal export of WEEE from the UK after an Environment Agency investigation.258

171. We note that the Environment Agency has responsibility for initiating enforcement where the illegal export of WEEE is suspected. We recommend that the Government ensure that the Agency is sufficiently resourced to carry out this responsibility effectively. Given that WEEE is often exported under the cover of re-use, the Government needs to put in place safeguards to ensure that WEEE for export and labelled for re-use is being used for this purpose.

6 Domestic extraction

Exploiting potential reserves

172. Wolf Minerals Ltd, a mining company developing a tungsten deposit in the UK, told us in a written submission that:

There is [...] a perception that metal mineral resources in the UK are fully known and that there is therefore very limited opportunity to provide metal from within the UK. This perception [...] is not correct. In most of the prospective areas within the UK the mineral potential is unknown at economic depths and there are indications of substantial targets.259

173. The Royal Society of Chemistry (RSC) agreed that there was potential to increase domestic extraction of strategic metals260 and the Mineral Reconnaissance Programme led by the British Geological Survey (BGS) has identified unexploited deposits of various strategic metals, such as the platinum group metals and gold, in the UK.261

174. The Mineralogical Society stated that “the UK is considered to have significant reserves of some of the critical metals, particularly in the historical mining area of SW England, although areas such as the Highlands of Scotland and parts of Wales also potentially contain exploitable deposits”.262 Professor David Manning, Secretary for Professional Matters at the Geological Society of London, explained:

We assume that because Cornwall has been around for thousands of years as a mineral stockpile, we don’t need to do any more work there, yet there are treasures in Cornwall waiting to be found. We need to make sure that this is consistently being worked through and that continued work takes place on the geology and aspects of the geological science.263

Professor Manning added that Northern Ireland was recently surveyed for minerals using modern geophysical prospecting methods, resulting in 90% of Northern Ireland being licensed for mineral extraction.264

175. In addition to raw reserves in the ground, there are also potential reserves in alternative resources that were once waste. The Geological Society of London explained that as well as primary ore extraction and the recycling of products, it might be possible to extract metals from industrial waste streams such as spent oil shales, fly ash and slags.265 It said that:

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259  Ev w15, para 1.6
260  Ev 58, para 13
262  Ev w21, para 7
263  Q 18
264  As above
265  Ev 53, para 16
[Researchers] have shown that the retorting process [a common extraction method] for generating oil from shale, for example, leaves increased REE concentrations in the residual shale […] There are 100 million tonnes of oil shale spoil heaps in West Lothian, representing a significant potential resource, though not all is available for use under current planning regulations.266

176. The UK is well placed to exploit domestic reserves—including from unconventional sources such as industrial waste streams—due to the expert knowledge of its research base. Dr Mike Pitts, from the Industry Technology Division of the RSC, explained:

We have the capability in the UK within our chemistry, science and engineering infrastructure to develop much better ways to get materials out of mining ores and also so-called waste streams where the concentration can often be higher than in the ore that it came from.267

The Geological Society of London took the same view: “the UK has the advantage of a world renowned mineral deposits research community, including not only university scientists, but also those in BGS, NERC isotope facilities, and the Mineralogy Department of the Natural History Museum”.268 However, concerns were expressed that:

this area is relatively neglected by NERC with regard to research funding, and that if the next generation of mineral deposits researchers is not nurtured, the community will lose critical mass and not be self sustaining.269

177. While Rt Hon David Willetts MP, Minister of State for Universities and Science, acknowledged that “we are world leaders in understanding some of the geological processes and the distribution of some of these materials”, he suggested that the UK was “quite active in researching this area” and that if there were specific areas where more research was required it was his expectation that industry would communicate that to NERC.270

178. The evidence shows that there are unexploited deposits of various strategic metals in the UK but, in many areas, it is unclear whether extraction is economically viable. The use of modern geophysical prospecting methods could identify economically accessible reserves. The Government should work with the British Geological Survey to ensure that Government has a comprehensive and up-to-date understanding of potentially valuable domestic mineral resources.

179. Research is underway into the potential to extract metals from industrial waste streams. We recommend that, if these techniques become economically viable, the Government ensure that current planning regulations do not unnecessarily restrict the use of significant potential reserves such as the 100 million tonnes of oil shale spoil heaps in West Lothian.
Impact of domestic extraction

180. The Geological Society of London explained that one of the benefits of domestic extraction was that “there is considerable potential to reduce our vulnerability [...] to some strategic metals. [For example] the UK has significant potential reserves of [...] indium and tungsten in south west England”.271 The Mineralogical Society agreed that “exploration and mining of critical metals within the UK would provide the country with some security of supply, as well as bringing economic benefits to rural areas”.272 Wolf Minerals Ltd added that:

Developing our own resources both enables the UK to minimise the offshoring of environmental and health costs to other nations, but also ensures that the UK can negotiate trade agreements from a strong position. [...] The most ethical method of ensuring supplies of strategic minerals to our economy is to provide them from our own resources. Such action clearly removes or reduces any threat of external controls on supply to the UK.273

181. We consider that UK mining for strategic metals could help to relieve the risk associated with external supply monopolies and reduce the “offshoring” of the UK’s environmental impact. We appreciate that any new mining in the UK would have an environmental impact. Professor Manning, Geological Society of London, did not envisage that this would be an insurmountable problem:

One of the good things about mining in this country is that we can be absolutely sure of the control of the environmental parameters. If we are interested in making sure that we are responsible consumers of mined materials, then the more we do that under our own control the better.274

182. Louis Brimacombe, Head of the Environment and Sustainability Research Team at Tata Steel, agreed that “we probably manage environmental issues of our mining operations [...] better than overseas [...] so the net impact globally might be better”.275 He added, however, that “the mining community now in general is improving its environmental and social performance overseas as well”.276 Tony Hartwell, Knowledge Transfer Manager of the Environmental Sustainability Knowledge Transfer Network (ESKTN), summed up the issue of environmental impact in the UK:

There is a demand for these metals and they are going to be produced somewhere in the world. The point is that, if we are using the metals, we have a responsibility to see that they are mined sustainably wherever they are made.277

271 Ev S2, para 11
272 Ev w21, para 7
273 Ev w15, w18, paras 1.7 and A2.2
274 Q 23
275 Q 38
276 As above
277 Q 38
183. We heard evidence that the impact of mining operations in the UK has been improving. Dr Bernie Rickinson, Chief Executive of the Institute of Materials, Minerals and Mining (IOM3), stated that “over the last decade […] sustainability, environmental parameters and health and safety associated with mining has changed in all respects”.\footnote{Q 23}
The Geological Society of London provided us with an example of UK mining activity with high environmental standards. In this example, Scotgold Resources Ltd are developing Cononish, a gold mine in the Grampians region of Scotland, which is currently in the planning process.\footnote{Ev 55, para 5}

In terms of satisfying planning and environmental legislation, the initial application was turned down largely because of concerns about ‘visual’ impact in the National Parks but since refusal Scotgold Resources has been working to meet these concerns by reducing the size of the tailings facility and by incorporating some underground disposal. For environmental reasons, a gravity/flotation process rather than the use of cyanide will be employed. Plant has been designed at additional cost to minimise the footprint—modularised and contained in a single building rather than a traditional design. The location demands the highest environmental and planning standards and it is perhaps significant that the Scottish Environmental Protection Agency withdrew their objection. The company is currently sufficiently encouraged to re-apply for planning permission.\footnote{As above}

184. However, perception of the environmental impact also matters, in particular with regard to convincing the public.\footnote{Q 14 [Professor Manning]; Q 23 [Dr Rickinson]} Professor Manning, Geological Society of London, elaborated:

> The important point about mining is that much of the problem arises from the automatic assumption that a mine is definitely not a good neighbour. This is where the mining industry has a role to play in demonstrating that a modern mine, run to standards that we would expect in this country, can be a very good neighbour. We see this in some of the open pit coalmining […] in Northumberland. The mines of one of the very good companies that operates there can be scarcely visible, and so the company can have problems in getting planning permission because no one knows a mine is there. It has backfired to some extent and they have to work very hard to demonstrate to the public for example just how quiet they are. That is where there is a double edge to this. The consultation process tends to throw up objections that are based on historical perceptions rather than present day perceptions, and there may be ways in which that can be eased.\footnote{Q 19}

The ESKTN concurred:

> the general public’s perception of mining operations [is] often based on views based on historical descriptions of operations and incidents but the modern mining
industry takes its responsibilities seriously and aims to develop mineral[s] using the most sustainable methods available.\textsuperscript{283}

185. We consider that domestic mining for strategic metals could alleviate the risk associated with sourcing metals from external supply monopolies. While any new mining in the UK is likely to have some environmental impact, this is likely to be lower than it would be abroad and so reduce the export of the UK’s environmental impact. It is important that the Government invests in the necessary research, to ensure that future domestic mining has the least possible environmental impact. However, perception of the environmental impact also matters, and the public rightly needs to be certain of the effects of mining in the UK. The mining industry has a role to play in demonstrating that a modern mine, run to standards can be a good neighbour.

**UK planning law**

186. The Mineralogical Society told us that “issues of cost, environmental considerations, and planning have restricted mining in [the UK] in recent years”.\textsuperscript{284} Professor Manning, Geological Society of London, added that “this country is one of the most difficult in the world to get planning permission to take a mine forward”.\textsuperscript{285} Mr Hartwell, ESKTN, agreed that “the planning process takes a long time”.\textsuperscript{286} This was illustrated by the ESKTN’s explanation of the initial phases of exploiting a mineral reserve in the UK:

> The whole process of identifying a mineral deposit is itself an expensive process and risky process. Ideally mining companies would like to identify large deposits of high grade material. Exploration geologists conduct surveys to identify signs of potential for deposits and then they must conduct detailed exploration work to determine if the deposit might be economically viable. This can include extensive drilling and mineral processing test work.\textsuperscript{287}

Prior to applying for planning permission, mining companies must invest significantly just to identify mineral reserves. The ESKTN continued:

> Mineral exploration companies are unlikely to invest in development work in locations where the mineral exploration rights are unclear and /or there is a high probability that an operating permit may not be granted—or will be only be received after long delays.\textsuperscript{288}

187. ESKTN explained that the uncertainty and delays in gaining planning permission was preventing mining companies even considering prospecting for reserves:

> We spoke to a company that was looking at developing mining assets and they said they wouldn’t even look at deposits in Europe because they know it is going to take

\textsuperscript{283} Ev 51  
\textsuperscript{284} Ev w21, para 7  
\textsuperscript{285} Q 14  
\textsuperscript{286} Q 41  
\textsuperscript{287} Ev 50  
\textsuperscript{288} As above
them 10 or 15 years to go from discovering the deposit to getting into production. They just can’t afford to do that. They can’t afford to invest in developing the deposit, exploring for it and going on to do that.289

188. However, not all mining companies are discouraged. Wolf Minerals Ltd stated that “the UK has one of the most rigorous and fair planning and regulatory regimes in the World. This regime fits within a local democratic process and within a stable and trusted national political framework”.290 The democratic process is key to giving local citizens a platform to voice their concerns about what happens in their region. We consider, however, that the nature of mineral reserves is such that they may only be located in one or two pre-defined areas within the UK. Their location is often not flexible. Therefore any substantial local opposition and resulting rejection of planning applications may result in the mining company pursuing an overseas location.

189. The Geological Society of London stated that the “Government should […] address the inconsistency between national mineral supply objectives and local planning policy and practice”.291 The ESKTN suggested that it was “the lack of clear statement from central government as to the importance of minerals which leaves the planning process (and the courts, who might review the legality of a planning decision in terms of national policies) open to pressure of ‘yes, but not here’”.292

190. The Planning Act 2008 was introduced to speed up the process for approving “nationally significant infrastructure” projects. The Act provided for a new Infrastructure Planning Commission (IPC) to decide applications for these major infrastructure applications. The Localism Bill 2010/11 is set to abolish the IPC and replace it with a Major Infrastructure Planning Unit within the Planning Inspectorate. We understand that mines are currently not considered to be nationally significant infrastructure and therefore must go through the traditional local government planning process.293 Professor Manning, Geological Society of London, stated:

There could be some ease in terms of the strategic need for materials being recognised in the same way that the planning law is being changed from the point of view of looking at major installations over power generation and things like that. If mining could come into that category, that would help.294

191. We consider that classifying mines as nationally significant infrastructure under the Planning Act 2008 would speed up the planning process and be of advantage to the UK’s economic development. It would encourage the exploration and the development of strategic metals mines. Mr Hartwell, ESKTN, stated that “the same is happening now in America where they are trying to shorten their planning process from two years to one year for minerals and metals”.295 When we asked the Minister whether he thought classifying

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289 Q 41
290 Ev w18, para A2.2
291 Ev 53, para 13
292 Ev 51
293 Planning Act 2008, section 14
294 Q 19
295 Q 41
mines as nationally significant infrastructure would have an impact on mining projects in the UK, he replied:

That is not a proposal that has been put to me. I can see the sensitivities of things such as that. It is an interesting observation [...] I will pass it on to my colleagues who are in the forefront of tricky decisions on planning.296

192. We are concerned by reports that uncertainty and delay in the planning process is preventing some mining companies from even considering prospecting for reserves in the UK. The nature of mineral reserves is such that they are where they are, that is, their location is a given. Therefore any substantial local opposition and resulting rejection of planning applications may result in mining companies pursuing an overseas location. In order to make the most of the UK’s valuable domestic resources and to speed up the planning process, we recommend that the Government classify mines, in particular those containing strategic metal reserves, as nationally significant infrastructure.
Conclusions and recommendations

Definitions and terminology

1. We are concerned that much of the Government’s response to this inquiry focussed on rare earth elements when there are clearly a number of other strategic metals that are important to the UK. Furthermore, we are concerned by the interchangeable usage and confusion of the terms rare earth element (REE) and strategic metal. In order to ensure the formulation of appropriate policy and support for UK metals users, the Government must use clear terminology. In our view strategically important metals comprise the rare earth elements, the platinum group elements and other main group elements of importance to the UK, such as those identified in Table 1. The rare earth elements are only one very specific group of metals, therefore the term “rare earths” must not be used to describe all of the above. (Paragraph 17)

Importance of strategically important metals to the UK

2. There is some disagreement about the vulnerability of the UK to metal shortages, especially in comparison to more intensive users such as Japan and the USA. However, there are important sectors of the UK economy that already rely upon a wide range of metals at stable prices. Furthermore, a stable supply of metals will be important in the transition to a low carbon economy. We are pleased that the Government recognises the importance of metals to the green economy, securing green growth and re-balancing the economy towards high value-added manufacturing. (Paragraph 24)

Departmental responsibilities

3. We conclude that it would be beneficial to industry if the Government were to clarify which departments have responsibility for strategic metals. The Government acknowledged its role to provide resource information to the private sector: it is reasonable to expect that this information include which metals are of strategic importance to the UK. We seek clarification on which department decides which metals are of strategic importance to the UK, which department provides high-quality information on resources, how regularly this information is updated and how this information is shared across Government and disseminated to businesses. We agree with the conclusion in the recent Defra report on resource risks that a shared database would develop business and Government understanding of resource risks in the future. We invite the Government to set out a timetable for developing such a database and explain what arrangements would be made for publishing all or part of it. (Paragraph 34)
Non-metals

4. We note the strategic importance of certain non-metals and as it is outside of the scope of this inquiry, we may choose to return to this in the future. However, in responding to this report, we invite the Government to explain how it will ameliorate the risks posed by the potential scarcity of helium. (Paragraph 36)

Metals supply

5. Most strategic metal reserves are unlikely to run out over the coming decades. In practice, improved technology, the use of alternative materials and the discovery of new reserves are likely to ensure that strategic metals are accessible. There will, however, be significant environmental and monetary cost associated with the exploitation of lower grade minerals. (Paragraph 44)

6. Monopolies and oligopolies in strategic metals distort the market. They can arise because of a variety of reasons, including economic, political, geographic and environmental issues. China’s reduction in export quotas of rare earth element raw materials is an example of this and restricts a free market in metals. We invite the Government to set out in its response the outcome of the investigation into Chinese export quotas, as described by the Minister. We consider that, to maximise the benefits of free trade, the Government should ensure that restrictions in the trade of strategic metals are discussed at an international level, through forums such as the WTO, G-20 and the OECD. (Paragraph 59)

7. The increasing global demand for strategic metals from emerging economies and new technologies will be a significant factor affecting their price, and therefore availability. Assessment of future demand will be essential to assessing the potential scarcity, risk to supply and future price of strategic metals. Assessments of future demand should be part of the shared database we have proposed. (Paragraph 63)

Functioning and operation of the market

8. Changes in supply and demand can lead to significant fluctuations in the prices of metals. While this may not be a problem for end users or large companies we are concerned that small and medium enterprises (SMEs) could suffer from unexpected large and rapid price increases. The Government must ensure that mechanisms are in place to reach out to SMEs across the country, a role previously fulfilled by the Regional Development Agencies. We recommend that the Government consult with SMEs using strategic metals to ascertain: (i) their awareness of resource supply issues; (ii) how SMEs may be affected by supply issues; and (iii) what information on resource supply SMEs need to enable them to prepare for changes in the market and maximise profitability. (Paragraph 70)

9. Stockpiling is an unattractive option because it is expensive but it may be necessary if the market fails because of sustained market manipulation by a monopoly supplier. The Government should keep this policy under review. (Paragraph 74)
10. The perception of scarcity of certain minerals and metals may lead to increased speculation and volatility in price and supply. There is a need for accurate and reliable information on scarcity of metals. This concern underlines the recommendation we have made, that the Government should establish and regularly update a shared database to provide such information. We are also concerned by reports of hedge funds buying up significant quantities of strategic metals. We recommend that the Government investigate whether there are increasing levels of speculation in the metals markets and, if there are, their contribution to price volatility and whether markets that allow high levels of speculation, with associated price volatility, are an acceptable way to deliver strategic commodities to end users. (Paragraph 78)

11. We use this report to bring the alleged activities of large dealers on the London Metals Exchange to the attention of the Office of Fair Trading. We would be concerned if a dealer were undermining the effective functioning of the market and we look for assurance that the market is functioning satisfactorily. (Paragraph 81)

**REACH legislation**

12. It appears that there may be, amongst some small companies, a misunderstanding of the REACH regulations and that consortia are being used to register metals when this may not be required. We recommend that the Government reassess the information and advice available to small companies about REACH regulations, in particular information about the most cost-effective means of registering strategic metals. We also recommend that the Government examine whether these regulations have become an unnecessary expensive burden inhibiting the market in strategically important metals. (Paragraph 90)

**Social and environmental impact**

13. We agree with the Minister that action on improving the social and environmental impact of mining needs to be taken internationally. We consider, however, that the operation of existing legislation, in particular the Companies Act 2006, could be improved to ensure that the social and environmental impacts of companies listed in the UK and operating outside of the UK are fully reported. We are concerned by suggestions that the Companies Act 2006 is being ignored rather than implemented. We invite the Government to explain what guidance is given to companies for reporting social and environmental information, what measures are currently being taken to monitor whether the information provided in companies’ business reviews is fit for purpose and what action is being taken against companies that are not complying with the guidance. (Paragraph 102)

14. We accept that international regulation is the best way to ensure that UK listed extraction companies meet sufficient social and environmental standards in their overseas mining activities. The Government should advise the House when and where it proposes to raise these issues in international forums. (Paragraph 106)
15. The Extractive Industries Transparency Initiative and the International Council on Mining and Metals are constructive initiatives, helping to address the imbalance in national social and environmental regulations. We encourage the UK Government to help grow their membership through channels of international diplomacy and business networks. (Paragraph 112)

16. Where labelling schemes are possible, to trace a metal’s origin from mine to market, we conclude that the Government should support and encourage their use. (Paragraph 113)

17. Given that many of the world’s strategic metals reserves are located in the developing world, there is an opportunity for developing nations to benefit from mining revenues. Fair royalties on mining sales will equip governments with funds that could be used to help improve social and environmental conditions. We recommend that the Government, through the UK’s representation at the IMF, promote IMF Structural Adjustment Policies that give a fair deal on royalties from mining to developing nations. (Paragraph 117)

18. Artisanal mining presents specific challenges in conflict areas such as the Democratic Republic of Congo. The OECD guidelines are in place to hold companies to account for their actions overseas. We are concerned, however, that there is limited follow up in cases where allegations of inappropriate conduct have been upheld. The Government should work with the OECD to ensure that guidance for the follow up of investigations is in place and available to all National Contact Points. (Paragraph 124)

19. In the US, under the Dodd-Frank Act, companies are also required to produce a detailed report on conflict minerals that they use. We recommend that the UK Government evaluate whether similar legislation be introduced in the UK to improve the social impact of mining in conflict areas. (Paragraph 125)

Recycling

20. Using a cradle-to-cradle approach to return products to manufacturers at the end of their useful life is an effective means of managing scarce resources, including strategic metals, efficiently. We have been given examples of the financial benefits to manufacturers that have tried this approach. We would like to see widespread use of this approach in UK manufacturing, and intelligent product design is key to its effective implementation. It is essential to build networks and facilitate communication between manufacturers, waste processors and designers. The work of the knowledge transfer networks in achieving this should continue to be supported by the Government. The Government should encourage the incorporation of sustainable design thinking into the manufacturing and waste processing sectors, thereby fostering a cradle-to-cradle approach. (Paragraph 139)

21. We recommend that where economically viable processes exist to extract or re-use strategic metals from scrap materials, these processes be encouraged by the Government. (Paragraph 142)
22. Assessing the potential contribution of recycling strategic metals to meeting demand within the UK is hampered by a lack of information. This includes a lack of information on the strategic metals contained in finished and semi-finished imports, as well as the amounts and locations of strategic metals in the national waste stream. We recommend that the Government conduct a review of metal resources—finished and semi-finished goods and waste—in the UK. This should include an estimate of the market value of these resources. It would also be valuable to assess the movement of these resources into and out of the UK. Provision of such information will not only identify routes to the recovery of strategic metals, but will also empower the private sector to realise the economic potential of recovery and recycling. (Paragraph 154)

**WEEE legislation**

23. We are pleased that the metal recycling industry in the UK is recycling 90%, by weight, of collected waste and that substantial quantities of platinum, rhodium, palladium, gold and silver are being recovered, mainly from recovered waste electrical and electronic equipment. However, it is of great concern to us that some strategic metals, which are often in products in small quantities, are likely to be lost in the 10% not being recycled. (Paragraph 162)

24. We are satisfied that the Government is working with industry stakeholders to see if implementation of the WEEE directive could be improved with a system of individual producer responsibility. We consider that the Government should continue to work with key stakeholders to identify other means of improving WEEE collection rates. In addition, we recommend that the Government work with EU partners to carry out a cost-benefit analysis of extending the WEEE regulations to cover commercial and industrial waste. (Paragraph 163)

25. Given that scrap metal and waste electrical and electronic equipment are a potential resource for the UK, it seems nonsensical to be exporting them abroad. The Government should be actively working towards minimising the export of these materials. We are also concerned that the export of scrap metal and waste electrical and electronic equipment abroad for recycling is, in effect, exporting our environmental problems elsewhere. We recommend that, where exporting has to take place, the Government engage with the governments of the countries importing these materials to encourage higher environmental standards and adequate working practices for those processing the goods material. (Paragraph 168)

26. We note that the Environment Agency has responsibility for initiating enforcement where the illegal export of WEEE is suspected. We recommend that the Government ensure that the Agency is sufficiently resourced to carry out this responsibility effectively. Given that WEEE is often exported under the cover of re-use, the Government needs to put in place safeguards to ensure that WEEE for export and labelled for re-use is being used for this purpose. (Paragraph 171)
**Domestic extraction**

27. The evidence shows that there are unexploited deposits of various strategic metals in the UK but, in many areas, it is unclear whether extraction is economically viable. The use of modern geophysical prospecting methods could identify economically accessible reserves. The Government should work with the British Geological Survey to ensure that Government has a comprehensive and up-to-date understanding of potentially valuable domestic mineral resources. (Paragraph 178)

28. Research is underway into the potential to extract metals from industrial waste streams. We recommend that, if these techniques become economically viable, the Government ensure that current planning regulations do not unnecessarily restrict the use of significant potential reserves such as the 100 million tonnes of oil shale spoil heaps in West Lothian. (Paragraph 179)

29. We consider that domestic mining for strategic metals could alleviate the risk associated with sourcing metals from external supply monopolies. While any new mining in the UK is likely to have some environmental impact, this is likely to be lower than it would be abroad and so reduce the export of the UK’s environmental impact. It is important that the Government invests in the necessary research, to ensure that future domestic mining has the least possible environmental impact. However, perception of the environmental impact also matters, and the public rightly needs to be certain of the effects of mining in the UK. The mining industry has a role to play in demonstrating that a modern mine, run to standards can be a good neighbour. (Paragraph 185)

30. We are concerned by reports that uncertainty and delay in the planning process is preventing some mining companies from even considering prospecting for reserves in the UK. The nature of mineral reserves is such that they are where they are, that is, their location is a given. Therefore any substantial local opposition and resulting rejection of planning applications may result in mining companies pursuing an overseas location. In order to make the most of the UK’s valuable domestic resources and to speed up the planning process, we recommend that the Government classify mines, in particular those containing strategic metal reserves, as nationally significant infrastructure. (Paragraph 192)
Formal Minutes

Wednesday 4 May 2011

Members present:

Andrew Miller, in the Chair

Stephen Metcalfe
Stephen Mosley

Pamela Nash
Graham Stringer

The Committee considered this matter.

Draft Report (Strategically important metals), proposed by the Chair, brought up and read.

Ordered, That the draft Report be read a second time, paragraph by paragraph.

Paragraphs 1 to 192 read and agreed to.

Summary agreed to.

Resolved, That the Report be the Fifth Report of the Committee to the House.

Ordered, That the Chair make the Report to the House.

Ordered, That embargoed copies of the Report be made available, in accordance with the provisions of Standing Order No. 134.

Written evidence was ordered to be reported to the House for placing in the Library and Parliamentary Archives.

[Adjourned till Wednesday 11 May 2011 at 9.00 am]
Witnesses

Wednesday 26 January 2011

Professor David Manning, Secretary for Professional Matters, Geological Society, Dr Bernie Rickinson, Chief Executive, Institute of Materials, Minerals and Mining, and Dr Mike Pitts, Industry Technology Division, Royal Society of Chemistry

Ian Hetherington, Director General, British Metals Recycling Association, Sophie Thomas, Council Member, The Design Council, Tony Hartwell, Knowledge Transfer Manager, The Environmental Sustainability Knowledge Transfer Network, and Louis Brimacombe, Head, Environment and Sustainability Research Team, Tata Steel

Wednesday 16 February 2011

Charles Emmerson, Senior Fellow, Chatham House, Dr Jonathan Di John, Senior Lecturer in Political Economy, School of Oriental and African Studies, Anthony Lipmann, Managing Director, Lipmann Walton and Co, and former Chairman, Minor Metals Trade Association, and Charles Swindon, Chair of the Trade and Lobby Committee, Minor Metals Trade Association

Wednesday 2 March 2011

Professor Robert Watson, Chief Scientific Adviser, Department for Environment, Food and Rural Affairs, and Professor David Clary, Chief Scientific Adviser, Foreign and Commonwealth Office

Rt Hon David Willetts MP, Minister of State for Universities and Science
### List of printed written evidence

<table>
<thead>
<tr>
<th></th>
<th>Name</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Department for Business, Innovation and Skills (SIM 00 and 00b)</td>
<td>Ev 39, Ev 74</td>
</tr>
<tr>
<td>2</td>
<td>Professor Robert Watson, Chief Scientific Adviser, Department for Environment, Food and Rural Affairs (SIM 00a)</td>
<td>Ev 43</td>
</tr>
<tr>
<td>3</td>
<td>The Institute of Materials, Minerals and Mining (IOM3) (SIM 03 and 03a)</td>
<td>Ev 44, Ev 45</td>
</tr>
<tr>
<td>4</td>
<td>The Environmental Sustainability Knowledge Transfer Network (ESKTN) (SIM 07 and 07a)</td>
<td>Ev 46, Ev 50</td>
</tr>
<tr>
<td>5</td>
<td>The Geological Society of London (SIM 10 and 10a)</td>
<td>Ev 51, Ev 54</td>
</tr>
<tr>
<td>6</td>
<td>British Metals Recycling Association (SIM 14)</td>
<td>Ev 56</td>
</tr>
<tr>
<td>7</td>
<td>The Royal Society of Chemistry (SIM 17)</td>
<td>Ev 57</td>
</tr>
<tr>
<td>8</td>
<td>The Design Council (SIM 19)</td>
<td>Ev 66</td>
</tr>
<tr>
<td>9</td>
<td>Minor Metals Trade Association (SIM 20, 20a and 20b)</td>
<td>Ev 69, Ev 70, Ev 71</td>
</tr>
<tr>
<td>10</td>
<td>Chatham House (SIM 21)</td>
<td>Ev 72</td>
</tr>
</tbody>
</table>

### List of additional written evidence

* (published in Volume II on the Committee’s website www.parliament.uk/science)

<table>
<thead>
<tr>
<th></th>
<th>Name</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>G R Chapman (SIM 01)</td>
<td>Ev w1</td>
</tr>
<tr>
<td>2</td>
<td>Nicholas Morley (SIM 02)</td>
<td>Ev w2</td>
</tr>
<tr>
<td>3</td>
<td>University of Strathclyde and University of Oxford (SIM 04)</td>
<td>Ev w4</td>
</tr>
<tr>
<td>4</td>
<td>Aerospace and Defence Knowledge Transfer Network, Materials and Structures National Technical Committee (NTC) (SIM 05)</td>
<td>Ev w10</td>
</tr>
<tr>
<td>5</td>
<td>Wolf Minerals Ltd (SIM 06)</td>
<td>Ev w15</td>
</tr>
<tr>
<td>6</td>
<td>Society of Chemical Industry Materials Chemistry Group (SIM 08)</td>
<td>Ev w19</td>
</tr>
<tr>
<td>7</td>
<td>Mineralogical Society of Great Britain and Ireland (SIM 09)</td>
<td>Ev w20</td>
</tr>
<tr>
<td>8</td>
<td>Natural History Museum (SIM 11)</td>
<td>Ev w22</td>
</tr>
<tr>
<td>9</td>
<td>Construction Materials Group, Society of Chemical Industry (SIM 12)</td>
<td>Ev w25</td>
</tr>
<tr>
<td>10</td>
<td>Research Councils UK (SIM 13)</td>
<td>Ev w28</td>
</tr>
<tr>
<td>11</td>
<td>British Standards Institution (BSI) (SIM 15)</td>
<td>Ev w34</td>
</tr>
<tr>
<td>12</td>
<td>The Cobalt Development Institute (SIM 16)</td>
<td>Ev w37</td>
</tr>
<tr>
<td>13</td>
<td>Gareth P Hatch (SIM 18)</td>
<td>Ev w38</td>
</tr>
<tr>
<td>14</td>
<td>Royal Institution of Chartered Surveyors (RICS) (SIM 22)</td>
<td>Ev w44</td>
</tr>
</tbody>
</table>
List of Reports from the Committee during the current Parliament

The reference number of the Government’s response to each Report is printed in brackets after the HC printing number.

**Session 2010–12**

<table>
<thead>
<tr>
<th>Type of Report</th>
<th>Title</th>
<th>HC</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Report</td>
<td>The Reviews into the University of East Anglia’s Climatic Research Unit’s E-mails</td>
<td>444</td>
</tr>
<tr>
<td>Second Report</td>
<td>Technology and Innovation Centres</td>
<td>618</td>
</tr>
<tr>
<td>Third Report</td>
<td>Scientific advice and evidence in emergencies</td>
<td>498</td>
</tr>
<tr>
<td>Second Special Report</td>
<td>The Reviews into the University of East Anglia’s Climatic Research Unit’s E-mails: Government Response to the Committee’s First Report of Session 2010–12</td>
<td>496</td>
</tr>
<tr>
<td>Fourth Report</td>
<td>Astronomy and Particle Physics</td>
<td>806</td>
</tr>
</tbody>
</table>
Oral evidence

Taken before the Science and Technology Committee on Wednesday 26 January 2011

Members present:
Andrew Miller (Chair)
Gavin Barwell
Stephen Metcalfe
David Morris
Stephen Mosley
Graham Stringer
Roger Williams

Examination of Witnesses

Witnesses: Professor David Manning, Secretary for Professional Matters, Geological Society, Dr Bernie Rickinson, Chief Executive, Institute of Materials, Minerals and Mining, and Dr Mike Pitts, Industry Technology Division, Royal Society of Chemistry, gave evidence.

Q1 Chair: Welcome, gentlemen. Thank you for coming as witnesses this morning. As you know, the Committee has decided to embark on an examination of strategically important metals. We are interested in a number of areas. Clearly, the reason why we have invited you is to listen to the scientific views, but we are also taking evidence on recycling, sustainability, product design and a whole range of other issues, some of which came up in an excellent lecture that Dr Pitts gave at the Royal Society of Chemistry not so long ago. The ground that we want to cover is going to be particularly important as time goes on. For the record, would you introduce yourselves?

Professor Manning: My name is David Manning. I am Professor of Soil Science at Newcastle University. I am here as Secretary for Professional Matters at the Geological Society, representing the views of the geological community.

Dr Rickinson: My name is Dr Bernard Rickinson. I am chief executive of the Institute of Materials, Minerals and Mining. I am a metallurgist by training. I also support the activities of the Materials Knowledge Transfer Network.

Dr Pitts: I am Mike Pitts. I am the sustainability manager for the Chemistry Innovation Knowledge Transfer Network. I am here today representing the Royal Society of Chemistry as I sit on the Industry Technology Executive, and I am the RSC champion for sustainable design.

Q2 Chair: Thank you very much. Let’s start at the very basic level. What criteria should we use to define a strategically important metal?

Professor Manning: The key factor that underpins the geological perspective to this is the ability of these materials to be sourced from mined resources. It boils down to security of supply. We have seen in the submissions that we have talked about the concept of reserves and resources. The important thing for the Committee to be aware of is the difference between those two terms, and I would like to clarify that a little, if I can. Resources is a term used to describe the overall availability of materials. We know that these materials and metals are out there. Reserves is the term used very specifically to define that material that can be won from the ground and has a particular value in terms of current technology. So reserves are defined in accordance with stock market regulations to guide investors. With any mining operation you know what the reserves are because you have to declare them according to very strict rules and regulations. But, equally, the geologists who might work for those operations, and indeed the directors, know that there is more to be found.

Q3 Chair: For practical purposes it is available in an appropriate form?

Professor Manning: It is there in the store cupboard, yes.

Q4 Chair: But in a form that can be extracted?

Professor Manning: In a form that can be mined, yes, and can be produced into a product.

Dr Rickinson: Taking it to its very heart, what I would see as a critical metal, a strategically important metal, is one that directly affects the wealth creation available within UK business. There are many metals that can affect that and can affect that supply chain, but, seeing metals as just one part of a materials panoply, there has been a tremendous explosion of development of materials, and metals is one part, during the last 13 years. We can reflect on being in the same position previously. Your inquiry in terms of this as an area of concern has similarly been voiced in the past and there are lessons to be learnt from the past.

Dr Pitts: I would echo the comments about the way in which metals underpin technology, development and growth within an economy. Of particular importance is where they are critical towards future sustainable technologies, which is the way we are going to have to move towards operating as a future healthy sustainable economy. In that respect, we have seen demand grow very strongly for some metals at a pace that will probably outstrip supply in the short term because we just can’t react that quickly to get them out of the ground. That is when they become extremely strategically important.

Q5 Chair: Some metals, of course, have very volatile prices in the markets. Tin is an example. It is not necessarily rare yet but the prices are very volatile.
Q7 Roger Williams: Perhaps you could set out what the key factors are that will dominate the supply shortages for strategic metals for the UK in particular.

Professor Manning: The important thing to bear in mind is that metals occur where they occur in the world, so we are looking at a global distribution of materials. Of course, much of the production is then related to local factors. So we have a complete spectrum of mining activity from what you might imagine in your mind’s eye as a modern huge copper mine or something like that in the western United States through to what is called artisanal mining, where you have very poor people working under very informal conditions to produce columbite and tantalite for our mobile phones. There is this entire spectrum. This is the nature of the business, effectively, across the world.

The supply varies from the large mining companies that are producing the commodity metals, to a large extent, down to the artisanal miners who are producing the more speciality metals. Some of the smaller companies on the AIM market are interested in that as well. The trade is global.

Then we need to think about where the use is. Of course, with commodity metals the use can be global as well, but with a number of minerals the use can be very local. There is a complete spectrum here. Much depends on where the value-added chain then takes off. Is manufacturing going to start closer to the mine so that the components that contain those materials are then sent to other units elsewhere, or does the raw material leave the mine and then go off to be processed elsewhere? For example, I am told mining perlite in that respect, which is not a rare material, but that is an example of a commodity that is mined, taken to where it is needed and expanded to give the fluffy insulation material that we use in building. It is a very diverse spectrum, and it is very difficult to generalise.

Dr Pitts: As a chemist I look at it in reaction rates. Essentially the rate of development of some technologies and the demand that that creates is far outstripping the pace at which we can find new sources to open up or reopen new sources and get them up to speed. It takes something between six to 15 years to either reopen or start up a mine to produce. The cycle time of some technologies come and go but the commercial pressure those can be re-financed and material resources exist elsewhere and with commercial pressure those can be re-financed and brought on stream. In many cases related to the present feelings about rare earth elements, there is a self-balance because, as David has explained, the export of raw materials—ores—could be made more limited as a consequence of their infrastructure development to satisfy growing needs within an emerging or growing population. The recent activity within the rare earth’s area is very much associated with informal conditions to produce columbite and tantalite where you have very poor people working under very poor conditions to produce columbite and tantalite for our mobile phones. There is this entire spectrum. This is the nature of the business, effectively, across the world.

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Q6 Chair: Dr Pitts, you have published a version of the Periodic Table with splashed all over it a list by scarcity almost.

Dr Pitts: We all know about endangered species—plants and animals. It is an attempt to show that the elements are potentially endangered. It is a dynamic situation, of course, and price isn’t always the best indicator of that due to the effects of speculators with certain metals and materials. I would encourage you to broaden the remit to look at phosphorus but also helium, which we are losing irreversibly from the atmosphere and which is the only element we are going to definitely run out of at some point in the future. You can’t create or destroy elements, but the way we are managing most elements is really bad, and we are dispersing them in the environment in a way that makes them harder and harder to recover. We know on a grand scale what we are doing with carbon. We are starting to wake up to how badly we are managing the nitrogen or influencing the natural nitrogen cycle, that material leave the mine and then go off to be expanded to give the fluffy insulation material that we use in building. It is a very diverse spectrum, and it is very difficult to generalise.

Dr Rickinson: In a similar analysis that went on in the late 1970s and early 1980s, from my own institute, they successfully forecast that the growth of developing countries’ needs would provide a stimulus by which the export of raw materials—ores—could be made more limited as a consequence of their infrastructure development to satisfy growing needs within an emerging or growing population. The recent activity within the rare earth’s area is very much associated with informal conditions to produce columbite and tantalite where you have very poor people working under very poor conditions to produce columbite and tantalite for our mobile phones. There is this entire spectrum. This is the nature of the business, effectively, across the world.

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will cause considerable price rises in the future. That will start to limit their availability or price certain technologies and uses out of the market.

Q8 Roger Williams: I don’t think that any or all of you have talked about trade restrictions. Certain Governments have been preventing or trying to work against the export of particular materials. Would you like to say something about that?

Professor Manning: I don’t think that is something we can comment on from a geological perspective.

Dr Rickinson: I can give you another example that doesn’t affect metals, but I was recently made aware that my own institute embraces natural materials just as well as it does metals. A proprietary levy that was being applied from Russia in terms of exporting wood will certainly have impacts associated with the UK’s consumption of that as a commodity, perhaps not at the level that we are aware of at the moment because we know that some construction is at a low, but it affects materials endlessly. There is more and more political debate going on to underpin what is important for local consumption. Last week Materials KTN organised a mission to Holland to understand in actual fact designing out landfill. This was a broad envelope. We succeeded in drawing together many presentations from Dutch business. Every single presentation really started from the point of material scarcity. The Dutch, as is going on in the UK, are very concerned about the way in which resources consumed within the UK’s economy are moved outside the international boundaries. Material resources are all about not just bringing materials in but controlling their use almost in second life and third life within the international contours of every nation. It’s a legacy that we must protect.

Dr Pitts: I am not sure that I am qualified to speak about the politics, but we do see a price differential between internal customers in the countries that control many of these minerals and the export, but that doesn’t really because as we know that some construction is at a low, but it affects materials endlessly. There is more and more political debate going on to underpin what is important for local consumption. Last week Materials KTN organised a mission to Holland to understand in actual fact designing out landfill. This was a broad envelope. We succeeded in drawing together many presentations from Dutch business. Every single presentation really started from the point of material scarcity. The Dutch, as is going on in the UK, are very concerned about the way in which resources consumed within the UK’s economy are moved outside the international boundaries. Material resources are all about not just bringing materials in but controlling their use almost in second life and third life within the international contours of every nation. It’s a legacy that we must protect.

Dr Rickinson: Perhaps one important area in which the UK has a strong presence is power generation, particularly, of power generation and aircraft power generation, the complexity of materials that are used in an engine is incredible and the demands on that are growing all the time. The staple base material for the compressors parts of engines rely on nickel. At the front end you are using titanium or composites. Within the recipes that go on within manufacturing goods within our aero engines, there are a lot of very special materials for coatings. Hafnium is one and platinum is another. Without those materials, the performance and, therefore, the wealth creation of those businesses could be seriously jeopardised.

Dr Pitts: I have spent quite a lot of the last few days talking to all sorts of companies around the UK about material security and every one of them has some kind of issue. It is pretty broad, certainly from a chemical manufacturer’s perspective. It impacts on oil refining, which is something we do a lot of. These materials are used in catalysis, fuel additives, catalytic converters in our vehicle industry and glass manufacturers. Most of the rare earth materials are used in about every consumer product you can think of in electronic equipment. You are all carrying some around in your briefcases, I assure you. So it is pretty widespread. It is probably more hidden than we can really get a full picture of.

Q9 Roger Williams: Perhaps you could tell us which sectors of the UK economy are going to be more vulnerable to shortages of these metals?

Dr Rickinson: Perhaps one important area in which the UK has a strong presence is power generation, aerospace and defence. Certainly from the point of view, particularly, of power generation and aircraft power generation, the complexity of materials that are used in an engine is incredible and the demands on that are growing all the time. The staple base material for the compressors parts of engines rely on nickel. At the front end you are using titanium or composites. Within the recipes that go on within manufacturing goods within our aero engines, there are a lot of very special materials for coatings. Hafnium is one and platinum is another. Without those materials, the
wealth for the UK and strategy for the Government that really need evaluating.

Q11 Roger Williams: I am not quite sure if this is the right panel to ask this question to, but I will give it a go anyway. Given the fact that the Government have set out their priorities and, obviously, industry is very driven within their own particular sector to deliver and improve their technologies, is it the responsibility of the Government or industry to hedge against these particular shortages?  

Professor Manning: There are certainly things the Government can do that would be strategically valuable to help us make better use of these resources. One of these is to make sure that we have an adequate supply of expertise coming through the system of people who understand these materials and who can answer questions of the type that you are asking from the different disciplines that are in front of you. We note that within the public sector we have bodies like the British Geological Survey that have been monitoring the production of minerals globally for 100 years or so now, where the expertise that is required to do that is almost unique globally. There is only the United States Geological Survey and the British Geological Survey that do this. It is terribly important that that type of expertise is maintained. We also note that the provision of teaching and research in universities of the work that is needed to bring new people into the field of economic geology and understanding the distribution, origin and where to find these materials is something that again needs to be sustained and it needs to be sustained through making sure that there is a research base that will allow us to attract the best academics in the world to come and work on this and then to inspire the youngsters, who then have brains agile enough to be able to respond to the needs as they arise. So there is a need for that kind of joined-up strategic thinking. I note in the submission from the RCUK that there is evidence of this and some very positive signs coming out of that in terms of the proposed plan to invest £6 million through the Natural Environment Research Council. We really do want to see that go ahead.

Q12 David Morris: Given that substitution of one metal for another carries the risk of replacing one supply problem with another, do you consider should go into developing substitutes for strategic metals?  

Dr Rickinson: I have just given you one example—the vanadium-niobium link. Another one comes back to medical. There has been a tremendous surge of interest in the use of titanium rather than the use of cobalt. Titanium in certain alloy configurations has certain disadvantages. Cobalt is somewhat well balanced, but the chain is there because if you turn the clock back 25 or 30 years—and it is still true in terms of animal implants because implants go into horses as well as human beings—you go from stainless steel. There is a chain reaction to improvement. The materials research and development activity within the UK is globally recognised as being a very significant player. To put more effort into alternatives to what we envisage as critical materials to wealth creation would be money well spent.

Q13 David Morris: What, if anything, can the Government and industry do to promote any of this substitution?  

Dr Pitts: Invest in research. With some of these, direct substitution is not always possible because the properties are fairly unique. In many cases you might have to go even deeper in the innovation and replace...
it with a whole new way of delivering the same effect. For example, one of the most critical materials is indium, which we use in the screens of phones, televisions at home and all sorts of different LCD-type products. The next generation of technology will probably be organic-based polymers to replace that. It will be organic LEDs that don’t require those metals. But that takes a long time. It has a long lead time in terms of development, but investment in that could put you ahead, and this is something that is happening in some eastern countries, Japan, Korea and so on. Samsung are working very hard on this, for example. I have a Samsung phone. It has an organic-LED screen. At the moment these screens still contain certain metals. The technology is not quite there yet but it is getting there. Within the UK, we have a strength in that area that could be nurtured and we could become real leaders. If you have a substitute technology like that, then you really can take on the world and solve a lot of people’s problems.

Q14 David Morris: So that is in perpetual development?

Dr Pitts: Yes. It is long-term investment. Let me make a quick comment which picks up the last point as well. In talking to a lot of companies recently, they are actively looking to find ways to substitute but they do need support in doing that. I was working in the last few days with the Technology Strategy Board. We are setting up an activity that brings in the Materials Knowledge Transfer Network as well as the Environmental Sustainability Knowledge Transfer Network. We are all connected with different parts of the puzzle on this one and we are working together to try and deliver this.

One of the things that companies would like the most, rather than stockpiling as well as help in looking towards substitution, is some understanding of what materials we will be critical in future, because they get surprised sometimes by the changes in availability. They don’t always know where they should be focusing on substitution within their own product ranges. It’s the International Year of Chemistry this year, and I hope you were all at its launch this week. One of the things that this group, together with the Royal Society of Chemistry, is hoping to do and will be looking at is material security, and it would be great to see this as a recommendation from this Committee as we move towards the fourth quarter of the International Year of Chemistry activities and focus on this topic.

It would be helpful for companies to have something akin to the Stern report for resources, putting an economic value on the linear economy as it stands, where we dig things out of the ground, add value to them and discard them so that we can have a real understanding of not only where materials go within the UK economy but where they come out and the value we are not placing on those, and even the environmental cost of removing these. Once you get to a certain low grade of ore in mining some of these materials, the environmental impact goes up because it is harder and harder to get to that. Although economics might say, “If the price rises, we can get to more inaccessible grades”, there is a concomitant rise in the environmental impact that needs to be costed in.

Professor Manning: I would like to make a very small comment because of course we have heard the response that there is a need for more research. Of course, we have the mechanisms for doing that through the research councils, through various links with industry and all sorts of schemes. The important point to bear in mind is that we need to make sure that what we are discussing today rises sufficiently high in the priorities, because what we recommend as research that needs to be done has to compete with other priorities. So having some kind of joined-up strategy is really important here.

Additionally, we need to recognise that, although the Engineering and Physical Sciences Research Council and the Natural Environment Research Council were named in the submission from the RCUK, the Biotechnology and Biological Sciences Research Council is active in mineral processing as well and we need to make sure that that is not excluded by virtue of not having been mentioned in some of the documentation that you might have seen so far. I think there is a lot a lot is going on.

Bearing in mind the way in which a great deal of research is funded at the present time, perceptions of the public are also becoming increasingly important. Again, we need to take that on board, especially if we are considering the way in which we might consider mining again in this country or developing our own natural resources. We know that this country is one of the most difficult in the world to get planning permission to take a mine forward. Much work remains to be done there.

Dr Rickinson: Could I just add another comment appropriate to substitution and take the discussion slightly wider? There is a problem when you are trying to develop substitutes, alternatives. It is not necessarily in the properties through which you can meet the properties and therefore displace the previous material. It is what happens next. Sadly, in many cases what happens next is a whole raft of testing and feasibility analysis, and that is a long process. Within the aerospace world it certainly exists over a 10 to 13 year period, so it is not short.

I would suggest to you that the word “substitution” is actually broadened to incorporate the recycling of second-use material. There are downsides within including used material into virgin materials because sometimes the properties aren’t exactly as you would wish. Therefore, if you are talking about the way in which Government could develop things, not only is there a need for the development of alternatives, but a need exists to consider the way in which we could re-use more of that material and apply development to improving that reused material. Perhaps from the people point of view, we should be encouraging the populace not to see recycled, reused material, that perception, as being second best.

There are two strands to the argument, but they very definitely come back to your words “substitution” and “alternatives”, but they are using more of the same rather than seeing a different element being used for the same purpose.
Dr Pitts: In relation to straightforward substitution of one material with another, you can spend a lot of time and a lot of effort, as Bernie suggested, just to be where you were when you started and there is no overall improvement in the material. An approach which Bernie has just described is to substitute a material with a better business model and a better process. A gain, that takes longer and more effort but potentially it puts you in a better position at the end of it. Some of these developments will take longer but we will have a more sustainable approach when we finish.

Q15 David Morris: Do you think the technology is in place at this moment in time to refine the recycling of these materials to make the quantities and qualities uniform in the recyclable approach?

Dr Pitts: Certainly potentially. In most cases it is technically feasible but economically not, because we are not really costing properly the use of virgin material. Hence there is a need to put a proper price on this and understand where it goes. In most cases the technology exists, but where more work is needed the cost is not necessarily in place and it is not seen as a nice academic challenge and there is not the concentration on it that there could be. There are however some really good groups around the UK that are already working on this.

Q16 Chair: If we model things based upon labour and energy costs in this country and applied that to the cost of the natural material, in that way you would be forced to think more rigorously.

Dr Pitts: It should be the full costs of taking it out of the ground because that is usually displaced in another country. It would be the energy cost and the environmental impact of mining the material in the first place. That has to be taken into account and balanced off. We all know that aluminium is something like 5% of the amount of energy used to recycle the material rather than from mined ore in the first place. That is not the case for every metal.

Q17 Chair: The more scarce it gets, the higher the price.

Dr Pitts: Yes. Obviously, the higher the price goes anyway, the more economic the recycling methods are, but I don't think we are seeing the true price of it, anyway, in the first place.

Q18 Graham Stringer: Dr Pitts told us one of the recommendations he would like to see out of the report. What recommendations would the other two witnesses like to see out of this report?

Professor Manning: The most important thing from our perspective is to make sure that we have the expertise coming through the system. I mentioned this earlier on. We are conscious that those people who were involved with a lot of the fundamental work about mineral deposits and the occurrence and formation of these things, which is the very base of understanding where minerals come from, are getting to be quite grey haired and there will be a bit of a demographic time bomb there potentially. We reckon that there may be six or seven universities in this country which, truly globally, are competing in terms of the science that is required, but they are competing against some extremely strong players in Australia, North America and Canada. We really do need to sustain this activity and make sure it continues.

We also see at the present time, for example, that there is only one Masts programme in mining geology in the country and that is in Camborne School of Mines, which is part of the university of Exeter. Of the 40 graduates who they take each year, which is a very successful course, they mostly go off to South Africa and Australia to work, so we are not retaining brains in this country. It was ever thus. This is a global industry, people work globally and it is very good for our people to go and study and work overseas and then to come back in the fullness of time. But, over the years, it has meant that we have tended to neglect what we have in this country.

We see, for example, a major survey carried out in Northern Ireland using modern geophysical methods, which has never been done in England and Wales or in Scotland, and 90% now of the territory is licensed for mineral exploration as a consequence. We assume that because Cornwall is fairly well prospected and for thousands of years as a mineral stockpile, we don't need to do any more work there, yet there are treasures in Cornwall waiting to be found. We need to make sure that this is consistently being worked through and that continued work takes place on the geology and aspects of the geological science.

In a way, we face a fundamental decision, especially as the universities and the British Geological Survey are going through a period of change, thinking about to what extent we are going to be spectators on the world stage or to what extent we are going to continue to lead. Given the success we have in sending our young people, our graduates, through to recruitment in the global mining companies, which is where we are still a preferred source of recruitment, it needs to continue. We see the long-term benefits of that coming through, but we have to make sure that we are able to capture the interest of the school leavers and turn out people through the universities who are stimulated by research that is appropriate. That is where the biggest challenge lies at the present time.

Dr Rickinson: I have seen almost four strands in some recommendations. I think it is timely that there be a re-audit—that could be part of your own remit—and an in-depth analysis of those materials in the broadest sense that are important for the UK economy. Certainly, from my point of view, I would like to see a recommendation that a more detailed audit is taking place.

You would probably find that many of the solutions to the problem already exist. It is one, therefore, of awareness. To give you an example, on the neodymium iron boron issue that I have already mentioned, through funding that has gone on within the TSB and collaborations at the university of Birmingham, a recycling technique has been discovered, evaluated and proven, and it is looking now for commercial development, by which neodymium iron boron magnets could be recycled within the UK. So out of that university of Birmingham work funded by the TSB, which was a
short, sharp programme, a solution is pending. We have to make that awareness of what is there available. We have to influence the way in which product design and materials work more closely together in the marketplace. Can we reduce our reliance on critical materials by alternative choice but at the product design stage just as much as at the materials science stage? I see the linking together of product design, the recycling and the ease of disability all being part of an important solution to the issue. Coming out of the mission that we ran in Holland last week, it was a reflection that we can’t do it on our own. The Dutch were saying that just as much as the UK were saying that. Therefore, I sense that this is a collaborative activity that has got to go on over international boundaries. So I would like to see those four recommendations very definitely coming through.

Q19 Graham Stringer: That’s our report written after those answers. If we can go back to the point that Professor Manning was making earlier about resources within this country, in Cornwall and the south-west, how big a problem are the planning regulations on mineral rights issues? If there was a will in Government, is it possible to exploit the resources that we have in this country or are the barriers too high?

Professor Manning: The barriers are certainly complex. We know that where existing planning permissions exist for all sorts of mining operations that is the easy way in to build on the back of something that has been granted many years ago for a different purpose sometimes. That can be taken forward. There could be some ease in terms of the strategic need for materials being recognised in the same way that the planning law is being changed from the point of view of looking at major installations over power generation and things like that. If mining could come into that category, that would help.

The important point about mining is that much of the problem arises from the automatic assumption that a mine is definitely not a good neighbour. This is where the mining industry has a role to play in demonstrating that a modern mine, run to standards that we would expect in this country, can be a very good neighbour. We see this in some of the open pit coalmining near where I live in Northumberland. The mines of one of the very good companies that operates there can be scarcely visible, and so the company can have problems in getting planning permission because no one knows a mine is there. It has backfired to some extent and they have to work very hard to demonstrate to the public for example just how quiet they are. That is where there is a double edge to this. The consultation process tends to throw up objections that are based on historical perceptions rather than present day perceptions, and there may be ways in which that can be eased.

In general terms, the issues of mineral rights and mineral ownership are extremely complicated and can also get in the way. Of course, they vary between England and Wales, and Scotland, on the other hand. I can’t comment on those in detail.

Q20 Graham Stringer: Dr Pitts was saying earlier that the other side of this equation is where we buy rare earth and other difficult-to-obtain metals from. How bad environmentally and to the individuals involved is the extraction of rare earths in China? Can you give us a description of what conditions are like?

Professor Manning: Have you come across this in detail? We were talking about this yesterday. We don’t know much about the extraction process.

Q21 Graham Stringer: I have just read that the conditions are poor.

Professor Manning: We were saying yesterday that one of the ways in which this is done is that the shale is taken out of the ground, it is treated with acid in vats and then the materials are leached out and taken away for refining. The important thing is that there is a huge amount of residual material left because we are seeing mining of a material that is quite low in concentration, even though the ore metals are abundant in these particular deposits. So there are huge amounts of waste. There is the use of acids. There is the potential of natural radioactivity associated with the rare earths in particular. So there is a whole accumulated set of issues even before it leaves the mine to go through to wherever the output of the mine is treated. We would like to know a lot more about it in this particular instance. It is not something that we are very familiar with.

Dr Pitts: They are working very hard to improve environmental standards and manage the industry right across China, which is having a knock-on effect on the price because there is an associated price with better management of tailings, radioactive waste and human welfare.

Q22 Graham Stringer: Has the European Waste Electrical and Electronic Equipment Directive helped with the recycling process or should it be developed further?

Dr Rickinson: I think it has very much helped but I am not sure that the logistics are absolutely right yet. Certainly, the evidence that we gathered from the Holland mission suggests that a significant amount of electronic goods related to either IT or straightforward domestic appliances is being recovered in a much better way than has previously been the case. I tended to see that the practice in Holland was somewhat better organised than in the UK, but it’s no doubt had a beneficial effect.

Dr Pitts: I don’t think the legislation has quite done everything it was intended to in terms of driving better product design and encouraging manufacturers to design their materials for recovery and reuse. That is not to say that there aren’t extremely good examples of companies that have done them, even within the UK. I know of one very good example which my colleague, Tony Hartwell, in the next session may be able to elaborate on some more, where Unipart has made a profitable business out of recycling the Sky receiver boxes. But in other cases the linking is not there. A parallel directive is the End of Life Vehicle Directive. It won’t be long before something like 90% of a vehicle has to be recycled. The people taking the vehicles apart aren’t necessarily connected up with the
people making the components in the first place, who would really like to get those materials back. It is a lot easier if you are taking back a product but, if you are part of a very long distributive supply chain, it is very hard for you to keep track of those materials and get them back in an economic way to use them again. You can design it for that. Of course, there are conflicting design requirements as well as the requirements of safety and longevity. Before Christmas, we talked to a manufacturer of car stereo speakers, for example, that use neodymium magnets because there is a huge pressure on weight. They want higher performing magnets for very good quality speakers but these things have to last, with car warranties extending all the times, 20 to 30 years. They have to be as lightweight as possible and as cheap as possible as well, but of course there is no way that a car speaker manufacturer, from the way we manage our vehicle waste at the moment, is ever going to see those speakers again, much as they would like to.

Q23 Gavin Barwell: Professor Manning was just saying that a modern mine run to a high standard can be a good neighbour. Does the panel as a whole think that a resurgence in domestic mining, either terrestrial or offshore, is compatible with contemporary attitudes towards environmental protection?

Professor Manning: Yes, I think it is. One of the good things about mining in this country is that we can be absolutely sure of the control of the environmental parameters. If we are interested in making sure that we are responsible consumers of mined materials, then the more we do that under our own control the better.

Dr Rickinson: I would certainly endorse that the change over the last decade in terms of sustainability, environment to be parameters and health and safety associated with mining has changed in all respects. Therefore, a mining application within the UK would be at a different level than it was probably previously thought of by the public. It’s a matter of perception, though, and convincing the public that that, indeed, is actually taking place.

Dr Pitts: I am not qualified to comment on mining but I would say we need to get better. We have the capability in the UK within our chemistry, science and engineering infrastructure to develop much better ways to get materials out of mining ores and also so-called waste streams where the concentration can often be higher than in the ore that it came from.

Q24 Gavin Barwell: My next question is to Professor Manning. The Geological Society of London in the written evidence it submitted said that with modern mining extraction techniques, coupled with high levels of environmental safety, you believe it is possible to satisfy concerns as well as deliver an economic benefit, and you would be happy to provide details of specific instances to the Committee. Could you give us a couple of examples?

Professor Manning: Yes. We can certainly supply some examples in writing in the fullness of time. With regard to the examples which come to mind, if I can call upon something which is not necessarily part of your inquiry, we can see that one of the justifications of open pit mining of coal is that it supplies the fire clay which is required to give a pale coloured brick that architects specify. If open cast coal mining did not take place, then it would not be possible to source those bricks. So that is a very small example of how a single operation can produce different products for more than one market and more than one requirement, making best use of the opportunity to break open the earth. That is just one example.

Q25 Gavin Barwell: Oakdene Hollins, in their written evidence, said that there was a case for voluntary labelling schemes, such as that which the Forest Stewardship Council uses to improve standards of mining across the world. Is that something that any of you would like to comment on? Is it something you agree with?

Professor Manning: It’s an interesting concept. There is certainly scope for that. Certainly the more reputable companies would be able to wear such a badge with pride. There is a lot to be said for that.

Dr Rickinson: I couldn’t answer.

Dr Pitts: Generally, with labelling schemes, the aim is engaging the retailers in understanding the issue because they tend to be the ones who make the decisions, not the consumer.

Q26 Gavin Barwell: Finally, can any of you offer any specific comments in terms of what can be done to protect the marine environment from offshore mining activity?

Professor Manning: Yes. There is obviously a long history of marine mining and damage that it has caused. That is a major concern in many parts of the world. It is like mining on land in the sense that there are, undoubtedly, going to be environmental costs. You cannot deny that in any mining operation. You have to make sure that those are acceptable. Then it comes down to how you define what the acceptable environmental burden is that mining might impose. I think that would be something carried out on a case by case basis. We have seen the damage done in the offshore extraction of aggregates to fuel this city with its construction needs. That’s one example which comes immediately to mind. If we were to look for materials like platinum offshore in western Scotland, it would be another matter again. A case by case basis is what is needed.

Dr Rickinson: Certainly from a materials point of view, manganese and magnesium are often cited as two materials that have the capability of being extracted from oceans. Of the two, manganese is probably more easily accessible on land rather than resorting to ocean mining. As for magnesium, quite a lot of development work is going on at the moment since magnesium is seen as a material of choice for lightweight going forward, but magnesium costs at the moment are prohibitive.

Dr Pitts: I couldn’t comment.

Q27 Chair: To what extent are mining opportunities offshore a significant part of the solution?

Professor Manning: It is very variable in the sense that you can think of some examples in some parts of
the world where offshore mining would be possible. I am thinking of materials that are sands that have been eroded from the surface and deposited offshore. Those have been mined particularly, for example, in southeast Asia, for tin in the past, and there is scope for going back to look at that. There has even been consideration of doing that offshore in Cornwall in the past, as I can recall, during my career. Generally speaking, I think the preference is to mine on land, because logistically there are some benefits. Offshore brings in additional uncertainties. We also have the issue of mining the sea water itself. Indeed, with the magnesium, that could be derived from sea water itself rather than from any minerals that are found underneath the sea. So there is a difference there to be borne in mind. Sea water itself is a raw material, that is, there are some benefits. We need to be aware that offshore mining is not so much a case of having a mine like an oil well that goes from an offshore platform, down a shaft and then you have mining offshore in that sense. Offshore mining is generally taking something that is at the sea bed and removing it for processing on land. So it is necessarily going to be very disruptive to the sea bed. Underground mining offshore is something that can be contemplated and, indeed, does take place in this country at the present time for potassium in Yorkshire. We know that you can have a mine where you start off onshore and end up offshore, underneath the sea. That is something which will go on with the same type of environmental restrictions as you find for an onshore mine. It just so happens that the sea is between you and the atmosphere.

Q28 Stephen Metcalf: If we were to expand mining activity here within the UK, would the driver for that be because it is economically viable and we would be adding to the overall capacity, to the pot of resources that we have in the UK? If we were to expand activity here within the UK, would that be because it is economically viable and we would be adding to the overall capacity, to the pot of resources that we have in the UK, or would that be because it is economically viable and we would be adding to the overall capacity, to the pot of resources that we have in the UK, or would it be because we need to protect our own supply chain? Is there a diversity available within our own country that would help do that?

Professor Manning: It is fair to say that we don't have the resources in this country that would enable us to go out and mine what we need on a strategic basis, particularly for something like rare earths. For tungsten we might have, but tungsten is the only metal that has come out of our inquiries in connection with this matter that would be in that category. We have to work with other people. In the context of some of these strategic metals, then a European approach might be the most appropriate way of looking at that. Even then, there are some materials that we don't know of as resources let alone reserves in Europe. So we are going to have to work with the north Americans, Canada and the United States, to look at rare earths, for example. This is the way the industry functions, of course, as a global industry and, in a sense, we want to see ways of encouraging that type of global exploration and trade but where we are in the driving seat and able to understand the commercial opportunities.

Dr Rickinson: Could I answer your question in a slightly broader way and suggest that mining opportunities might exist but not necessarily in the traditional way in which you are creating a new mine? Certainly the activities that I have seen over the last few years of our KTN activity starting to gain favour is the mining of resources that, to some extent, we have created— in other words, mining of landfill. There is good documentation within landfills as to what they contain. As the choice of the public has changed over the years, there is a repository of material that exists within our landfills. As a future life rather than simply to extract methane as a fuel gas from evolving landfills, here is an opportunity to create that second resource. Alternatively, one goes back to the tailings that exist in previous mines. I would suggest that work should go on both from a strategic point of view and from meeting domestic supply in tailings rather than necessarily sinking new mines. In both cases, one is re-evaluating that which has already been used. Certainly, the opportunity of re-mining landfill is something that we should take seriously. I was struck by the fact that, again, coming back to our Dutch mission, they were suggesting that the UK had a unique opportunity not to make the same mistake that the Dutch had fallen into. They had very little landfill to consume and needed to slow down the rate of landfill use. So they opted for a pathway towards incineration. Incineration has a habit of effectively using up the resources that are coming into the country. From the point of view of containing that raw material that has been used on our island and giving it a new life, I would suggest that mining might be considered in slightly different contexts.

Dr Pitts: I would endorse that and add to it slightly in terms of not really knowing where all our so-called waste material goes. I don't really have much in the way of data for where much of our electronic waste goes, for example. Most of it gets exported because it is cheaper and more economic to have that process dealt with elsewhere in the world. I have some data with me. In 2005, we exported 800,000 tonnes of non-ferrous metals. That was a 20% increase on the previous year. Would it have been better if it had been kept here and been used and processed? Bernie, you might want to comment on that.

Dr Rickinson: I could. It is incredibly sad. Part of an activity that we are involved in with the Home Office comes back to copper and copper theft—effectively, it's getting out of the country and, potentially, it's going out to China and it might even be to Poland. Why is it going there? It's going there because the evidence we have at the moment is that scrap dealers who are dealing in scrap copper have no place left in the UK for it to be re-melted. This has gone under the radar, effectively. When I trained as a metallurgist, the north-west area around Preston was rich in so far as the manufacture of copper cable was concerned, and it still is. As we understand, but to be confirmed, all of that raw material is actually coming in as coil to be drawn down to supply our national infrastructure. It seems rather sad, then, that all of that theft or all of that scrap material is exiting the UK, with all the carbon miles associated with bringing it back, rather than a
Q29 Chair: That ignores the morality of those awful pictures of kids sitting on scrap heaps dismantling things, doesn’t it?
Dr Rickinson: Yes, it would.

Q30 Chair: They are our goods.
Dr Rickinson: If one developed a strategy along these lines, it might also create a greater deterrent through which you could stop copper theft happening in the first place because much of it goes outside the country without it necessarily being observed.

Q31 Graham Stringer: Do you think we need a form of Government intervention or do you think that the market will deal with that situation? It is rather surprising, given those enormous figures, that the market hasn’t dealt with that.
Dr Rickinson: I think it is commercially related. The market could respond, but herein is an opportunity. Within your own evaluation, whether it is rare earths or whatever, there are immense technical opportunities for the UK, because processes have been developed in which the UK could invest without necessarily going through a melting route.

Q32 Stephen Metcalfe: Assuming that we did develop this recycling capacity, how would we then encourage manufacturers to design products where either we are minimising the use of these particular metals or we are making it much easier to recover them? You spoke of mining old landfill sites, but not much thought was given to how you might get the material out of the product again at a later point. Going forward, presumably, this has to be a priority. How do we encourage manufacturers and designers to do that?
Dr Pitts: Behaviour change does come with changes in price. I have heard much anecdotal evidence in the last few days where companies, because the price has risen, have started to do internal recycling where they had not done that before. As I said, good quality information is what they need to know what might surprise them in the future. They can’t say what it might be because they are going to be surprised, and we need to know what is coming in, what is going out and what might be a future threat. The picture is really not as clear as it should be. The real value of SIMs is not placed on them.
Professor Manning: The only point I would make in connection with recycling is, of course, that the demand for raw materials far exceeds the amount that is being thrown away, or at least I would like to be satisfied that we are able to bridge that gap quite happily. Provided that limitation is taken on board, there is no reason why recycling shouldn’t contribute a major amount, but whether we are going to go the whole way remains to be seen because we simply haven’t thrown away enough yet. We are still using it. That is a major issue that means that continuous mining is going to be needed.
As to the mining of landfills, as one who has spent many a happy hour on a landfill site, it is a challenge for us. The interesting aspect of this is that some of the innovative ways of treating domestic waste are mineral processing-type activities that are being applied to what the dustbin lorry delivers to a works. We are seeing movement in that direction. We will see this develop more and more as time goes on, but the materials that would be coming out of landfill would be the commodity metals, I would think, more than anything else at the present time.

Q33 Stephen Metcalfe: I understand that as we recycle some of these metals they lose their properties. You touched upon that earlier. Is there any way of mitigating that? How does one maintain the quality of material that has been recovered and then recycled, or do you lose it eventually?
Dr Rickinson: It varies from one material to another, so there is no universal rule here. You can certainly go through product development in terms of greater and greater use of recycled scraps, but when it comes to critically performing materials like turbine blades in aircraft there is only a limited amount of material that might be returned for a particular specification. The same is true of aluminium in terms of picking up tramp elements like iron, which reduce properties. I am convinced that, with additional alloying substitutions and development in that area, that might be counter-balanced. From metals it goes into plasterboard. Plasterboard has a limit in terms of the amount of recycled materials that you can put into it. It is really a matter of helping and encouraging that development, by which we might increase that quantity to reduce our net inventory of raw material coming into the UK.
Dr Pitts: Pure metals are infinitely recyclable. It is only when we start to combine them that it causes the problem. It is economy of scale, really. When you are mining, it is the same kinds of processes. If you can get a high enough concentration of a particular type of material, you will find a way to do it because it will be worthwhile.
Chair: Gentlemen, thank you very much. That has been an extremely helpful start to our inquiry.
Examination of Witnesses

Witnesses: Ian Hetherington, Director General, British Metals Recycling Association, Sophie Thomas, Council Member, The Design Council, Tony Hartwell, Knowledge Transfer Manager, The Environmental Sustainability Knowledge Transfer Network, and Louis Brimacombe, Head, Environment and Sustainability Research Team, Tata Steel, gave evidence.

Q34 Chair: Thank you for attending this morning. Perhaps, for the record, you would be kind enough to introduce yourselves.

Sophie Thomas: My name is Sophie Thomas. I am here representing the Design Council of the UK.

Ian Hetherington: My name is Ian Hetherington. I represent the British Metals Recycling Association.

Tony Hartwell: My name is Tony Hartwell. I am from the Environmental Sustainability Knowledge Transfer Network.

Louis Brimacombe: I am Louis Brimacombe. I am the environmental research manager for Tata Steel Europe but also I chair the Sustainable Development Group of the Institute of Materials, Minerals and Mining.

Q35 Chair: I have a simple question for you all and then I have a couple of specific questions. Perhaps you would tell us what criteria you would use to define a strategically important metal?

Louis Brimacombe: Tony and I have been discussing this. I regard something as strategically important if the UK is vulnerable in terms of either supply or production in terms of our future viability from a GDP viewpoint. I would include more than just rare earth metals. I would include steel, aluminium and all the alloying elements that go with that as well.

Tony Hartwell: Traditionally, “strategic” has been thought of in military terms. Historically, people have stockpiled to cope with situations to deal with military applications. Certainly that is the case in the US. In Japan, they have stockpiled for different reasons for their own economic performance and manufacturing industries. The US has one definition, which is called “critical materials”, when the Department of Defense is the major customer for that material. For example, beryllium is what they consider to be a critical material. It is not only the materials themselves that are important but the facilities for processing and making a finished product from those materials. It is no good just having any rare earth metal itself if you can’t process it and then convert it into a finished product. It is technology throughout the supply chain that makes a strategic material.

Q36 Chair: In your earlier written evidence from your organisation, you referred to the form of metals in the context of what was strategic. Could you expand on that?

Tony Hartwell: For example, there is a new manufacturing technique called Additive Layer Manufacturing where you can make complex components from metal powders, but the powder has to be in the right form. It is a special technique to make the powders for that particular process. You may be making something out of titanium but if you have a titanium ingot you can’t use Additive Layer Manufacturing. You have to convert that titanium into a titanium powder that can be used in the process.

That is the point I was trying to make. It’s not just the material but it’s the form that it’s in that is important.

Ian Hetherington: Yes. We would hesitate to define strategic metals or strategic materials. In very broad terms, it’s those that are critical, in danger or their scarcity would endanger the economy, not of the UK because I don’t think we can look at this on a domestic UK basis, rather we have to look at Europe and at other western developed countries. A narrow definition of what is strategic to the UK leads us down some very black alleys and some dangerous paths.

Q37 Chair: Again, coming back to your evidence, Mr Hetherington, you encourage us not to look at metals that have volatile prices in the market. If the word “strategic” does mean to some end users what they pay for it, why are you trying to discourage us from looking at that?

Ian Hetherington: The reason why we submitted in that form and would continue to assert that is because metals are traded as a commodity, whether it is steel, copper or any of the rare earth metals, although some of those are special cases, we believe. These prices are volatile. They are volatile for particular reasons, but that in a sense does not make them in any national or geopolitical sense strategic. The economics of extraction, recycling, recovery and processing are such that they have price volatility. It is an inescapable fact. It doesn’t necessarily signify any great scarcity. We would argue that there is no intrinsic scarcity of copper. The reason for price volatility at the moment is as much to do with hedge funds buying vast quantities of physical copper as it is to do with excessive demand within the Chinese infrastructure. There are many factors affecting price and we would contend that they do not form a basis on their own for needing to develop national strategies.

Sophie Thomas: I come from a very different point of view. As a designer and somebody who is representing the design industry, I see these materials as the building blocks of design. They are the raw materials that we make things with. If you look from the other side of the argument, with regards to the waste stream that is coming out, the fact that we are not being responsible in the way we are using these materials and the way that design should be thinking about the whole loop of how we recover them, I see great opportunity in that. There is a bigger picture when it comes to material scarcity.

Tony Hartwell: I would like to comment on one point that Ian made. I was talking to an alloys producer yesterday that uses a pure chromium metal in their alloys. They used to buy it from a company called Elementis in the UK that shut down their plant two years ago. The price they pay now is about £9 per kilo when they used to pay about £5. I agree with Ian that the UK needs to look at it in a European context, to consider the European Raw Material Initiative and the critical materials strategy and find places where the UK has niches where it can contribute in a European
context. We have manufacturing facilities for magnesium and magnesium alloys in Manchester. That is a special facility which we should expand on. It makes special alloys for the aerospace industry. Let’s find the niches where we can support a European programme.

**Q38 Stephen Mosley:** We heard in the previous panel that there might be an opportunity for UK domestic extraction to meet some of the shortfall in future demand. We are also considering the environmental impact of that. As a starter question, how do you consider that the environmental impact of mining in the UK compares with the impact of mining elsewhere in the world?

**Tony Hartwell:** Once upon a time we had the biggest copper mine in the world in the UK in Anglesey, and Swansea was called “Copperopolis”. It was the centre of copper production in the world. That was one of the bubbles before the internet or after the tulips. There is a demand for these metals and they are going to be produced somewhere in the world. The point is that, if we are using the metals, we have a responsibility to see that they are mined sustainably wherever they are made. The International Council on Mining and Metals is working towards a sustainable development programme for all of their members, for all of the international mining groups. There is the prospect to develop a tungsten mine in the UK. Coming back to the military connection, it was developed during the Second World War because tungsten was a strategic material. They built a pilot plant. It was never quite developed before the end of the war. It was revisited in the 1970s, and they were going to reopen it. They had planning permission to reopen it, and then there was an oil crisis and it never happened. Now they are looking at redeveloping it again. Tungsten is certainly a strategic material and Europe is very dependent on imports of tungsten. In my view, tungsten is a critical material so we should look at how we can develop it and process it sustainably within the UK.

**Sophie Thomas:** It helps in terms of when you are looking at closed loop systems and concepts such as cradle to cradle, which is about knowing where your materials come from, how they are mined, making sure that there are proper labour laws in your chain of suppliers and building it into the whole infrastructure of when and how you get it back. The more you can control quality throughout the whole phases of material and design, reprocessing and recovering, the better.

**Q39 Stephen Mosley:** On that last point, when it comes to importing materials from elsewhere, do you think the Government have a role in setting and monitoring environmental standards, or do you think that we should be moving in the direction of some sort of voluntary scheme, for instance, similar to the Forest Stewardship Council, having some sort of mark to demonstrate that the materials are coming from an environmentally friendly source?

**Sophie Thomas:** They are very interesting points. I was with the Institute of Materials and Metals last week on a Designing out Landfill mission in the Netherlands. We were shown really good case studies of manufacturing systems which had very close relationships with their waste manufacturing companies. They were backed up by good, strong central government laws and local municipal laws which helped make sure that the chain of custody, knowledge and experience of all the people came together to create very innovative ways of designing and recovery of materials. We could learn a lot from them here. And it showed that a mixture of these things brought the ideal environment for innovation. There was a big push from Government there, including the landfill ban, for instance, and a move towards effective recycling, efficient recovery and incineration.

**Tony Hartwell:** I am in danger of being considered a Japanophile if I talk through this presentation, but they have an organisation called JOGMEC that looks at sourcing materials such as oil, gas and minerals for the Japanese industry. They not only look at what they do with materials within Japan but they invest in mining developments. If you are going to influence how a mine is developed, then investment and engagement in the mining activities is a way that you can do that. They will take a share. People are now talking about the Chinese buying into mining organisations and controlling them. The Japanese have done that for many years. Britain did it, but through commercial companies in the past. There is not really a central agency in the UK that is responsible for managing resource inputs into the UK. So there is not one department that is responsible for that. Maybe that is something we could consider.

**Q40 Chair:** Should there be?

**Tony Hartwell:** When we produced more than 100 million tonnes of coal we had a National Coal Board. Materials are responsible for a great deal of energy consumption and a lot of CO₂ emissions. So if we have agencies for energy and CO₂, it would make sense to have an agency for materials that was looking at aspects of materials.
Stephen Mosley: In answer to one of the previous questions, you mentioned about planning permission being granted in the 1970s for this tungsten mine. One of the issues that we heard about from the previous panel was that it is difficult to open new mines because of the planning restrictions, and in many cases you do have to rely upon mines that gained planning permission many years ago in order to look for new resources. Do you think that the UK’s planning system needs some sort of reform to make it easier to open new mines?

Tony Hartwell: Yes. I don’t think it is just the UK, but Europe as a whole is in a similar position. We spoke to a company that was looking at developing mining assets and they said they wouldn’t even look at deposits in Europe because they know it is going to take them 10 or 15 years to go from discovering the deposit to getting into production. They just can’t afford to do that. They can’t afford to invest in developing the deposit, exploring for it and going on to do that. The same is happening now in America where they are trying to shorten their planning process from two years to one year for minerals and metals. Certainly the planning process takes a long time. There are two aspects to that. Of course, these things do need to be properly evaluated, but we need, perhaps, to educate, not indoctrinate, the public that we all use materials, so if we are using them they have to come from somewhere. If you have a quarry or a mine close to where you live and you don’t want that, then maybe you shouldn’t use any materials at all because we all use them, so somebody has to have a mine next to them.

Q43 Roger Williams: In answer to one of the previous questions, you mentioned about planning permission being granted in the 1970s for this tungsten mine. One of the issues that we heard about from the previous panel was that it is difficult to open new mines because of the planning restrictions, and in many cases you do have to rely upon mines that gained planning permission many years ago in order to look for new resources. Do you think that the UK’s planning system needs some sort of reform to make it easier to open new mines?

Louis Brimacombe: Can I make a general point? Picking up on what Sophie said, you can have an avoidance of landfill by having incineration and so on, but there is no doubt about it that, in life cycle terms, in trying to reduce environmental impacts, reuse, recycling and reduction are the key strategies. The way you have mentioned it is as if the reuse systems are already there, but they are not. There is a huge opportunity for the UK to develop infrastructure and knowledge to improve reuse. That would be a significant change to the environmental impact, but it would also be a significant change in terms of the availability of scarce materials because the range of materials that we are talking about is broad. But there are things in electronic goods, phones and computers. The material is in there. If we have a scarcity of supply, why not develop technologies to move into that area? It is a fairly new concept that will require new technology and we need to do some research to support that.

Ian Hetherington: The volumes of strategic metals—well, I will borrow that phrase—occurring in the end of life supply chain at the moment are very limited. As to the life cycle for any of this type of equipment, if it is a car, it is running currently at 16 years. I suspect that some of the energy generation equipment that we are talking about and some of the more sophisticated electronic uses of rare earth metals may be shorter than that. They are of that type of dimension—it could be 10 to 12 years. If we look 10, 12 to 16 years back from today, the use of these materials was not as great as it is today and, clearly, it is probably not as great as it will be in another 10 years. We are now at the point of having to plan as recyclers to start to receive these materials in meaningful quantities. At the moment the quantity is not available, so it is not that the capability does not exist within UK recycling—because it does exist—but the volumes are not available. Currently, we are recovering substantial quantities of platinum, rhodium and palladium, along with gold and silver, mainly from recovered waste electrical and electronic equipment. Recovery rates from materials that actually get to UK recyclers are very high. We are hitting over 90% of all materials that are recovered and reused. The difficulty comes from collecting the stuff in the first place. The rates of collection are low. Government are trying to do more with that at the moment and I think they will succeed in time. So the capability is there. Not only is there not the supply, but also there is not a market. I did some work ahead of today to find out what the current quoted price for secondary neodymium was, which is probably the most frequently occurring, and nobody can find a price. There isn’t actually a market for a lot of these secondary strategic materials. While there isn’t a market, there won’t be any effective recycling.

Q44 Chair: It sounds to me as though you could have a discussion with Mr Brimacombe afterwards and a deal could be struck. You talked about the collection issues. Have you given any thought to how that ought to be put in place strategically? Do we need
Tony Hartwell: critical, especially with magnets, for example, because collection, recovery and reuse. Reuse is absolutely see some of this more sophisticated material coming informational basis, especially as we are beginning to equally industry. A lot of this can be done on an European countries have done it less well than the UK, but we are all moving in the right direction. Where there are no controls is in the area of industrial and commercial electronic and electrical waste. That is working. It's working more slowly in the UK than in Holland, for example. Holland have embraced this and done it very well. Some other Where there are no controls is in the area of industrial and commercial electronic and electrical waste. That is working. It's working more slowly in the UK than in Holland, for example. Holland have embraced this and done it very well. Some other areas which Government need to grasp but equally industry. A lot of this can be done on an informational basis, especially as we are beginning to see some of this more sophisticated material coming through, which is essentially industrial equipment. We need to build more sophisticated models for its collection, recovery and reuse. Reuse is absolutely critical, especially with magnets, for example, because they can be reused.

Tony Hartwell: There are two important points that I would like to make here. We don't consume metals. When we use oil, we burn it and it is destroyed, but, with metals, we don't consume them. We dissipate them to a greater or lesser extent. So when we look at metals, we have supply from ore and from scrap, and it goes into the technosphere and is available for future use. We have to try and balance the supply of primary material and the supply of secondary material to replace the losses in the system, and that is different for different metals. If anybody talks about consuming metals, it is a term that is used loosely because they divide the number of tonnes produced by the number of people and it gives you consumption per head. But please don't think of it in consumption terms like we do with oil. It is available.

What is important with secondary materials is that the environmental impact of using those, if the system is designed well, is significantly less than primary production. We can help to reduce our CO2 emissions and improve our energy efficiency by a well-designed secondary recovery.

The second point is that the problem we have with recovering some of these hi-tech metals is that they are used in very small quantities. It is probably 50 mg of tantalum here (pointing to a mobile phone) and 50 mg of other high-value materials. We need to try and design them in a way that we can dismantle segments of it that have compatible metals. At the moment this would probably go to a copper smelter in Belgium or Sweden and they will recover some of the metals, but some of the hi-tech metals will not be recovered because they are incompatible with that smelting process, whereas if you separated them out into different components and processed them in a different way you would have a better chance of recovering them.

Q45 Roger Williams: Mr. Hetherington, following on from that point, we have been told that British metal recycling is a big industry. It has a £5 billion turnover. We were told by a previous witness that much of the recovered material is sent abroad to be processed. So there is a lot of recovery taking place in Britain but not quite so much of the reprocessing. Is there any opportunity to increase that reprocessing in this country and then, at the same time, recovering some of these important rare earths but in very limited quantities?

Ian Hetherington: Yes. If I can just use that opportunity to make another point, when this discussion was taking place in the earlier evidence session, there was some confusion between the theft of non-ferrous metals and the export of non-ferrous metals. Metal theft is a serious issue for us. It's illegal and it is not endorsed by anybody in the industry. We work with the police and the Home Office to try and eradicate it. It is a criminal activity, so let's put that down as a marker. This is entirely different from the legitimate export and import of secondary metals. The numbers are right. Yes, we process, as an industry, around about 15 million tonnes of metal every year and about 40% of that is exported. There is a very good reason why it's exported. Our friends at Tata Steel were always the mainstay of the UK ferrous recyclers and virtually every tonne of iron and steel recycled in the UK was sold into Tata and its sister plants. Sadly, those volumes and the scrap buying of Tata Steel has followed the pattern of many other UK metal processing activities by falling away. The UK has a substantial surplus of recycled metals. As a consequence, we have a highly successful and very well developed export market. I would add that our members would love to sell all their material to UK processors. Nothing would give them more pleasure. They are producing a furnace-ready product and it has an international market.

Q46 Chair: just for the record, because there is potentially a slight contradiction between what you and Mr Hartwell said, I want to be clear. You were not disagreeing with the example of his mobile device when, earlier on, you were referring to 90% being recycled. Your 90% was of those big volume metals—steel, copper and so on.

Ian Hetherington: Yes.

Q47 Chair: You are accepting that there is a real problem with those low volume small devices and things like that.

Ian Hetherington: I totally agree. I am not disagreeing.

Tony Hartwell: That's a design element that I think we'd all agree with.

Q48 Chair: We are coming on to that. Louis Brimacombe: On Ian's point about recycling in the UK, it is quite true that we have been exporting 5 million to 6 million tonnes of steel scrap for many a year now. Part of the explanation for that is because the UK has built up infrastructure for primary ore steel production and glass furnace operations simply because it is more economic to do so when electricity prices are very high and the scrap-based route is electric arc furnace-based. The iron ore prices at the moment are also on the increase and there may be
more incentive for us to look again at scrap. But because
the arc furnace infrastructure is not really there in the UK, there is about 20% to 25% arc furnace infrastructure, we could do with improving the rates of recycling scrap in the primary routes as well. The BOS route has the potential to increase the scrap levels and when you do that, the site CO2 emissions per tonne will reduce. In a way, when you are exporting scrap, you are exporting carbon credits. We need to think about that and about how to incentivise scrap use in the UK.

Tony Hartwell: This is important, too. People won’t invest in electric arc furnaces or aluminium smelters in Anglesey if they can’t get an electricity deal that is suitable for them for long-term production. Uncertainty over electricity prices will mean that those large infrastructures won’t happen. The only reason we have any aluminium smelting left in the UK is because it is relatively low CO2 emissions. They are very small plants in world class terms. The one in Scotland handles about 40,000 to 50,000 tonnes a year, but most world plants are working on half a million tonnes a year to be economic. The reason why it is relatively lower CO2 is because it is hydropower, so it is a low CO2 emission product. We need to think structurally about what we want to do with these secondary materials. If we want to process more, we need to have a system in place that encourages that.

Q 49 Roger Williams: The other way to reduce demand is to reduce waste. So the question is: are these materials wasted in some of the manufacturing processes in the UK, and what can be done about it to make the use more efficient?

Tony Hartwell: I suspect a lot of them were talking about invisible imports because we don’t import a lot of these special metals directly. They are in the computers and the equipment we purchase and support. In a way, we could look at that as a potential resource. It makes sense for us to look at special ways and techniques of dismantling and researching on doing this. That is the sort of work that is happening in Japan.

Ian Hetherington: We are not excluded from that in the UK. We are now starting discussions with the automotive manufacturers on advance battery packs because the design of the battery pack in the cars we are going to be seeing in the next 10 years is absolutely critical to the means and effectiveness by which we can extract the critical metals from those battery packs. Those discussions are going on. They are very secretive to it and we are looking here at a closed loop, so, hopefully, by the time we are seeing the volumes of these materials coming through on to the end of use market we will have those processes in place. The UK is not immune from that.

Q 50 Chair: We are going to move on to look at the design and disassembly issues now. Before we do that, when it comes to when it comes to where volumes smelting of scrap materials, the larger the volume, the better the economics in terms of design of furnaces, I guess. But for recovery purposes of very specific materials that are in scarce supply I am presuming that, with some of the smaller more sophisticated furnaces that per tonne might be more expensive, but in the long term might be a better way of operating.

Louis Brimacombe: That may be true for some of the lower volume materials.

Q 51 Chair: When you deal with large tonnages, as you do, what effort is put in to screening them for more scarce materials?

Louis Brimacombe: I don’t think there is very much effort to look for scarce materials in our scrap.

Q 52 Chair: But you can see the logic that there ought to be.

Louis Brimacombe: Well no, the key thing for us is that to manage the metallurgical process you need to define scrap in certain qualities to optimise the processing requirements for alloying and so on. Scrap management is about optimising the through value, if you like. The scarce materials, from a steel industry perspective, is fairly low on the agenda. For example, which is in some high strength steels, it is in tiny amounts. If you are referring to trying to recover low volume materials you wouldn’t go to the steelworks to try and recover rare earth metals. It is probably better done by the equipment dismantlers and scrap merchants at source.

Tony Hartwell: Generally speaking, in the scrap process, to separate steel is relatively straightforward because it is magnetic. The valuable materials go in with the non-magnetic fractions. It is processing of the non-magnetic residues from a scrap processing method.

Q 53 Chair: My point is that there is a dilution factor, is there not? You lose some of the rare materials in that recycled steel.

Louis Brimacombe: It’s possible, but I suspect there’s not really much of it in steel scrap.

Q 54 Chair: That’s the whole point. There isn’t much of it. That is why we are having this inquiry.

Louis Brimacombe: From another perspective some of it could be useful, though. If you have low niobium alloy steels in the scrap, you can factor that into your processing to achieve the required new alloy. So you are reusing that alloy again. So it is not all waste, by the way. It is cleverly done. The recycling of scrap in steelworks is a very efficient process. It is very technical and very economically organised. I don’t think we waste very much in that respect.

Q 55 Stephen Metcalfe: We touched on the design qualities of products. How do we encourage manufacturers to design with reuse and recycling in mind? What incentives do we need to put in place to make that happen?

Sophie Thomas: From the experience of going round different manufacturing systems in the Netherlands, as I said before, there seem to be a number of elements that pushed the agenda forward, particularly in the way that they have been looking at their landfill issues, which for them is a big critical factor, and looking at new ways to reduce and recover. Crucial partnerships were set up within manufacturing systems, including waste manufacturers like Van...
I am taken with Sophie’s description. I would add that the most sophisticated and largest WEEE recovery and recycling plant in the world is in Newport. I commend the Committee that if anybody ever wants to come and visit, you are very welcome. We can arrange it.

The other point I would make on this—we were talking about exports earlier—is that the UK is a major importer of waste electrical and electronic equipment, largely because European manufacturers are working with our members on design for recycling. It is happening now. It may not be perfect but it is happening now, and the UK is the preferred route because of the economics of using high technology as opposed to the use of a very large labour force in that plant you looked at.

Sophie Thomas: Yes.

Ian Hetherington: It isn’t really very economic and we are employing some high technology. I am sorry.

Stephen Metcalfe: Do you think, therefore, we need to change the WEEE legislation to widen the range that it is covered by and perhaps use it to target some of the more specific critical metals that we are after, so not just the weight issue, but actually trying to target material from it?

Ian Hetherington: First, the WEEE regulations should be expanded to cover industrial and commercial waste, yes. Can the WEEE regulations target particular materials? I am hesitant about that. Once the regulatory framework is in place, the commercial imperative will drive it because it is in manufacturers’ interests—OEM’s interest—to drive this through, because these materials will and should find their way back, especially if it is closed loop, into the manufacturing process.
Q57 Stephen Metcalfe: As some of these materials are recycled, they lose their properties. In particular, I am thinking about rare earth magnets. They are very fragile, they break very easily and as they are recycled they lose that magnetic property. How easy is it to develop a recycling policy for materials that recognises different qualities in different materials? Is it possible to do that? Are we talking about recycling when actually what we should be doing is finding alternatives, substitutes, for some of these really rare metals?

Sophie Thomas: I was just reading the KTN material security report. They state that when you start looking for alternatives you end up using something that is probably rarer or you end up swapping it with something that does not have any kind of infrastructure at all to recover it, whereas before you might have something for which a system of recovery has been developed. I believe a huge amount of incentive needs to be built. Take the example of Xerox, the evidence suggests they have redesigned their machines so that they can take bits back and directly use them in other products. They estimate they can get their products to have up to seven lives within each recovered component and this process is twice as profitable as manufacturing in the first instance. In terms of policy, designers tend not to be clued up on policy. A huge amount of communication is missing. Relationships with British Standards, where we are assisting with new sustainable design guidelines, have great potential. I came away from the Netherlands with the incentive to create new conversations with manufacturers, designers, recovery and recycling facilities. That is where the power is and having the Government there and legislation in place is really key.

Tony Hartwell: It is not so much a question of recycle or substitute. You have to research on both because whether recycling is viable or not depends on the relative costs of the recovered material compared with the primary material. If the primary material is highly valued, then you have a big incentive to recover and recycle it. The question then is: can you develop techniques that make it economic to recover those secondary materials? While the value remains high, you can. If you have recovered so much that the value came down again, there is a balance. When the price goes high people certainly look for substitutes. My overall answer is that we need to continue that long-term research on recovery methods and on substitution, because if you don’t have the expertise on the materials then the beginning of your whole supply chain doesn’t exist and the reason for having manufacturing and production in the UK is weaker. If you have knowledge and expertise of the materials, you have the basis and the beginnings for doing that.

Louis Brimacombe: Following on from all the comments, one of the key things is that directives like the WEEE and End of Life Vehicle have been very positive in terms of environmental improvements, but we need to emphasise more and more the whole product life cycle. You can make decisions about end of life, which might have a marginal effect or even a detrimental effect on the use phase. Whichever way you look at it these days, roughly 60% of the environmental impacts of something is in the use phase, be it automotive, buildings and so on. We need to be careful that any kind of guidance or regulations takes that into account. There are tools such as life cycle assessment to assist with that kind of evaluation. That is a good thing.

Life cycle assessment tends to look at environmental issues, carbon and water footprinting and so on. I am very much of the mindset that we should broaden that to a sustainability agenda which includes the economics and the social value of these products as well. We get into a fairly complex discussion about what is sustainable economically and how you drive that, because, if you drive sustainable economics in the right way, you will end up with a more efficient system. I appreciate there is no simple answer to that, but it is something we should be building into any policymaking, for sure. Also we must not underestimate the social value of all the things we are talking about. They are devices, buildings and consumer products, all of which we use in our everyday lives. That should not be undervalued or underestimated. The materials contribution is huge to that.

Q58 Stephen Metcalfe: Ms Thomas, in the written evidence that the Design Council gave us it stated: “For every £100 a design-alert business spends on design, turnover increased by £225.” Can you give us some examples of how this is achieved in companies that use strategic metals?

Sophie Thomas: In relation to strategic metals, I have been trying to find them. In terms of the Xerox example, because they have a recovery system in place they get back their materials, they have managed not to have to bring in raw materials for that. That was a result of the design decisions. They designed and built them so that they could pull them apart easily. Also, their designers were in touch with their waste management people, so it was a completely closed loop. Again, Philips have now set up nine different ‘cradle to cradle’ design teams within their group. They also take a different perspective in that their profit includes areas relating to wellbeing, so broadening out their definition of profit. Because of these strategic moves they are in a situation where they can build in components with all the strategic metals they use within their microchips, within the coffee machines, knowing they will be able to recover them and not scrap them or down cycle them or send them to be recovered in developing countries, their value is not lost.

Q59 Chair: Are they marketing things like the coffee machine in a way that focuses on, “It’s cool to have a recyclable coffee machine”?

Sophie Thomas: They are, but probably not in the UK because we put less emphasis on it. If you go to the Netherlands, they do. It is added value.

Q60 Chair: Britain has tremendous strengths in design and that is recognised across the world. Is it something that your profession needs to run hard with,
to encourage designers to sell the concept that recycling is cool, to use the customers' language?

Sophie Thomas: Yes. Maybe not recycling but more designing for recovery.

Chair: Yes.

Sophie Thomas: And then recycling.

Q61 Chair: You are there to put the language in place because you know your customers better than I do.

Sophie Thomas: The UK is definitely a leader in terms of design, entrepreneurship and innovation. We are recognised for that. Because we are small groups scattered around the UK, we are very thought-led and creative-led in terms of how we go and find projects, how we go and work with different manufacturers, so the question is how to promote that and to push this industry to start talking properly to manufacturing. What is missing is knowledge—the life cycle analysis knowledge—the education of what materials they are using, how they are using it and where it is going to end up, the holistic thinking.

Q62 Stephen Metcalfe: So education of the designers.

Sophie Thomas: Education of the designers. We rely a lot on their knowledge on the WEEE directive, for instance, but if we had papers like that on materials, a lot on their knowledge on the WEEE directive, for instance, but if we had papers like that on materials, then we could push them that way and say, "This is now a law."

Q63 Stephen Metcalfe: Should the Government be encouraging or legislating to make that happen?

Sophie Thomas: I would say both.

Tony Hartwell: One thing we should be doing is encouraging more engineers and scientists to have a knowledge of sustainability. Probably what we shouldn’t be doing is asking them to pay higher fees.

Louis Brimacombe: I agree with Tony about the content of courses. For sure, the Institute of Materials, for example, is encouraging much more life cycle assessment being taught to material scientists, mechanical engineers and so on, I still think that has not necessarily got through to the product designers and the architects on the more creative side of design. One of the things that would improve things is awareness.

Q64 Chair: At the moment, the mobile phone industry market is very complicated because of the packages that are sold on phone use and so on. If it were possible to encourage the market to look at recovery of materials as one of the criteria, it would undoubtedly help shift that market, wouldn’t it?

Louis Brimacombe: I think so, yes, as long as it can be done economically as well, because otherwise it just shifts to somewhere else.

Q65 Chair: That’s the problem. It is how you encourage the customer to look at all the design holistically and buy on the basis of other interests than simply their short-term financial ones.

Louis Brimacombe: Yes. That is absolutely right. If we encourage sustainable purchasing or sustainable consumption of things, that is the ultimate goal. It’s the goal of Europeans.

Q66 Chair: That is precisely what the automotive industry is going through at the moment on trying to create the volume market to justify the investment in battery technologies. How do you incentivise the public to think about buying into an early technology?

Sophie Thomas: The automotive industry is a very good case study. We were discussing outside how we can get the mainstream design group to follow on from that. How can you incentivise these people to set up a system and look at all their processes. They can lead by example because they are looking at how you deconstruct a complicated object like that. But when you start talking about a toothbrush, a pen, something that has been designed by a designer, has had a design brief written for the designer to respond to and has taken a chain of people to make it, it is a different ballgame because then you go back to the dispersion of the elements. When we get back to the mobile phone, even though there are 40 elements in them, they are very small amounts.

Louis Brimacombe: But it leads on to awareness, for example. There is not a great deal of awareness of the contribution that materials can make towards sustainable design and improvements. It is quite significant that there is not an awareness of it. There is lots of naivety about recycling of materials. Quite a few groups that we have questioned didn’t realise that steel was recyclable, which it clearly is.

Q67 Stephen Metcalfe: So what’s the best way of raising that awareness, though?

Louis Brimacombe: For me it would be awareness, promotional campaigns, education, university education, and it is simple to build these things into courses, but you have got to hit the general public as well. It is not just about academia here. It is about raising people’s awareness. If they want to be more sustainable, there are easier ways of doing it. Be aware of what materials are and how they are used.

Tony Hartwell: I have been accused of being a Japanophile, but they have done that since 2000. They engage their civilian population in those programmes. It is amazing what is possible. They even recycle disposable cameras. They refurbish a disposable camera so that it can be used again. There is no reason why we could not make phones or laptops recyclable and reusable. There are a few more bits and pieces that people pile on them, but the basic platform could be refurbished so you would reduce the amount of materials that you use in the system.

Q68 Stephen Metcalfe: I have one final question. If we are to change policy and amend regulation, how do you think that might affect the smaller businesses? You said that the designers are functioning in relatively small teams up and down the country. Do you think there is a risk that by overregulating we could damage that innovation and creativeness, and would that make us a less attractive country in which either to work or invest?

Sophie Thomas: Designers always moan and complain about legislation but they also thrive on it,
too. Once you start putting boundaries on where we can do things, we are lateral thinkers. We enjoy challenges. That is what we are trained to do. It would probably be very good for designers because they would start to understand and educate themselves, obviously depending on what the legislation was. Basically, there is very little that they can grab hold of. Stephen Mosley was talking about the FSC accreditation. That has been a very good driver for communication designers, for instance, to start looking at their paper as a raw material. So something similar to that, even though it is not perfect in any way, it is a very useful incentive.

**Q69 Stephen Metcalfe:** Are there any other comments?

**Ian Hetherington:** In terms of legislation, given that we are talking essentially here of a combination of consumer goods, consumer goods manufacturing, development and design, this is not a UK-centric activity. We know it is a world market. Anything that is done in the domestic context needs to be done very carefully to ensure that competitiveness is not in any sense eroded. We would encourage promotion and encouragement rather than, probably, a regulatory solution there.

**Chair:** Thank you for a very interesting session.
Wednesday 16 February 2011

Members present:
Andrew Miller (Chair)
Gavin Barwell
Stephen Metcalfe
David Morris
Stephen Mosley
Pamela Nash
Graham Stringer
Roger Williams

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Examination of Witnesses


Q70 Chair: Gentlemen, thank you very much for coming. A pologies for the slight delay. We will try and keep this fairly clinical and catch up some of the time we have lost. For the record, please introduce yourselves.

Charles Emmerson: My name is Charles Emmerson. I work at Chatham House on a range of resources issues, such as food, land, water, energy and minerals.

Dr Di John: My name is Jonathan Di John. I am a senior lecturer in political economy of development at the School of Oriental and African Studies. My primary research is on the political economy of growth in oil economies.

Anthony Lipmann: My name is Anthony Lipmann. I am an former chairman of the Minor Metals Trade Association, which is a group that governs the smooth running of the minor metals trade. I have my own company, which is a metal trader, and we handle some of the special and strategic metals that we are here to discuss.

Charles Swindon: I am Charles Swindon, also a former chairman of the MMTA and currently chairman of the MMTA Trade and Lobby Committee. I am also the managing director of RJH Trading, which is a physical metals trader.

Q71 Chair: Thank you very much. My first question is specifically directed to the last two witnesses, Mr Lipmann and Mr Swindon. The Minor Metals Trade Association said to us that minor metals are reaching industrial, economic and political maturity. Can you expand on this?

Anthony Lipmann: We may have said that. It is not something that I personally agree with. In the 1970s we had a situation when there was a great lather about strategic metals. There was even a company called the Strategic Metals Corporation that enticed people to invest in things that we were going to run out of. In the 1930s the Americans formed a stockpile to buy tin that they thought was going to be threatened. In practice, you just dig deeper. That is my view about strategic metals.

Q72 Chair: So you don’t think there is a shortage?

Anthony Lipmann: No, I do not.

Charles Swindon: If we are considering the most strategic metals and we are talking about the Rare Earths, and in particular the Heavy Rare Earths, where China has such a predominance—it is alleged that they produce about 99% of the Heavy Rare Earths needed by the world at the moment—I think there are real problems. That is probably one of the reasons why we are all sitting here today. The time factor in investing large amounts of money from heavily capitalised companies to find, outside of these areas, new supplies of these strategic metals is very costly and will take time. But something that the UK should work with and consider is long term supplies of these metals.

Dr Di John: I take a bit of a different view about this. While China does control 97% and upwards of Heavy Rare Earth metals—and there have been two recent export quotas that China has put on, in 2006 and 2010, which have reduced the global supply of them—if you look at a larger geopolitical picture, there is very little incentive for China to use this as a geopolitical bargaining chip, principally because it is very dependent on other base metals and fuels from other countries. So I don’t think you are going to see any shortfalls in that.

Secondly, a long time ago, Deng Xiaoping said that Rare Earth metals are to China what oil is to the middle east. The big difference in comparing Rare Earth metals with oil is that Rare Earth metals comprise a very small part of the production process, even of most high technology industries, unlike oil, which is a big component of production in GDP. The other issue is that China has legitimate reasons—environmental and smuggling—for why they have put these export quotas on. Also China, unlike the middle east, is undertaking industrial policy and industrial transformation, and it is likely to use and try to secure its own resources, like other countries have, for its own industrial transformation process. That is something the middle east didn’t have the political commitment or capacity to do with oil. Those are some big differences, but, also, I think the concern has been exaggerated.

Charles Emmerson: Just to come back on a couple of those points. The time horizon issue is absolutely key. There is a qualitative difference between the issues which arise in the near term, the medium term and the long term, and the policies that one might use in order to deal with the issues which arise in those contexts. There is always the danger of suggesting that this time is different in terms of resource scarcity. However,
there are a couple of good reasons for believing that this time is different. One of those is the scope and pace of industrialisation in China. The other, with regard to some of the Rare Earth minerals, is the extent to which China’s future economic development may be predicated on green growth. In the 12th five-year plan, for example, electric vehicles are key. Instead of having generalised industrialisation and growth, you have some quite specific sectors where there are quite specific needs.

Charles Swindon: I would like to come back to a point raised by the penultimate speaker. I don’t agree that there are legitimate environmental reasons on the part of China for restricting the exports of these Rare Earths from China. A really this matter is being raised at the WTO. The WTO does recognise that all countries must have unrestricted access to all of these metals, however strategic they are. I believe that China is artificially cloaking its claim of not being able to export in any numbers. The other quick point I would make is that, even when we are seeing some of the most strategic metals coming out of China, they are very much on value-added products, where a huge margin of profit is being kept, with so many other commodities in China, so the price we pay in the UK and the west is very inflated.

Q73 Graham Stringer: The more we get into this inquiry, the more confused I get. Do we have a real problem or not with the supply of these strategically important metals? What factors are going to dominate the supply of these metals? Is it hedge funds or is it China cornering the market and hindering supply, or are other countries doing that?

Anthony Lipmann: I believe that you are absolutely right. I think the problem resides here. In Europe, we have a law, called the EU Chemical Directive, which is turning Europe into a dark age of lack of innovation. People are afraid to handle materials because of the restrictive law under which we have to register our mere ability to import metals. For example, if I want to import titanium, I must buy a letter of access that will cost my company £70,000, just to have the pleasure. If you translate that across the 20 elements that I trade, it is unenlight. It creates monopolies, which in turn create manipulation, which create high prices. Unfortunately, I am one of those who thinks that the solutions lie here.

Q74 Graham Stringer: Does anybody else want to add anything?

Charles Swindon: You refer to hedge funds. It is well known that hedge funds have moved into all commodities, whether it is gold or energy. Sadly, they have also moved not just into exchange traded instruments, as traded on the London Metal Exchange, but there is evidence that they have moved into more strategic metals, which are only traded between counterparties, including Rare Earths. If it is perceived that the rate of return over the next 10 years is going to be much greater by investing in very small quantities of rare metals, that is a risk.

In response to your question, I think there is a real problem that will take many years to resolve. There is no quick fix, so we should start to look at doing something about it. We should be looking at creative ways outside of the box, through diplomacy, commercial channels and bilateral promotion, even of more ethical areas, by showing people who are producing these metals, or might want to produce them, that it is worth working with a country like the United Kingdom that can help them in the longer term with infrastructure, giving profit to stay back in their country in return for what we can do with them. I would like to reiterate, absolutely, what Anthony Lipmann has just said. The punitive effect of the chemical legislation, which is meant to protect the environment, is becoming so financially onerous that it is exacerbating the problem. We should look at ways of making sure that the costs of enforcing this environmental legislation do not drive more and more industry away from the United Kingdom.

Dr Di John: On a broader point, it is worth keeping in mind that this is a time horizon issue. The term “Rare Earth metals” is misleading in the sense that they are not actually rare. There are known deposits of them all over the world. In the United States, Canada, South Africa and so on but, at the moment, they are in very isolated mines that are economically unviable. If we saw any substantial price increase from today, and the prices have increased substantially in the last five to 10 years, that would provide an incentive, as it did with oil in the 1970s, for more prospecting and exploration. That is underway in the United States, Australia and in other countries as well.

In the medium term, I don’t think there is a geological reason why there should be a concern. There is an economic viability concern, and there will be a time lag for these mines to become viable, so we could have short to medium-term problems but I don’t see any long-term issue in terms of Rare Earth metals supply.

Charles Emmerson: There is also a generic problem with market dominance by any country for any commodity, and Rare Earths are no exception to that rule. The question in my mind is how you get supply in the medium term from countries where you can be confident they will operate according to market principles and, indeed, where there is neither political incentive nor economic incentive for exports to be curtailed. China is different in this respect. China is industrialising rapidly and it has a strong domestic demand for many of these minerals. It may be that, frankly, rather than politics or any broader strategic intent, which is behind conceivable curtailment of supplies to countries such as the UK and, indeed, other advanced economies in the future.

Q75 Graham Stringer: We are talking about regulation, the market and national interests. Are there particular problems with any of these metals? We have been told in our recent evidence that there is only 20 years’ supply of indium and there are particular problems with neodymium in terms of its application within wind farms, so you have given us a good
Science and Technology Committee: Evidence

16 February 2011  Charles Emmerson, Dr Jonathan Di John, Anthony Lipmann and Charles Swindon

Q76 Chair: Can I just stop you? We heard some evidence from Tata in our last session. One thing that stuck me is that Tata has invested heavily in some very sophisticated, large scale recycling of steel operations.

Anthony Lipmann: Yes.

Chair: But nowhere is there any apparent attempt to extract from it the rare metals that do get diluted when you crush cars and whatever. Surely, there is a problem of finite resource?

Anthony Lipmann: I read that testimony. There is wastage. Without doubt, we are not 100% efficient, either as an aero engine or—

Q77 Chair: It sounds to me as though you are being a little complacent about this.

Anthony Lipmann: I am not complacent at all. I believe that price is a marvellous stimulant to make people collect things that would be thrown away. Our entire minor metal trade is made up of elements which were once discarded. 30 years ago, or when this association was founded, 1973, the elements that we trade in today that end up in your mobile were once discarded. They are not today because we need them. I will give you one example, and I want to be very specific because it makes things real for people. An element called thallium—rat poison to the Victorians—is one of the most toxic elements in the Periodic Table. You cannot make a repeater in a fibre optic cable without thallium because it has a unique diffraction of light, yet we are having trouble trading it because the EU says, “This is toxic. You mustn’t handle it”, so it goes to landfill. That is the paradox.

The law is unintentionally preventing us from delivering, as merchants, to the people who need the strategic elements.

Q78 Graham Stringer: Can you go back to the two metals I mentioned? You have given a very strong case, as far as I am concerned, for it working on rhenium. Do you believe it will work on indium and neodymium?

Anthony Lipmann: Neodymium is a perfect example. In the 1990s General Motors sold the technology for neodymium boron iron magnet-making to the Chinese. No one can blame the Chinese for developing that patent. Now we wonder why we are beholden to China for the very product for which the patent was sold. So now we feel vulnerable and people are digging. In California there is a company called Molycorp that has raised huge amounts of money on the American stock exchanges to fund it and, in the end, neodymium will come back to the market in other parts of the world than China. That is what I believe. That is the market delivering.

Q79 Stephen Metcalfe: Really, you are an exponent of the argument that the free market will deliver whatever we need and when we need it, because it will set the price and that will stimulate activity?

Anthony Lipmann: Yes.

Q80 Stephen Metcalfe: What happens in the lag? With some there is a gap of up to 15 years between the market demand—presumably we all accept that market demand is rising—and the delivery of product, because it is often quite difficult to get these mines up and running.

Anthony Lipmann: Mining houses, metal merchants and everyone involved in the cycle wants to make money and they will invest in it. They will bring forward metals by their investments. The one thing that I am very critical of, as our stock exchange prostitutes itself before huge commodity companies that wish to list here, is that we forget the ethical and environmental sides of our need. The two, in my opinion, must co-exist. That is where this country needs to put much greater emphasis on the enforcement of the existing laws on ethical and environmental behaviour during that process. This is the Companies Act 2006.

Charles Emmerson: There are things that you can do in the time lag, and there are things you must do in the time lag. One thing is to invest in better frameworks for the management of trade in some of these minerals. You can insist on transparency, diplomatically, as to how these minerals are dealt with by various exporters and you can raise the political cost of any interruption or curtailment of supply by indicating that it is not for money, but a uniquely UK issue but a UK and EU issue. I think it is very important to remember that what the UK can do on this qua the UK is fairly limited. What the UK can do with its partners in the European Union is much stronger.

Dr Di John: In terms of the lag, I think this varies according to which metal we are talking about. The share of the cost that these metals constitute in terms of the production process is much less than, say, oil was. While there will be a lag, the effects of any dramatic increase in price is likely to be of much less effect in terms of production costs. That is something to bear in mind.

Also, countries that use these metals more intensively, such as Japan and Germany, are more vulnerable, because if you look at the industrial structure of those countries they are much more intensive users than the UK. In the EU, the UK would certainly want to ally with Germany, the biggest player in this market in terms of its production process.
Charles Swindon: At the MMTA we have espoused a minor metals policy. We believe that this is effective for the whole world and is not peculiar to the United Kingdom or any other country. We believe it is fair. All the objectives and components of that minor metals policy embrace everything that is important in minor metals. We would like to see more and more recycling and promote more green technology in the minor metals. In the short to medium term over the next 15 years, I believe that the new technology coming into urban recycling and urban technology, which can be done easily in the United Kingdom, or, if it is not appropriate, in collaboration with other countries, so that the finished product comes back to where we want it, is a way forward.

In addition to that, the UK could work much more closely within the EU in terms of looking at areas that the MMTA sees as important to the economic and financial viability of the metals manufacturing industries in Europe. We will continue to promote, at the MMTA, the elimination of unfair or restrictive import duties on minor metals into the EU. That will help to prevent some of these shortages in the coming years.

Q81 Stephen Metcalfe: Thank you. One final question: Do you believe that the current producers are able to meet the rising world demand in that very short term? Do you see any problems, coming down the line, we should be aware of? I understand that you said we need to look at this closely and do some work on it, but is there going to be a period where we are going to have a real critical problem? Is there anything the Government should do about that specifically?

Charles Swindon: This is all about economic cycles. There was a very strong economic cycle for all commodities from 2002 to 2008 and then, of course, there was the bust and no investment. Now we seem to be back in a period of very high commodity prices—having peaked in most cases. Certainly, copper and most of the other metals we are involved in, and most particularly the ones we are talking about here of a strategic nature, have reached very high prices, well above the levels they achieved in 2008. If this cycle continues, there will be investment. There will be fat in their balance sheets to invest for the longer term. We cannot predict how long this good cycle will be fat in their balance sheets to invest for the next five years. You absolutely are obliged to ensure that you supply, not just for tomorrow but for the next five years. You have to be proactive, to ensure that you have a reliable supply, probably from more than one area and from more than one producer. Yes, you will have a premium. You pay a premium. You can’t carry on if you are missing one or two of these.

Anthony Lipmann: I believe there is a lot we can do just by enforcing correct commercial law. For example, on the London Metal Exchange there are four very large companies that own the very warehouses that people deliver metal into. J. P. Morgan2 is one of them. They own a company called Henry Bath. They are, therefore, a ring-dealing member of the exchange and they also own the warehouse. That is restrictive. They were also reported, at one point, to have had 50% of the stock of the metal on the London Metal Exchange. That is manipulative. These are things that we can do something about here. That would mean the copper price probably would not be $10,000 a tonne, which is higher than for some forms of titanium. That price is not down to the fact that the metal is not being mined, it is because of such actions.

Dr Di John: Just to reiterate the penultimate speaker’s point, if I could refer you to an article in The Financial Times of 12 February, a few days ago, which reported on the general mood of the Indaba mining conference in Cape Town, which is one of the big mining conferences in the world. It seems that most of the big players are quite optimistic about increasing reserves and the development of new mines, even in places like the DRC. What we are talking about is the big western multinationals that have quite an optimistic mood. In the short term it seems as though there already is a lot of optimism and investment going on, particularly in southern Africa.

Q82 David Morris: As you said before, China is currently dominating the resource market. You have also mentioned that, due to economic activity, the prices are being driven up in certain elements and minerals. Do you believe that the industries are willing to pay a premium for a reliable supply of Rare Earth metals? If not, should they do something? Should various Governments get involved across the world in making a readily available supply of metals?

Anthony Lipmann: There is a specific problem in the Rare Earths at the moment because of the predominant position of China. China also will sell and is selling the Rare Earths. We do not have an industry that could use them. We have one company in the north of England, Less Common Metals, which makes neodymium boron iron magnets. They are feeling the pinch but they, heroically, are the only magnet maker, probably, in Europe actually making the stuff. They are still managing, amazingly, to do this, despite an import duty of 2.6% on neodymium, which has been suspended. But why not cancelled? How can you plan if something is only suspended? These are the problems, but we have already denuded Europe of the type of businesses and products that China wants to make with the Rare Earths.

Charles Swindon: 39 different raw materials—metals—go in to making a normal air engine. You cannot carry on if you are missing one or two of these. What is more important to you is the continuity of supply, not just for tomorrow but for the next five years. You absolutely are obliged to ensure that you have a reliable supply, probably from more than one area and from more than one producer. Yes, you will pay a premium. You have to pay a premium. You pay what the market is dictating. There is no substitute for nearly all of these metals that are needed to make complex manufactured goods, like air engines.

Whether the Government should intervene to do this, short of being involved in diplomatic areas and in the G20, the WTO and the OECD, which I think is very important, on the specifics of helping out the UK Government because the price has gone high, I don’t think so. Prudent large manufacturers do plan five years ahead, will pay premiums and will pay the price for what they need.

Q83 David Morris: Dr Pitts of the Royal Society for Chemistry said that there is a social cost that could be involved in mining these certain elements. Do you think that that should be included in any production price to even out the fair trade balance across the countries? If so, as an example, how much would the cost of a mobile phone, a laptop or whatever we are using in the western cultures, go up as a readily available media outlet that we seem to be addicted to?

Charles Swindon: There is a social cost involved in mining these certain elements. Do you think that that should be included in any production price to even out the fair trade balance across the countries? If so, as an example, how much would the cost of a mobile phone, a laptop or whatever we are using in the western cultures, go up as a readily available media outlet that we seem to be addicted to?

Anthony Lipmann: In the Klondike-type rush for resources in this resource war that we are living through, we need to use things like the Companies Act 2006, in which any UK-registered company must abide by an environmental audit and provide an environmental audit. That is the means by which we try and ensure that the by-product of our unhealthy rush for metals does not produce untold suffering, basically, in developing countries. I am talking about pollution and things that go on that are out of sight and out of mind. We have listed companies on the FTSE 100 whose practices away from home are not what they are here, and no one brings them to book.

They are not audited in that way.

Dr Di John: In terms of social cost, from a developing country perspective, I have done some work on the political economy of tax regimes in sub-Saharan Africa, and in particular mining tax laws. The current situation is that in many sub-Saharan African countries a lot of strategic metals were nationalised and poorly managed. Many of these countries ran into very heavy debt crises, and they were, in some sense, forced in their structural adjustment programmes, to privatise. An example is the copper industry in Zambia.

In return for that privatisation, there was a very investor-friendly deal to companies to revitalise the copper mines in Zambia, for example. In the 2000s Zambia was receiving a 0.6% royalty on copper. That is, basically, peanuts. The IMF originally endorsed that but now is coming round to saying that these countries need to get a much better deal from mining generally, even in poor countries.

Q84 Chair: That ethical line that is coming from you seems to suggest that there would have to be some significant co-operation between Governments in developed countries to find ways of making good the social and environmental impacts in underdeveloped countries?

Anthony Lipmann: Let me just put one figure on what Jonathan has just said. Zambia exports 700,000 tonnes of copper. That is $7 billion today. That is before the by-products of silver, tellurium, selenium, gold and cobalt, which comes from copper as well, and all the other things. Yet Zambia does not see anywhere near that, as Dr Di Jonathan said. That is because of the huge tax breaks that were given, under pressure from the IMF, when President Chiluba was in power in Zambia, to companies that themselves reside in places like Zug, and yet who own vast shares of companies listed on our FTSE 100.

Charles Swindon: It is absolutely true that these countries in sub-Saharan Africa are not benefiting to any great extent. Ironically, it is the UK and France that have been working with the Governments of sub-Saharan Africa in advising them on new mining laws and everything. It could go too far the other way. In terms of royalties that we are talking about, we do not want to be paying incredibly high ones. We do not want to go from one extreme of their not benefiting at all to the other extreme where they are just extorting, or imposing vast royalties and if you don’t pay them, you go to some court to resolve it.

We need to find a mediation, a way through this that is not just looking at the bottom-line royalty, but is sharing in the social problems of the country, the infrastructure problems, the housing and the education. Working with the bigger picture is what I believe they want, from my experience of dealing with these sub-Saharan countries, and not just the extra buck on the royalty.

Q85 Pamela Nash: I would like to explore the role of China a little further than we have already this morning. It was reported last year that China had halted the export of Rare Earth elements to Japan following the arrest of a Chinese trawler captain. However, at the same time the export quota in China was reduced and they were very close to meeting that quota. In your opinion, do you think this was, indeed, a diplomatic decision by China or was it a trade decision?

Anthony Lipmann: I am afraid that I believe China was throwing its weight around. They know that they are big in the playground, and there is no love lost at the moment between Japan and China. As metal merchants, we have inquiries every day for metals that come from China where Japan is simply searching for them in anywhere that is non-China. It is a diplomatic trade problem. In the end, it will stimulate all the investment that is going on all over the world for more Rare Earths. That will happen and it will be delivered.
Charles Emmerson: I totally agree with Anthony here. There are trade and other political problems between China and Japan. The excuse is given by China, which is absolutely not good enough, that the fact they have taken over central control of the south Yangtze area, where most of these metals are produced, is good evidence that they want it run and controlled by Beijing. This is absolutely unacceptable and we should not be fooled by the sham that says it is to protect the environment.

Dr Di John: I agree that the price increases will stimulate investment elsewhere in these metals, but this policy is not just a trade one. It is central to China’s industrial policy. One of the reasons why, in the medium to short run, there might be increases in export quotas and they might disguise it in the form of environmental concerns and smuggling concerns, is that they would like, as they have done in many other industries, to force, or at least provide a lot of incentives, for firms to locate in China. It is an FDI policy. It’s a foreign direct investment strategy and an industrial strategy. Every country that is wealthy today has done it in the past. OPEC has done it with oil, so this is not a new idea. But what we are seeing is that the difference with OPEC is that China has an industrial transformation strategy as well as being the country that has the largest amount of these minerals at the same time. It is a little more concerning because it was, but its effect is less because the price of these metals in production is much less than oil. So for the world’s economy it is not as big a concern.

This is something that is part of an historical continuity of countries trying to catch up, and one of the things that they have used is import tariffs and export quotas to stimulate domestic industry. China has enough leverage, I would suspect, vis-à-vis the WTO, that they will be able to get away with some of it but I don’t think they have any interest in the long term, political or not in the medium to long term is irrelevant, actually. However, the perceptions matter. We have seen a real flare up in perceptions of scarcity around certain minerals. That, in itself, will drive investment and government policy. It may drive price but it is dangerous and we have to make clear that transparency, market mechanisms and open international frameworks are the key to building in—and this is the key word for me—long term “resilience” as opposed to risk management, which is an approach that is often taken in this area.

Dr Di John: On that point about transparency, one of the key features of sub-Saharan African mining deals is the fact that they are very rarely transparent. As a matter of fact, with a country like Zambia and copper, and this is true of most of the countries, almost all of the deals are off budget in the sense that the Finance Minister never sees it and it is never declared for tax. This is part of, perhaps, elite bargains in the country where the top leaders, politically and economically, are sharing the proceeds from this. It is a very serious problem, and not just for China but also in sub-Saharan Africa. I would say that 95% of deals were secret in mining.

Q86 Pamela Nash: Just to go back to China, you have all expressed your concerns. But, Dr Di John, you said that you still feel that a genuine reason for their restricting exports is their domestic requirements for these metals. Do each of you think that China is well able to use this monopoly on the international market in political negotiations throughout the world?

Charles Swindon: Politically, China do not want to have further embassamments at the WTO. If we raise the pressure and the bar, I believe that top meetings like the G20 should be talking about such events. They don’t want the embarrassment. If world leaders can make sure that politically driven disputes, such as we are talking about, are raised at the highest level, it will push back China and the near monopoly that they are going for. Let’s raise the game and the bar rather than making it go away, because it will not.

Anthony Lipmann: China say that their Rare Earths are national treasure. If only every African country said that their minerals were national treasure. This is the difference. You can’t blame the Chinese for developing everything from the raw material through to the hybrid car. That’s what they want to do.

Q87 Pamela Nash: I have one final and very quick question. Last year the Chinese reduced their export quota relatively suddenly. Would it be helpful for the industry if these quotas were known in advance, and is there any possibility of that happening?

Charles Swindon: From what I know, as you say, these export quotas were cut on the key areas of bauxite, coke, fluor spar, silicon carbide, zinc issues and so on. There is no way of knowing in advance, not even with the greatest intelligence as far as I know. Of course, if it were possible, that would be of great value.

Q88 Stephen Mosley: In your answers to previous questions, you have mentioned sub-Saharan Africa quite a bit. I want to bring it all together. The Democratic Republic of Congo is the largest supplier of cobalt and one of the largest supplies of coltan in the world, yet it has huge problems. In eastern Congo you have got militias controlling the mining. In the rest of Congo there are huge problems with corruption, bribery, etcetera. We had First Quantum Minerals in Parliament a couple of days ago speaking about it, giving a very forthright opinion of the situation there. Of course, there is a court case currently in Paris at the moment, so I don’t think we should stray on to that ground, but it does give an indication of the problems.

Of course, you talk about environmental things. The mining that is going on out there is not to the same standards that we would expect in this country. As a result, the people don’t benefit. How can we use our mining policy to promote peace, stability, stability of supply and also help those people who do the mining
often in small-scale mines in the Congo? Is it a big question. Can we have quick answers because I am aware of the time? 

Anthony Lipmann: I would like to come back to what we can do. Companies are attracted to Britain to list. They come out of cover to list on our stock exchange. These are the companies where a light has to be shone on them through the Companies Act 2006 to make sure that they bring up the level of their practice in sub-Saharan Africa.

Tantalite has one particular problem, which is that you can take it out with a bucket and a spade. It is artisanal. It doesn’t lend itself to huge companies. All the problems in eastern Congo and western Uganda are because it is so easy to mine. People are mining at the point of a gun. That is why the war lords are able to have this power. The laws which have come in, such as the Dodd-Frank from the US about conflict-zone minerals, are actually changing the situation on the ground. That is where law is beginning to help.

Charles Swindon: We can change this. Anthony forgot to say that he was instrumental in setting up the MTA’s charity where we have been sponsoring the Mufulira area in the last three years. Tremendous work has been done there. My own daughter went to work in the schools of Mufulira to help be amongst the community, which is a huge copper-producing region, and one of the polluted areas. By education, by example and by working with these people, the social cost and problems will go away. Of course, what will help is promoting good governance and the London stock exchange and its rulings being stricter. 

Dr Di John: The challenges of achieving a good governance agenda and a transparency agenda in mining are going to be formidable. We have the Extrusive Industry Transparency Initiative, the EITI. The World Bank championed this for the Chad-Cameroon pipeline and it fell apart. As to one of the reasons why it fell apart, one has to keep in context how political stability is maintained in a country. Historically, and certainly in sub-Saharan Africa, it was often maintained by bargains between different types of elites, to give them incentives not to rebel against the state. These bargains tended to take the form of giving huge economic privileges and rents to various regional elites. Under state intervention it was quite easy to do that because the state had big patronage machines. Through state-owned enterprises they could control and fix multiple exchange rates, give cheap credit and so on and so forth.

In the era of economic liberalisation, a lot of the hands of the state are tied. For instance, privatisation removes many of the patronage opportunities that public enterprises. With financial deregulation there is less control of the financial sector, so the patronage levers of elites to maintain stability are much more restricted now than they were in the past. So you are likely to see things like secret mining deals and the tolerance for tax evasion. We are seeing those other ways to give elites rents beginning to emerge. The problem of maintaining political stability doesn’t go away just because you have liberalised economically.

I think that it will be a formidable challenge to implement a good governance agenda in these very poor countries because of the nature of the way elite bargains need to be constructed. Douglas North, an economic historian who won the Nobel Prize, has recently written a lot about this particular problem in a co-authored book called Violence and Social orders. It is something to keep in mind. We must ask whether, historically, good governance has been the means by which countries have maintained political stability. If you look back in history, the answer is very troubling; regimes have hardly maintained institutions that resemble anything like ‘good governance’.

Q98 Stephen Mosley: One of the issues that Congolese Government officials and Parliamentarians have raised here is that of minerals from the east of Congo being flown out. Basically, they describe it like the drugs trade, with makeshift airfields, small planes; they dig it out and then move to neighbouring countries to the east which then export it. Is there any technological way of proving where it has come from, such as fingerprinting or something, in the same way that they have done with blood diamonds where they can trace the source? Is it physically possible to do the same?

Anthony Lipmann: There is a system of tagging that is supposed to happen, direct from the approved place right through the system. But then you would probably get a trade in tags.

Charles Emmerson: It will be easier to tag minerals that are produced on an industrial scale than those that are produced artisanally, anyway. That is the challenge.

Anthony Lipmann: The real thing is the failed state scenario. At the very extreme, the tantalite mining is just an extreme version of what is going on throughout Africa. You are not going to solve the tantalite problem before you resolve the problem of the failed state and the way our companies, which are listed here on the stock exchange, behave in those countries. That is where we can get them, when they are vulnerable here—when they need to raise finance.

Q99 Roger Williams: You have talked about recycling. Perhaps we could look at it in a little more depth. The UK is a world leader in metal recycling and a major exporter. Could the UK become a global leader in secondary production of minor metals? If so, how could we promote it? 

Charles Swindon: It is a commercial matter. The UK has been a world leader in non-ferrous and ferrous metals recycling but not so much in the areas that would be of great strategic importance because of the difficulties of having substitution in these areas. Certainly, it would stop the landfill and mean that we look to recycle these metals with which we are most concerned. If they are commercially viable in the UK, we should do it; otherwise we should do it in collaboration with other countries. Everything should be done from Government legislation downwards to promote this green technology.
Q91 Roger Williams: Does any work need to be done on an academic basis to initiate new ways of recycling or new ways of extraction?

Charles Swindon: Academically, a lot of research goes on in universities that is becoming more and more commercially viable. Top scientists should be encouraged to focus on this and keep those scientific brains working on the recycling of strategic metals because I am sure that the top listed companies with large budgets would do a commercial deal with such universities.

Anthony Lipmann: If you take it to its very simplest, recycling includes picking up an aluminium can or a steel can and getting it back to the recycler. We are in a kind of anti-manufacturing period, where even the small yard that wants to open up as a collecting yard faces such an enormous amount of regulation—just the health and safety in case someone is cut by a piece of sharp metal—that that militates against the scrap recovery that should be taking place and all the recycling. A gain, price is the issue. It shines the light. Wherever that metal is, people will try and recover it.

Q92 Roger Williams: We were told by Ian Hetherington of the British Metals Recycling Association that part of the problem is that, for some of the metals we are talking about, there isn’t a market. He says that he can find no market for secondary neodymium.

Anthony Lipmann: He couldn’t find a price for it. I read the transcript. He said he couldn’t find where a price existed for secondary neodymium. You make a price. The current price for neodymium is $60 a kilo. If I recycle it and it costs me $20 to recycle, I will try and sell it for $60, or, maybe, because it is recycled, I will sell it for $50.

Q93 Roger Williams: I think it was you who was telling us about this company in the north of England that makes neodymium boron iron magnets.

Anthony Lipmann: Would you say that again?

Q94 Roger Williams: I may have misunderstood you, but you said that there was a company that makes these magnets made of neodymium, was it?

Anthony Lipmann: Yes, that is right.

Q95 Roger Williams: And boron, was it?

Anthony Lipmann: Yes. They make neodymium boron iron magnets in Widnes.

Q96 Roger Williams: Where do they get their neodymium from?

Anthony Lipmann: They import it from China.

Q97 Roger Williams: But they would have no problem with reprocessed or recycled neodymium if it was of the quality?

Anthony Lipmann: Yes. The atoms are the atoms. Once the atoms are back out, as in 99.9% neodymium, it’s re-useable.

Q98 Roger Williams: The other evidence that we have received is about the WEEE directive and that it needs extending. Your association stated that the legislation needs to be streamlined. Can you tell us what that means?

Charles Swindon: The purpose of the legislation is to promote something like at least a 85% recycling rate for all of this waste product. It shouldn’t even be called a waste product. It should be called a new product. Calling it “waste”, in the first instance, is the misnomer. The legislation is difficult and onerous, and it needs to be streamlined. Recycling has to be made easier. At the MMTA, we are fully in favour of the environment, health and safety and all of this, but when it goes mad and it is stopping vital recycling, which we need, it has gone too far.

Q99 Roger Williams: Most of the metals that we are talking about are in the form of an alloy of some sort. Is there ferrous scrap that is going out of this country that would contain some of the metals?

Charles Swindon: Sadly not, not in terms of ferrous scrap or, at least, not in any commercially viable way. We would have to carefully target the non-ferrous scrap and, by scientific processes, we would know what to focus on in order to obtain something like a commercially viable recovery rate for these strategic metals.

Q100 Roger Williams: The point I am trying to get to is that we do export a lot of our scrap and it might not be in the ferrous scrap.

Anthony Lipmann: Because we have set the bar very high in Europe to prevent any injury to any EU citizen, we have, therefore, allowed the recycling process to be exported to places like China, where the same standards may not exist. That is part of the unintended effect of the EU Chemical directive.

Q101 Roger Williams: Some of that scrap would contain some of the metals we are talking about?

Anthony Lipmann: Absolutely, yes.

Charles Swindon: The labour costs are one of the reasons for this. I have seen grannies in their 80s in the freezing cold in China taking apart these pieces of scrap metal. That is not something we want to see happen here, of course, but that is one of the problems we are facing.

Q102 Gavin Barwell: This is my final question. You touched on them in some of the earlier answers, but in the Minor Metals Trade Association’s submission you talked about the detrimental effect on the industry of the EU’s REACH regulations.

Charles Swindon: Yes.

Q103 Gavin Barwell: Could you say anything to the Committee about how those regulations could be improved to avoid some of the detrimental effects but still maintain the necessary environmental and health and safety controls?

Charles Swindon: It is a case of finding the balance. The REACH legislation is enforceable now and different tonnage bands will come in gradually over the next two years through to the end of this decade. The headquarters of that, even though it is spearheaded by Brussels, are in Helsinki. We would like to see enforceability in each country, and I believe...
different countries will have their own way of enforcing it. At least the UK could have its own user-friendly way of enforcing it, whatever happens in the other 26 EU countries. Perhaps we could have a more pragmatic approach within the UK towards enforcing REACH, one where you can pick up a phone, send the emails and find out how you can conform. In terms of more draconian changes to it, which might be desirable, it might be too late.

Q104 Gavin Barwell: To pick up on that, the body responsible for enforcement in the UK is?

Anthony Lipmann: DEFRA.

Q105 Gavin Barwell: The Ministry is directly doing the enforcement?

Anthony Lipmann: I think so, yes.

Charles Swindon: They are mandated. In each country someone has been mandated. Within the UK it is DEFRA.

Q106 Gavin Barwell: Finally, one of the things you said in your submission was that you felt the destructive effect of this regulation was unintentional?

Anthony Lipmann: Yes.

Q107 Gavin Barwell: Can you tell us a little more about what it is you think they have done that they did not intend to do?

Anthony Lipmann: The EU Chemical directive is a law directed to all substances, not elements. In a Rolls-Royce gas turbine engine it is thought that there are between 3,000 and 5,000 substances that go to the making of that engine. This law is a cradle to grave law that requires any import of any substance into Europe to have had carried out a whole range of tests for carcinogenicity, mutagenicity, toxicity, etcetera. Then, for the privilege of importing that element or substance, you are either part of a consortia where you spend a lot of money to be a part of that consortia—in rhenium, for example, it will cost our company a couple of hundred thousand pounds—or I buy a letter of access which, in the case of titanium, will be £70,000 to import that material. That is an incredible dead-weight on the free market and trade. It simply exports the jobs, the technology, the innovation and the wish to produce anything in Europe. It goes abroad because overseas they are not beholden to REACH. That is the problem.
Wednesday 2 March 2011

Members present:
Andrew Miller (Chair)
Gavin Barwell
Stephen McPartland
Stephen Metcalfe
Stephen Mosley
Pamela Nash
Graham Stringer
Roger Williams

Examination of Witnesses

Witnesses: Professor Robert Watson, Chief Scientific Adviser, Department for Environment, Food and Rural Affairs, and Professor David Clary, Chief Scientific Adviser, Foreign and Commonwealth Office, gave evidence.

Q108 Chair: Good morning, gentlemen. Thank you for attending this morning. We are on a fairly tight schedule so we will be keeping the questions to you fairly brief. We did ask for a Minister from the Foreign and Commonwealth Office to attend, but that is apparently not possible. We want to push hard to make sure that we understand how well joined-up the thinking is in this area. Could I ask the two of you, first of all, to introduce yourselves?
Professor Clary: I am Professor David Clary, Chief Scientific Adviser at the Foreign and Commonwealth Office.
Professor Watson: I am Bob Watson, Chief Scientific Adviser in DEFRA.

Q109 Chair: Thank you very much. On 24 January DEFRA published a Review of the Future Resource Risks Faced by UK Business and An Assessment of Future Viability. How will it be used, is it a one-off review or are there plans to repeat it and expand it?
Professor Watson: As you said, this is a review not just of strategic metals but it considered other issues, such as timber, palm oil, and so on. Our aim was to try and get an understanding of what are some of the critical resources for the private sector business in the UK. We believe that our job, primarily, is to provide information to the private sector as to whether some of these resources are rare, are getting rarer and whether there are issues such as price volatility, etcetera. We can imagine working through WRAP to try and make sure that the private sector, especially the SMEs, are made aware of some of the critical issues. So it is a conversation, basically, between DEFRA and the private sector as to what their needs and wants are.

We find that the EU study, which also looked at some of the resource issues, is very important. Whether we will do exactly this study again or not, I do not know, but it is an issue that we will keep a watching brief on, along with the EU, so that we can continuously update what the needs of our British industry are and we can advise them as to what we know about resource scarcity.

Q110 Chair: Were other Departments involved or was this just DEFRA? Did you consider Government policy for economic growth as a part of your thinking?
Professor Watson: Unless my colleague corrects me, it was a DEFRA study, but of course on issues such as this we work with BIS all the time to make sure that we are joined-up. It was a study that we contracted out to an external group. Obviously, the key issues are: what do we know about resources and resource use efficiency, and what can you do on recycling? The obvious answer was that it had to be in the context of economic growth in the UK. The question, fundamentally, was, were any of these resources going to be scarce and could that undermine some of the private sector?

Q111 Chair: You mentioned the EU study. I take it that it is fair to assume that the work you have undertaken complements the EU study?
Professor Watson: Exactly, yes.

Q112 Chair: Did either of the two Departments have any direct involvement in the EU critical raw materials initiative?
Professor Watson: No. I did not know the answer to that, so my colleague sitting behind me has given me the answer, which is no.

Q113 Chair: Is it your intention now to feed into that process the findings from the UK?
Professor Watson: Absolutely. We are open and transparent about anything we study. The review has already been published, as you know. We will make absolutely sure, if we haven’t already, that our EU colleagues have the findings, absolutely. We can learn from each other.

Q114 Chair: Whose responsibility is it to decide when a metal becomes strategically important to the UK?
Professor Watson: Have you got an answer to that?
Professor Clary: I don’t have an answer to that.

Q115 Chair: But you would regard that answer to lie within the UK, not in the EU, I take it?
Professor Watson: The EU will decide from their perspective whether it is strategically important, but we should independently decide. For example, on many of the Rare Earths, we are not a major user of Rare Earths at this moment, but as we move towards a low-carbon economy, a number of these Rare Earths are going to become much more important, so we need to keep a watching brief as our private sector starts to develop wind turbines, for example, which
will use some of the metals and materials that go into an electric car. We need our own watching brief in addition to the EU, quite clearly.

Q116 Graham Stringer: You said, Professor Watson, that we are not a major user. Compared with what—compared with the totality of Rare Earths or compared with other countries?
Professor Watson: Yes, correct. We are probably something like number nine or 10 in the world. We are a very minor user at this moment in time compared with the US and Japan, and even compared with France, etcetera. For the Rare Earths, in particular, at this moment in time, we are a relatively minor user.

Q117 Graham Stringer: When you say that, are you talking about manufacturing or end use?
Professor Watson: Our use of it in manufacturing.

Q118 Graham Stringer: In end use, we may well be up at the top.
Professor Watson: Exactly. We buy some of the products in that already contain the Rare Earths.

Q119 Graham Stringer: Even if we are not manufacturing it, the supply of Rare Earths is important because we use them.
Professor Watson: Absolutely.

Q120 Graham Stringer: And we are not in ninth position in that?
Professor Watson: As we know, China totally dominates the Rare Earths market at the moment. Something like 97% of all Rare Earths come from China, which, of course, potentially poses the risk of instability. As we know, they put some export quota limits on only a few months ago. Therefore, I would argue that it is rather important from a UK perspective to see other sources start to materialise. Clearly, there are thoughts of re-opening mines in Australia and in the United States so that there is a wider diversity of sources.

Q121 Chair: The point that Mr Stringer has raised is important because that means that DEFRA’s responsibility, which includes oversight of the recovery and recycling of materials, is bigger than our actual primary use in manufacturing.
Professor Watson: Yes.

Q122 Stephen Mosley: In your answer to the previous question, Professor Watson, you said that DEFRA was responsible for updating businesses on resource scarcity. When we had before us Tony Hartwell from the Environmental Sustainability Knowledge Transfer Network, he pointed out that he did not really know who was responsible. There is no central agency. Dr Pitts, from the Royal Society of Chemistry, pointed out that UK companies need good-quality information. He seemed to imply that they are not getting that at the moment. Is it DEFRA’s responsibility not just to update businesses but also to make sure that they are aware that the source exists? Do you also look at things such as the levels of import, export and the amount of rare metals that are traded within the UK?
Professor Watson: I am not sure we have formal responsibility, but given, quite clearly, that one of the roles of DEFRA is to understand resource efficiency—to what degree you can recycle—we undertook this study to inform ourselves and the private sector. Whether we have any formal responsibility, I am not clear.

Q123 Stephen Mosley: Leading on from that, do you think there should be an organisation within the UK Government that has formal responsibility for collecting all of this information and disseminating it?
Professor Watson: The question would then be, would it be an entity such as DEFRA or BIS? Clearly, we need to be joined up. The private sector needs to be informed, and we need to be informed by the private sector as to what they see their resource needs are likely to be now and in the future as they see whole new product lines coming on base. We, in the Government, ought to be able to make sure that we can at least provide information to them as to whether there is either scarcity or a question of access and price volatility, as in the case of Rare Earths. Until we get other sources of supply, China could set quota at any point in time.

Q124 Stephen Mosley: You mentioned BIS, and I know we have the FCO here and yourselves, so a number of different Departments seem to share responsibility. To what extent do you share data, information and responsibility?
Professor Watson: As soon as this study was commissioned and we had the final results, we obviously made sure it was published and available to everyone. One way in which in we try very hard to share information is through the chief scientific advisers. We, typically, meet every Wednesday morning for breakfast, as we did this morning. There is an informal network right across all chief scientific advisers as to key issues, whether it is Rare Earths, climate change, biodiversity and a whole range of issues. There is an informal network and we each make sure that we are aware of some of the big issues that are coming up.

Q125 Stephen Mosley: In your previous response you also mentioned the transition to the green economy, the low-carbon economy. You mentioned about the importance of rare metals. Are you able to quantify that at all?
Professor Watson: No. Again, the question is, what will the UK’s strategy be? Clearly, we have legislation, as you and I know, that by 2050 we need an 80% reduction in greenhouse gas emissions in the UK. We also have some intermediate targets for 2020 to 2030, especially advised by the Climate Change Committee chaired by Adair Turner. There is a real question of exactly what that energy mix will be. What will we do in the production of energy and to what degree will wind turbines be an effective part of that solution versus carbon capture and storage and nuclear power? How will we look at end use efficiency, so to what degree will we go to hybrid cars
or all electric cars? The strategy to meet our target will depend on what the demand is. DECC has a calculator that talks about a whole series of approaches to get to this 80% reduction of greenhouse gas emissions by 2050, depending on what combination of technologies you use in different sectors. A very logical piece of work could be almost what you are suggesting. We must think through different pathways between now and 2050. What types of demand will be needed of Rare Earths for either wind turbines or electrically driven cars? That is a piece of work that would make some sense. Of course, to what degree are we going to manufacture here and to what degree are we going to import? So one could do a piece of work around that.

Q126 Stephen Mosley: I was going to tie it all up by asking, does the Government know what the demand and need will be over the next couple of decades and where will those metals come from? I think the answer, from what you have said, is no, effectively, is it not?

Professor Watson: There are multiple pathways to get from here to 2050 in playing around with both end use and production of energy. It is a combination of the two, of course, in addition to how we manage our land and agricultural emissions. There are multiple pathways, but one could clearly then try and do some thinking that, if you took one pathway between here and 2050, what are the implications for different technologies that would need to be manufactured? You can make some assumptions of what would be domestic production versus imports. One could at least come up with a range of the demand for these materials. Obviously, one would really want to study the global demand for these particular products, and one could make an assumption of likely demand if the world went more towards wind turbines or electric cars.

Then, of course, one would want to examine to what degree you can recycle and recover. A lot of it would be in the initial design in terms of to what degree you could subsequently recover and recycle or to what degree you could create a longer lasting piece of equipment in the first place. We would need to consider many factors when making an assessment of demand.

Q127 Stephen Mosley: But there is nothing going on at the moment?

Professor Watson: Not that I know of.

Q128 Pamela Nash: Good morning, gentlemen. We have seen evidence in the Committee that large businesses have been able to bulk purchase and plan ahead so that they can hedge against any strategic metal supply risks that may be on the horizon. However, we are concerned about small and medium businesses that may not have the resources to plan ahead in this way. In what way can the Government support those businesses?

Professor Watson: I presume, to be quite candid, that the best way we can support the SMEs is by providing information about availability, about whether we see that there is likely to be scarcity or not. I see the Government’s role is in helping to provide information. What you are also suggesting is that the larger companies have more the ability not only to bulk purchase but to stockpile. I don’t see that there is a role for Government in stockpiling. I see the role of Government in providing information about availability, etcetera.

Professor Clary: I think the Foreign Office has a particular role in promoting companies overseas, and that includes SM Es through agencies like UKTI and Science and Innovation Network. They have a role in that regard. I think that is an important aspect also.

Q129 Chair: Do our science counsellors in overseas missions collate any information and feed it back to the centre on the specific question that Pamela asked?

Professor Clary: There has been a certain amount from Science and Innovation on SMEs and what can be done in other countries, certainly. At the moment there is going to be a little more emphasis on that than there has been in the past.

Q130 Chair: Clearly, there should be a structured reporting mechanism covering perceived risks of supply from the different countries.

Professor Clary: Yes. The science counsellors do provide reports on policy issues from all the different countries. Those are published on the BIS website in the annual report of the Science and Innovation Network.

Q131 Pamela Nash: Thank you, Chair. I am interested that you said that. How can the Government do that when the supply risk does not seem to be very clear to the rest of us? Does the Government have sufficient information to provide that to small businesses?

Professor Watson: I might be missing your question.

Q132 Pamela Nash: My concern is that the supply risk is unpredictable. Is it as unpredictable as I think as a lay person, or do you have the ability to predict it sufficiently to provide to business?

Professor Watson: What has happened on the Rare Earths, which we all know, is that China put some significant export quota limits on a number of them during the last year. The situation was not that supply was uncertain but that the price became much more volatile. What we need to do is to keep a watching brief as to what will happen to availability and to price. As I say, we are starting to see the potential increase in production of new mines or the re-opening of some mines in California, USA, and a couple of mines in Australia. Also, there is the possibility of other mines opening in South Africa, Vietnam and in other places. As the price goes up and the Chinese start to put on quotas, these other mines could come to be quite lucrative. However, one of the big challenges is that much of the skill base for knowing about mining—it is meant to be quite complex—resides in China. One needs to make sure that there are multiple sources. Then you will get supply certainty and probably more price certainty as well,
which would indirectly encourage other sources of minerals, especially the Rare Earths.

**Q133 Pamela Nash:** Can I take from that answer that you believe we need to offset China’s monopoly with these other mines?

**Professor Watson:** This is a personal viewpoint. Whenever you have a single source, by definition they can hold the world to ransom, basically. Clearly, what would give us more stability on both price and availability would be multiple sources. It would make the market work.

**Q134 Pamela Nash:** Do you think that the World Trade Organisation talks in Doha will provide us with a more successful strategic metals trade?

**Professor Clary:** Obviously, the Doha talks have stalled somewhat, but currently there is a lot of enthusiasm to get that going again, and this could be a mechanism for developing, emerging and developed nations to get together on this issue. There is a promise there.

**Q135 Pamela Nash:** Do you think the progress in this area is dependent on these talks being successful?

**Professor Clary:** I think it is one of the many areas where progress is needed. It is not just the WTO. There are other agencies like the World Bank and the IMF, for example. Even if you go to international fora like the G8 and G20, there are quite a few opportunities to address these issues. A though the Doha trade round has great potential, it is not the only way forward.

**Q136 Stephen McPartland:** Professor Clary, how practical would it be for the Government to implement and monitor schemes such as the International Council on Mining and Metals’ best practice?

**Professor Clary:** I think the International Council has had some very useful initiatives and proposals for those companies getting together and making proposals on sustainability, for example, with respect to mining. Certainly from the FCO’s point of view, they support those initiatives and reports that have come through from that direction.

**Q137 Stephen McPartland:** From your answer, how practical do you think it would be to monitor those schemes and enforce them so that we know what is going on in those mines?

**Professor Clary:** Enforcing is something else altogether. Obviously, the UK cannot do that on its own. These are done more through the international agencies, through the European Union, for example, or even through agreements through the WTO. The International Council on Mining and Metals can provide good ideas but it is up to the other agencies, if they wish, to take those forward. That agency also comes forward with good practice between the major mining companies, and if those companies can keep up that good practice that is also very advantageous.

**Q138 Stephen McPartland:** Do you think it is feasible to trace the source of these strategic metals to identify that they have been produced from specific mines?

**Professor Clary:** Scientifically, that is very difficult to do. There has been some research in that direction, but once the metals are released, especially if they are in alloys and so on, it is very difficult to trace where they come from, as I understand it.

**Q139 Chair:** It does need political oversight to manage the supply side in making sure that they come from morally acceptable sources.

**Professor Clary:** Yes. That is correct.

**Q140 Stephen McPartland:** Does that political oversight exist at the moment?

**Professor Clary:** I do not think it exists in the form that people would really like at the moment. There are lots of discussions going on between various agencies, for example, in the DRC, in the Congo, to try to make progress there. As far as I can tell, there is no overarching procedure that is working at the moment.

**Q141 Stephen McPartland:** You have mentioned the DRC. Do you think that there is anything the UK Government could do to minimise the social and environmental impact that mining causes in a country like that?

**Professor Clary:** DFID has had some programmes in that regard, for example, the Trading For Peace Initiative, which has recently finished. I believe that it also has an initiative with the World Bank to provide some resource to try to help the DRC have a more sustainable well-governed mining process. There is some work going on in that direction in one of the Government Departments.

**Q142 Stephen McPartland:** On a slightly different point, the IMF’s Structural Adjustment Programme required very low royalties. Zambia gets 0.6% of the royalties from 700,000 tonnes of copper. I am wondering whether or not you think that was the wrong policy.

**Professor Clary:** It is an interesting idea. If it is possible to increase the royalties that countries get, then that could have a very significant effect. The quote that you have from Zambia is remarkable in that it is less than a 1% royalty. If there is a way, perhaps with the IMF, of increasing that royalty, that could help the developing countries to develop a sustainable system for mining metals.

**Q143 Stephen Metcalfe:** Professor Watson, I want to go back to what you said about multiple sources of supply. You said that most of the expertise in mining lies in China. Presumably, we need multiple sources of ownership as well and to expand that mining expertise. Do you see that as a risk or was that just a comment you threw in?

**Professor Watson:** It was just a comment, given that at the moment 97% of all the Rare Earths are coming from China and, effectively, there has not been any significant production outside of China. As I understand it, you need quite a range of skills to mine these Rare Earths. It is just a comment, basically, that one not only has to have a source of the Rare Earths,
but one has to have the skills to extract and process them. I would imagine that within the US that skill base does exist. If not, I am sure they can get it. As I said, a mine in California is being opened up. They are optimistic that within a couple of years they will have quite a significant production. Equally, there are a couple of mines in Australia which they hope will have quite a significant production. How optimistic those production numbers will be, is only time will tell. Between the two mines in Australia and the one in the US, the thought is that it could start to produce a significant percentage, be it 30%, 40% or 50% of the production currently in China. I would presume that if there is enough profit to be made, those skills can soon be acquired, if they haven't already got them.

Q144 Stephen Metcalfe: I want to pick up on the issue of recycling that we touched on earlier because, presumably, as well as new supply, recycling can play a big role in this. Ian Hetherington of the British Metals Recycling Association told us that the WEEE regulations should be expanded to cover industrial and commercial waste. Should we or could we change the WEEE regulations to do that?

Professor Watson: I am not an expert on this. The amount of Rare Earths in many of these products is extremely small, so the question is to what degree it is economically viable to recycle. We are working with WRAP to look at the issue of product design in the first place, the life expectancy of the product and then the potential for recycling. It would strike me that we need to do a lot of work on product design and to see to what degree recycling is indelibly.

Professor Clary: Perhaps I could add to that. Japan has something of a lead in recycling science. I know there are proposals from the research councils that were in the RCUK submission—from NERC, for example—on promoting recycling. It is an area that is being given attention in the fundamental science being funded by the research councils.

Q145 Stephen Metcalfe: Where do you think the Government role lies in encouraging companies to design products so that it is easier to recycle the strategically important metals contained within them?

Professor Clary: That is a difficult one. We have a trade situation of openness. The regulations in that respect might not be productive. It is a difficult one to answer.

Q146 Stephen Metcalfe: Okay. So you do not necessarily see a role for Government in encouraging businesses. Is it just a question of back to the information?

Professor Watson: I would argue that it is information as to the cost of these products and the potential for recycling. One needs to let the market work, basically. As long as the private sector has all the relevant information about what the current and potential future demand is and they can think through how you would produce a product and what the potential for recovery and recycling is, that is the role of Government basically, and then one will let the market work.

Q147 Stephen Metcalfe: At the moment, as I understand it, quite a lot of waste electrical goods are not exported, but a fair degree of that is exported illegally. How do you see the Government addressing that? What is their role?

Professor Clary: Have you come across that, Robert?

Professor Watson: I know it is a potential issue. The question is, how does one stop the illegal waste dumping, because it is the Basel Convention which prohibits dumping? One of the other points is, within the UK, when a product sometimes reaches the end of its useful life here, it still has some potentially useful life in other places. The question is, if indeed that is not exported not as waste but as a product that has Rare Earths in it, if one could recover them, would we want then to re-import what is waste? This is a real question of what the economics look like, to be quite honest.

Q148 Stephen Metcalfe: But it does go wider than economics, does it not, because these are metals, as you say, that we might be exporting and re-importing with some additional value added to them, but they are important to the UK economy as well in their own right as a resource? Do you see WRAP having a role in controlling the export of waste? Does WRAP have enough of its own resources, bearing in mind it has taken the best part of a 30% cut in the last few years, to be effective in that role?

Professor Watson: I do not see WRAP having a regulatory role. We need WRAP to focus on the issue of material efficiency, how you design to avoid waste in the first place and analyse to what degree one, effectively, can do product design recycling recovery. You are absolutely right that WRAP, like the rest of DEFRA, will be reduced in size. We are looking at a 30% cut over the spending period, so clearly WRAP, like the rest of the entities we fund, will also face cuts. However, we have talked to WRAP. They believe that even within their smaller budget—they have a small core in-house group and then a larger external expertise they work with, some of which is voluntary—they can keep this issue of strategic metals as one of their priorities, but they do not really have a regulatory function. Their function is to advise us on what is the waste resources programme, basically.

Q149 Chair: Is there a function for WRAP or DEFRA to work more closely with academic institutions to deliver some of the research that is needed to improve the recovery rates of these metals?

Professor Watson: It is something we should look at. I believe that David Willetts will be appearing in front of you next. It is not necessarily just DEFRA but we need to be joined up. I think that some of the research councils, like NERC, could well look at this. It is quite clear that this has not been an area of active research in the UK. We need to look at to what degree there is a research agenda and a combination of funding entities, which can include DEFRA but also NERC as a major research council. We should look at this. It is one area where putting more emphasis on it might well be useful, absolutely.
Q150 Graham Stringer: The Minor Metals Trade Association told us that the European REACH regulations are causing huge problems for them in terms of costs and making it difficult to handle strategic metals. Do you think the REACH regulations should be changed?
Professor Watson: I don’t know enough about the REACH regulations. Obviously, REACH is meant to look at, I think, at least 30,000 chemicals at the moment. Their job is to understand what the implications are for the environment and human health. A raw rare metal should not, as I understand it, come under the REACH directives. Where they have a role is if it is chemically modified. REACH, of course, is fairly new and it has only recently got up and running. Of course, some people would argue that, if the chemical is on the REACH agenda, it can actually stifle innovation. You can also say that, if it is trying to protect society from harm, whether it is environmental or human health, it can also stimulate innovation. Given that I don’t have enough information, I can get back to you. I will talk to the people who run our REACH programme and come back to you later on with some information.

Q151 Graham Stringer: That would be helpful. In terms of the evidence we have had, it certainly applies to titanium, and they told us it costs £70,000 for a licence just to handle it, which strikes me as excessive. The same people also said that thallium ends up in landfill sites because it is toxic but it is an absolute necessity for repeaters in fibre optics. Can you think of any way that we can stop it just being dumped in landfill?
Professor Watson: Again, let me get back to you on that. I am not an expert in waste disposal, so I apologise for not having an instant answer for you. Obviously, we are trying to move much closer to a zero-waste society. To what degree regulation should stop things being put into landfills versus encouraging the recycling and recovery of these metals is a key issue. I need to get back to you on that.

Q152 Graham Stringer: We have had fairly firm evidence that the regulations are actually increasing the amount of toxic waste material going into landfill rather than being recycled. Do you know in terms of recycling strategic metals where we are in the league table of European nations on that?
Professor Watson: I don’t. The answer is no, we don’t know.

Q153 Chair: Once again, your answers indicate that there is a gap in knowledge that does justify some joined-up thinking across Government Departments and reaching out into academia to help improve our ability to recover metals.
Professor Watson: I would agree completely with that. Absolutely.
Chair: Gentlemen, thank you very much.
Professor Watson: I will come back with the information you requested.

Examination of Witness

Witness: Rt Hon David Willetts MP, Minister of State for Universities and Science, gave evidence.

Q154 Chair: Good morning. Minister, thank you for coming to see us this morning. We were getting a bit anxious. The just-in-time principle applies to Ministers, we see. There are several issues we are going to cover this morning, starting with strategic metals, moving on to Pfizer and then UKCMRI. Just to flag up to you, there are other issues that we will be chasing your Department on, not least of which is our inquiry into particle physics and astronomy. So I am parking that to one aside and putting it on the record for the time being.
If I may start on the strategic metals, we have just had the chief scientific advisers of DEFRA and the Foreign and Commonwealth Office in front of us. As you know, we have taken evidence from other external experts in this field. BIS said in its memorandum that there is a need to support and encourage companies, and I quote, “to assess their own particular situation to mitigate risks to supply.” That very much fits in with some of the evidence we have received. How does the Government intend to do this?
Mr Willetts: First of all, Chairman, I appreciate the fact that the Committee has a very weighty agenda today to get through. I am sorry I was not here bang on 9.40. I apologise for that.
Of course, on Rare Earths we are not a major importer of Rare Earths in their raw form. We are more a user because we import products that incorporate them. We reckon, incidentally, that we are directly importing about 1% of the world’s production of Rare Earth compounds. What we are trying to do is, first of all, work with our EU partners on the impact of the Chinese export quota, which is a significant challenge to the industry. We are also working with industry to get them to try to develop smarter purchasing strategies. Also, through the excellent reports that the TSB has produced, of which you are doubtless aware, work with our EU partners on the impact of the Chinese export quota, which is a significant challenge to the industry. We are also working with industry to get them to try to develop smarter purchasing strategies. Also, through the excellent reports that the TSB has produced, of which you are doubtless aware, work with our EU partners on the impact of the Chinese export quota, which is a significant challenge to the industry. We are also working with industry to get them to try to develop smarter purchasing strategies. Also, through the excellent reports that the TSB has produced, of which you are doubtless aware, work with our EU partners on the impact of the Chinese export quota, which is a significant challenge to the industry. We are also working with industry to get them to try to develop smarter purchasing strategies. Also, through the excellent reports that the TSB has produced, of which you are doubtless aware, work with our EU partners on the impact of the Chinese export quota, which is a significant challenge to the industry. We are also working with industry to get them to try to develop smarter purchasing strategies. Also, through the excellent reports that the TSB has produced, of which you are doubtless aware, work with our EU partners on the impact of the Chinese export quota, which is a significant challenge to the industry. We are also working with industry to get them to try to develop smarter purchasing strategies. Also, through the excellent reports that the TSB has produced, of which you are doubtless aware, work with our EU partners on the impact of the Chinese export quota, which is a significant challenge to the industry. We are also working with industry to get them to try to develop smarter purchasing strategies.
the Government’s advice and guidance gets down to that sector?

Q156 Chair: In Japan, the government-funded Japan Oil, Gas and Metals National Corporation—what a fantastic title—has an annual budget equivalent to over £11 billion, nearly twice the combined budget of DEFRA and DECC. Should we conclude that the UK is not taking resource security as seriously as our competitors?

Mr Willetts: It is a particularly fraught issue in Japan because of their relationship with China and because of their very different industrial structure, with more direct manufacturing incorporating these elements.

Q157 Chair: But much of that manufacturing you would like to capture to the UK, wouldn’t you?

Mr Willetts: Yes and, of course, we are seeing a revival of British manufacturing. We have to see what sectors our manufacturing expands into, but at the moment we tend to be rather further down the chain than Japan. We tend to buy and import products, which can be components that we are doing further work on, but we tend to import products and components where an intermediary country has itself bought the Rare Earths and done the first set of work on it. So we are in a slightly different relationship to the supply chain than Japan is.

Q158 Chair: The Government strategy for growth will have to rely on strategic metals, which, in turn, will have to be sourced from a number of nations. Should resource management in the UK be dealt with by a single public body, such as the Japanese example?

Mr Willetts: This is an area where I would be very interested to have the Committee’s views. I think it is excellent that the Committee is investigating this subject. The Committee has raised the salience of it, quite rightly. It is a very odd position where something like 97% of these Rare Earths and materials are all coming from one country, China, which has now imposed export quotas. At the moment, working with the EU on areas like improving recycling through the WEEE directive, working with the EU and WTO on the trade issues—of course we are waiting to see the outcome of a related trade case—and through the work of the TSB on specific industrial challenges, we think that we are covering the waterfront. If this Committee had a view that there should be some changes in the arrangement—it obviously cannot commit us to it—I would certainly undertake to consider them very carefully.

Q159 Graham Stringer: I think the only way of interpreting the evidence we have had from the Minor Metals Trade Association is that the reason why we are only importing 1%, to go back to your original statement, is partly the costs of the REACH regulations. Would you accept that and do you think you can do anything to reduce the burden of the REACH regulations?

Mr Willetts: We think that the REACH regulations are, on balance, helpful in this context. They are driving industry to do the kind of things that have to be done if we are to reduce our—

Q160 Graham Stringer: Let me give you an example. We were told that to handle titanium, which is a metal that has been known for a long time and its properties are pretty well known, you need a letter of access that will cost you £70,000 because the body that imports that has to pay even more than that and it wants its money back. That can’t be helpful to British industry, can it?

Mr Willetts: The regulations provide a common framework across a wide range of potentially hazardous materials applied consistently across Europe. We think that it is in the best interests of British industry to have one consistent framework. If there are individual examples where the regulations are too onerous, then, as we are also the Department responsible for deregulation, I will happily pursue them. It is challenges like the one we face on Rare Earths that reveal the relevance and value of these type of regulations.

Q161 Graham Stringer: That was facing both ways, really, wasn’t it? Do you think a letter of access costing £70,000 to trade in titanium is an unnecessary burden? As you pointed out, your responsibility or the Department’s responsibility, in your manifesto, was very clear on removing burdens from industry. I would have thought that the REACH regulations were ideal for amending, whatever the philosophical basis for them is.

Mr Willetts: If you have specific examples of—

Graham Stringer: I have just given you one.

Mr Willetts: I am not aware of that specific case. I am very happy to go away and look at it. Certainly regulation has to be proportionate, but the REACH framework we regard as very valuable. If there are particular areas where it is being applied, especially if it is being gold-plated in the UK, going beyond the EU requirements, then certainly we will have a look at it.

Graham Stringer: Maybe titanium-plated.

Chair: Or both.

Q162 Graham Stringer: You mentioned the WEEE directive. A gain, the Minor Metals Trade Association said that that directive and the interpretation of health and safety legislation is stifling innovation and business start-ups. Do you recognise that? Do you think the WEEE directive needs amending in any way?

Mr Willetts: Again, the basic idea of the Waste Electrical and Electronic Equipment Regulations is to encourage more recycling of electrical and electronic
items where the current recycling rate is very low. I think we get something like 1% of these Rare Earths from the recycling of existing equipment. It is clear that one thing we have to do is to get better at recycling. As more and more old computers, IT equipment and mobile phones are chucked out, they are a potential resource. So, again, we back the principle of the WEEE regulations.

Q163 Graham Stringer: Just on the principle, what is the cost benefit of the WEEE regulations?
Mr Willetts: I don’t have the cost benefit analysis to hand.

Q164 Graham Stringer: If it was negative, would you change your view?
Mr Willetts: I believe that in the context of the specific problem we are looking at today on Rare Earths, and more widely, given this Government’s commitment to recycling, like that of the previous Government, the WEEE directive overall make sense. We are trying to improve it. At the moment it has a framework of, essentially, collective producer responsibility. I can tell the Committee that we are working with industry stakeholders to see if we could get a system of individual producer responsibility which might improve the incentives. If there are specific ways that we could implement the WEEE directive better, again, I would be very happy to look that document out in whatever form it was taken to implement the regulations, and I am very happy to look that in whatever form it is available to us as a new Government and share it with this Committee.

Q165 Graham Stringer: Thanks, but you will come back to us with a cost benefit.
Mr Willetts: I am not aware that this Government has carried out any new cost benefit analysis. I am sure there was a cost benefit analysis when the decision was taken to implement the regulations, and I am very happy to look that document out in whatever form it is available to us as a new Government and share it with this Committee.

Q166 Graham Stringer: We were also told that one of the perverse consequences of the REACH regulations is that thallium, which was used over the road in the Palace of Westminster in the 19th century for rat poison, is now considered so toxic that it is put into landfill rather than being recycled. It is vital in repeaters in fibre optics. Do you think that is sensible, and doesn’t that require a re-look at the REACH regulations?
Mr Willetts: Yes. I think we need to be far more imaginative about ways in which we can reclaim and recycle these Rare Earths.

Q167 Chair: Can I just stop you there, Minister? You keep referring to Rare Earths. Are you specifically referring to lanthanides and actinides or are you using it meaning scarce minerals?
Mr Willetts: I am referring to the particular elements in about the middle of the periodic table. What I found quite useful as a layman, as the simplest guide, if I may say so, is the Chemistry World chart.

Q168 Chair: Our inquiry spans beyond scarce metals, just so that we are talking the same language. I apologise, Graham.
Mr Willetts: One of the ways forward is to do better at reclaiming and recycling. If there are particular examples the Committee has where British industry could do more or the regulatory framework is having perverse effects, that would be very helpful and we would undertake to look at them.

Q169 Graham Stringer: One of the things that I have so far failed to get a handle on in terms of whether we are going to run out of these strategically important metals is whether, as some of the witnesses we have heard have said, if the price goes up, we’ll dig deeper and get more metals out, assuming there isn’t an access problem, but what if the real problem is not even that but the fact that the market is being manipulated? Do you have a view on whether it is market manipulation that is sending the prices up or just scarcity and, eventually, the price mechanism will deal with that?
Mr Willetts: These are delicate issues. There are investigations pending, are there not? It is very odd if a country imposes an export quota on the raw materials but with no constraints on those materials in finished products exported from that country. That is an odd way of conducting international trade. That is the first point.

The second point is that, although we currently have many of these materials, over 90%, I think, of the world’s supply coming from China, this is not, as I understand it, because there is something special about the geology of China which means they are concentrated in China. It is more to do with other things, for example, that mining some of them is a nasty, dirty and environmentally risky business and the environmental regulations in China may be less onerous than in many other countries. It may also be that, as I understand it, as they are not concentrated in areas where you can have large-scale mining but are more dispersed, you need a rather different industrial structure for people to operate in large numbers of small mines, which again appears to be the Chinese industrial structure at the moment.

There are several reasons why we have ended up with China as such a key player. It would be a good thing, as part of the market response to this situation and the export quotas, if we saw improved effort at recycling and reclaiming in other countries and we also saw the opening up of alternative sources of supply, including extractive technologies that were less environmentally damaging. There could well be an issue about how international trade is currently being conducted but I don’t think that is the full story. There are several factors behind this and I am trying to share with the Committee our understanding in BIS as to what those are.

Q170 Graham Stringer: That is interesting. Apart from the restrictions that China have imposed, we have been told that one major dealer on the London
Mr Willetts: As someone who does, I confess to this away from the Chinese factor, is operating fairly as a strategic metals, not necessarily Rare Earths but fairly Metals Exchange owns a large proportion of certain

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The implication of that is

Q171 Graham Stringer: The implication of that is that you are not satisfied that the market is operating properly. Are you going to do anything about it?

Mr Willetts: There is currently an investigation of the related case involving Chinese export quotas. I do think there are issues here that could well come up in a WTO context, but meanwhile we are trying, in a practical way—again, I praise the work of the TSB and the reports they have done—about being smart about things like better recycling, looking at technologies for extractive industries to tackle the problem in several different dimensions.

Q172 Pamela Nash: Minister, yesterday the Resource Extraction (Transparency and Reporting) Bill was presented to Parliament, which will require businesses performing metal extraction to publish what they pay in developing countries. This reflects the opinion that the UK has a responsibility to ensure that businesses trading in the UK act responsibly in the communities where they are mining. Does the Government agree that we should make sure that extraction companies that are listed in the UK meet sufficient social and environmental standards in their overseas mining activities?

Mr Willetts: This is the kind of area where I think action is best taken internationally. We are looking at ways in which we can work with our partners on this and agree standards in the extractive industries globally. I would be more wary of a particular burden on a company that happens to have its headquarters located in London and if a company’s headquarters were located somewhere else it would escape the burden. These issues are best tackled with other countries alongside us.

Q173 Pamela Nash: Are any current negotiations going on either through the World Trade Organisation talks or elsewhere?

Mr Willetts: This is something about which there are discussions at the EU level. I am sure it is something that we can raise again at that level. As I say, I would be very reluctant to see us impose special burdens on extracting businesses which are headquartered here but otherwise could move elsewhere.

Q174 Pamela Nash: Can I take it that you do not think there are any measures that we could use within the UK at the moment?

Mr Willetts: In BIS and DEFRA we keep in close contact with businesses. Of course, that is a two-way process. We talk to them about some of the issues that concern us and they raise their concerns with us. I would be reluctant to see UK specific regulations.

Q175 Stephen Metcalfe: We would probably all accept that strategically important metals are going to become more important to the UK, certainly if the Government’s strategy of expanding its manufacturing base works. Many of those metals are currently concentrated in China. We also heard in our earlier session that a lot of the expertise for extracting those metals also lies in China and the UK has always had a strong mining and exploration research base. Yet, the Geological Society is concerned that NERC is not putting enough money into funding and supporting that research base. What do you think the Government can do about that and do you think the Government should do something about that?

Mr Willetts: We do have a responsibility through our excellent science and research base. There are things that we can do. I keep in touch with NERC and others. We are world leaders in understanding some of the geological processes and the distribution of some of these materials. If there are specific areas where more research is required, I am sure the industry will communicate it to NERC. My impression is that we are quite active in researching this area.

Q176 Stephen Metcalfe: Why would you imagine that the Fellows from the Geological Society have expressed concern about that?

Mr Willetts: All I can say is that I visited the British Geological Survey in Scotland only a few weeks ago and went through with them the work, for example, that they were doing and was impressed by the range of their activities. We do have a post-graduate course in mining geology at Camborne School of Mines at Exeter. My impression is that, both through the British Geological Survey and some of the work done at universities such as Exeter, we have a reasonable presence in this area. As we know from a previous set of exchanges at this Committee, I do not instruct research councils about specific areas that they should research because that would be a breach of the Haldane principle, but if there are specific areas where there is a view that we need more research and there is more that NERC could do, then, of course, the business community are free themselves to communicate directly with the research councils.

Q177 Stephen Metcalfe: That does identify whether it should be an industry pull or an academic push.
Perhaps the next part of my question is that some of these strategically important metals may well lie within the UK. However, extracting them requires planning permission. We know that in the UK the planning law is lengthy, uncertain and complex. Would the Government like to see more mining done in this country which may then encourage more research into the extraction of these metals, and what can we do to encourage it?

Mr Willetts: It is my understanding that in this country we have one gold mine, which is in Northern Ireland. I believe there was recently a planning application for a mine in Cornwall, which was turned down. Planning permission was refused, I think, from memory. Mr Metcalfe, you may have more information than I have about it.

Stephen Metcalfe: No.

Mr Willetts: I have asked officials if there are ways in which our current plans to reform the planning system might affect decisions on mining and the extractive industries, and so far that connection has not been made. Nobody has been able to identify to me specific provisions that might change that. Certainly, as the thinking of other Departments about the planning regime advances, there is a potential read across here and we need to keep an eye on it. But, at the moment, I personally have not been briefed on any specific ways in which that would change.

Q178 Stephen Metcalfe: Would changing the classification of mines to nationally strategic infrastructure have an impact?

Mr Willetts: That is not a proposal that has been put to me. I can see the sensitivities of things such as that. It is an interesting observation, which, if the Committee wants to pursue it, I am sure we will look at as part of our response to your report. I will pass it on to my colleagues who are in the forefront of tricky decisions on planning.

Stephen Metcalfe: Absolutely. Thank you very much.

Q179 Chair: These are very difficult questions, Minister, and range much wider than simply Rare Earths, as I indicated. In the critical raw materials review for the EU there are a dozen or so elements listed, including, for example, tungsten, of which we used to be a very significant producer, the platinum group and so on. We would ask you to make sure, in conclusion, that your Department's evidence does reflect the broader shortage of certain minerals as identified by that critical raw materials review.

Mr Willetts: That is a very fair point. Yes. Quite right.

Chair: Thank you.
Written evidence submitted by the Department for Business, Innovation and Skills (SIM 00)

1. Is there a global shortfall in the supply and availability of strategically important metals essential to the production of advanced technology in the UK?

   1. The current situation is that whilst there is currently no significant shortage/lack of availability of key metals, the situation could rapidly change. The UK operates in a global market and largely requires the same materials as other developed economies, and as the world economy moves towards high technology and low carbon manufacturing competition for strategic metals and resources in general will increase.

   2. Whilst there have been no reports of shortages, various industry sectors have expressed concerns relating to access and security of supply rather than scarcity of key metals and minerals. However there are differences in opinion on which resources are at risk as well as concerns that some shortages of materials might be short-lived and that others are likely to emerge.

   3. The UK, EU and other developed economies are consuming some natural materials (not just metals) at an unsustainable rate. Although reserves of most critical materials are sufficient to meet demand, pressure on untapped reserves may increase, with associated environmental impacts. Critical metals are produced in highly polluting and carbon intensive industries, accounting for 3–10% of global GHG emissions. It should also be noted that UK businesses depend on a wide range of materials.

   4. There are some concerns regarding the supply of metals such as platinum and tantalum; with the former likely to become increasingly scarcer, whilst supplies of the latter could possibly be disrupted by geo-political factors. (There are large, mostly undeveloped deposits in the Democratic Republic of Congo).

   5. The EU released a report\(^1\) in June 2010 which listed 14 “critical” materials that could soon be in short supply unless the trade and policy measure of the EU were modified to ensure steady imports and domestic exploration and recycling promoted. The report states that EU economies would be damaged if the materials were inaccessible either due to shortage or export embargo, given that they are produced in a handful of nations only. The 14 metals and minerals are antimony, beryllium, cobalt, fluor spar, germanium, graphite, indium, magnesium, niobium, platinum group metals (PGM), rare earth elements (REE), tantalum and tungsten. Although China and Russia are significant producers of cobalt there are significant reserves in the Congo and others under development eg New Caledonia and Madagascar. Lithium is not included but EC sources consider that may soon change if the use of lithium in electric vehicle batteries increases dramatically. The increased use of the materials in new and emerging technologies suggests that demand for them could triple by 2030.

   6. The report cited the importance of changes in the geopolitical-economic framework that impact on the supply and demand of raw materials. These changes relate to the growing demand for raw materials, which in turn is driven by the growth of developing economies and new emerging technologies. Moreover, many emerging economies are aiming at reserving their resource base for their exclusive use. In some cases, the situation is further compounded by a high level of concentration of the production in a few countries.

2. How vulnerable is the UK to a potential decline or restriction in the supply of strategically important metals? What should the Government be doing to safeguard against this and to ensure supplies are produced ethically?

Vulnerability

7. In common with other countries, the UK is potentially vulnerable to shortfalls in supply of key metals. As there is no EU mining capacity for some materials (antimony, cobalt, iodine, molybdenum, and zirconium); they are all imported into the EU. For other materials (bauxite, graphite, iron ore, tin and phosphate rock), the EU produces less than 25% of its requirement. Brazil provides 54% of the EU’s imports of graphite and 28% of its imports of mined cobalt. China provides 28% of the EU’s imports of antimony ores and concentrates.

8. The situation regarding rare earth elements (REEs) is of particular concern. There are 17 REEs which are used in a wide range of applications, particularly low carbon technology. These metals are integral to the transition to a low carbon manufacturing economy and are also important to other key UK industry sectors such as transport, defence and security. A stable supply will be important for achieving the transition to a green economy, securing green growth and re-balancing the economy towards high value-added manufacturing. The term (Rare earths) is somewhat misleading as they are relatively abundant in the earth’s crust, some even more abundant than copper, lead, gold, and platinum; however they tend to be found in remote locations and small concentrations which render their mining expensive.

9. Although China has the largest share, territories such as the CIS, United States and Australia have significant reserves of rare earths. Recent reports indicate there is an ample supply especially within the US, though many of these reserves are not at present exploited; collaborative science is vital in predicting and finding such deposits. There are known reserves of rare earth ore in Canada, South Africa, Brazil, Vietnam, and Greenland.

\(^1\) Critical Raw Materials in the EU—Issued by the EU’s Raw Materials Supply Group
10. China is expected to remain the main world supplier in the near term due to the time required to develop resources in operational mines elsewhere. A number of mines are likely to open outside China (United States, Australia and Canada) by 2014. Supply of particular Rare Earths may be limited over the medium term.

11. World demand for rare earth elements\(^2\) is currently estimated at 134,000 tons per year, with global annual production of around 124,000 tons—The shortfall is covered by existing stocks. World demand is projected to grow at 8-11% per year between 2011 and 2014 to 170,000-190,000 tons annually by 2014 (Source: IMCOA, Roskill and CREIC\(^3\)). New rare earth mining projects can take 10-15 years to reach production, however a number of projects are due to come online in the next few years. In the long run global and undeveloped reserves should be sufficient to meet demand. China currently has 97% of the world’s short-term production capacity of rare earths. China’s market share is forecast to decline as productive capacity increases elsewhere.

12. The highest growth is expected for magnets and metal alloys, as required in hybrid and electric vehicles. Hybrids are expected to gain an increasing market share, but other applications such as wind turbines will compete for the essential materials. Although total world supply is forecast to exceed total world demand, shortages are expected for key heavy elements such as dysprosium and terbium.

13. Supply of rare earths at the present (and in the immediate future) is therefore reliant on China responding to the increase in demand and adjusting output. Concerns were heightened early in June this year when the Chinese government announced that mining rights for the rare earth elements would be restricted to a small number of Chinese state-controlled mining companies. The announcement did not specify the exact number or identity of these companies, but state media reporting made it clear that it referred to the four companies which already dominate the white-market supply of rare earths in at least one Chinese province each. This followed the capping of production levels for 2010, and the imposition of a moratorium on all new mining licenses until 30 June 2011. China’s Ministry of Land and Resources published its six-monthly review of rare earth export quotas on 21 July 2010, cutting them far more than is usual, and hitting foreign-affiliated companies hardest. China’s Ministry of Finance announced on 14 December 2010 that it would increase rare earth export taxes in 2011. The announcement did not specify the extent of the increases, nor which rare earths they would target, nor whether they would apply to raw, processed, intermediate or final rare earth goods. China’s rare earth export taxes currently apply to raw and processed rare earths only, and range from 15 to 25%.

14. The results of this action, which effectively reduce rare earth exports by over 70% (for the second half of 2010 compared to 2009), will be twofold: protection against foreign ownership of strategic resources, and incentives for foreign companies to relocate manufacturing plants to China. We assess these to be the main motivations behind China’s policy. In addition, prices are likely to be forced up in the short-medium term. The increased restrictions are also likely to deepen international concerns that China may be intentionally hoarding its reserves of rare earth metals and other key raw materials at a time of rising global demand; yet if this were China’s intention, we would expect it also to impose export restrictions on the export of finished rare earth products— and it has not done so. Reports of a temporary cessation of rare earth exports from China to Japan— during a period of political tension—further illustrate the potential vulnerability of the West.

15. Research for Defra has sought to identify those resource issues which represent the greatest threats and opportunities for UK businesses; and to assemble data on the nature and scale of those threats and opportunities, and the business understanding of these. This research covers a wide range of biotic and abiotic resources, including key metals, and is based on a review of literature and engagement with key sectors. It will be published shortly.

Safeguarding Supply

16. Concerns have heightened since the recent China-Japan dispute. Therefore whilst options in terms of securing supply are perhaps limited, other countries are already taking pre-emptive/contingency measures to safeguard supply.

17. Such measures are largely contrary to the UK’s traditional free market approach to economic policy. Unilateral action aimed at securing supplies of critical metals should be subject to very close scrutiny and can be proposed only after careful analysis of the long-term costs and benefits involved, with particular attention to the environmental consequences.

18. The UK possesses some rare earth reserves in the tailings of disused tin mines in Cornwall. However given the marginal economics and limited success in recovering rare earths from operational tin mines overseas, these are unlikely to be economic.

19. An issue that any country intending to develop rare earth production facilities must consider is the potential lack of qualified workers. Very little extraction and refining knowledge exists outside China and such knowledge will have to be developed.

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\(^2\) Rare Earth Elements—The Global Supply Chain—US Congress Research Paper, July 2010
\(^3\) IMCOA: Industrial Mineral Company of Australia, Roskill: http://www.roskill.com/
CREIC: China Rare Earth Information Centre
\(^4\) These are: Baotou Steel Rare Earth Hi-Tech Company; China Minmetals Company; Jiangxi Copper Corporation; China Nonferrous Metal Industries Foreign Engineering & Construction Company.
20. China’s export restrictions create a two-tier pricing system, where raw and semi-processed rare earth prices inside China are much lower than on the international market. (There are no current restrictions on the export of finished rare earth products from China.) Consequently, there has been much speculation that China’s objective may be to attract foreign firms with low domestic prices to develop high value-added technology industries within the country. However, China’s Ministry of Land and Resources has said publicly that the main intention of the quotas is to protect reserves from environmentally reckless exploitation. Some commentators have predicted the cessation of licences for rare earth exports from China in 2014, but Beijing has denied any plans to choke off supplies. There are currently 32 licensed exporters of rare earths in China. China’s Ministry of Commerce said in November that China needed to improve the management of rare earths by a combination of measures including [but not limited to] export quotas, export taxes, and regulation of exporters. (Other measures could include extraction licences and export licences.) The UK Government supports free trade and therefore believes an export ban by China would be anticompetitive and undesirable in the long run. Nevertheless, a cessation of Chinese exports would have a number of long-term effects:

- It would improve the economic viability of non-Chinese sources of rare earths that were previously undercut by Chinese supply, thus increasing global security of supply.
- Such a long-term signal may be helpful to non-Chinese mining projects in raising finance and in long term planning. It may also work as an incentive to develop specialist skills in extraction and refining of rare earth metals.
- These new mines would be expected to operate to much higher environmental standards than is currently the case with most Chinese mines. Chinese mines in the south of China are generally regarded as having an extremely poor environmental profile. The major producer in north China has also been criticised in this respect. Thus the export ban would enable not only a newer but also greener supply chain to be established.
- China could become the de facto monopoly supplier of goods dependent on these important materials, if the cost of alternative sources were to remain relatively too high.
- Non-Chinese businesses would still be able to purchase value-added items (magnets, motors etc) from Chinese sources, or establish more expensive non-Chinese supply chains albeit with a better and more transparent environmental profile. This principle already applies in many other UK industrial sectors.

21. The main negative effect of the export restrictions is likely to be some short-term supply tightness, particularly if the first two major non-Chinese rare earth projects are delayed. However such tightness will also be an incentive for the acceleration of these and other projects.

22. It may be that China will tempted by higher prices to continue the export of rare earths. This could impact on the economic viability of the new non-Chinese mines, and thus leave China as the possible sole supply of rare earths. There is also the “grey” market to consider—the considerable volume of rare earths that circumvent the export quotas and are mined and exported illegally from China. The degree to which these exports are targeted by enforcement authorities will also affect the viability of non-Chinese mines. If China does continue to export rare earths, the possibility remains that no alternative, greener, sources of supply will become viable.

23. The UK could encourage the accelerated development of commercially viable sources of rare earth in other countries more likely to be amenable to exporting such materials to the UK and/or countries which might supply components for or complete electric vehicles.

24. Scientific research has an important role to play and the UK Research Councils are a source of relevant information in support of strategic approaches to tackling the issue. The British Geological Survey, a centre of the Natural Environment Research Council, and the UK’s premier centre for earth science information and expertise, monitors global metal production and trade. Research Councils UK (RCUK) has provided a separate submission to the Committee.

3. How desirable, easy and cost-effective is it to recover and recycle metals from discarded products? How can this be encouraged? Where recycling currently takes place, what arrangements need to be in place to ensure it is done cost-effectively, safely and ethically?

25. Currently, re-use and re-manufacture of components rich in strategically important metals would be preferable to recycling on a cost and environmental basis. In many cases, particularly for REEs recycling is labour intensive and very costly. Recycling of REEs is currently not economically viable and currently makes limited contribution to demand; however if the cost of REEs continues to rise recycling becomes more realistic. Therefore, it is important to design products so that valuable components can more easily be recovered and whenever possible, re-used. Reducing the amount of resources such as rare earths used in various production processes and applications is also necessary, in addition to looking into alternative materials. Research is underway in Japan which has had some success. The Japanese firm Hitachi has developed machinery which can recover rare earths from discarded disk-drives eight times faster than manual labour. The company plans to get 10% of its rare earth needs through recycling in 2013.

5 Baotou Steel Rare Earth Hi-Tech Company
26. The UK is looking at targeted measures to encourage, incentivise and enable improved resource efficiency through the Review of Waste Policies, the new strategic steer for Defra's resource efficiency delivery body, WRAP, the Natural Environment White Paper, and through the Roadmap to a Green Economy being developed by Defra, BIS and DECC. It is also important to continue working with Businesses and Trade Associations to raise awareness, and spread best practice.

27. Internationally, Japan is thought to have only one or two facilities left that are able to recycle rare earths from scrap, a costly process which has largely passed to China, according to industry sources. To be cost-effective in Japan, the price of rare earth metals would have to rise 10-fold, but with further price rises likely, the likelihood of more REE recycling increases—Over the past five years, the price of neodymium, used in such products as computer hard disks, has risen about six-fold and that for dysprosium, used in data storage devices, eight-fold.

28. It is worth noting that the current recycling rate for REEs in most countries is around 1%, a figure consistent with that for other metals.

29. There are well-established methods for the recycling of most batteries containing lead, nickel-cadmium (Ni Cd), nickel hydride and mercury, but for some, such as newer nickel-hydride and lithium systems, recycling is still in the early stages and not designed for the recovery of their rare earth contents.

30. There is no collection infrastructure in place for nickel-metal hydride (NiMH) batteries yet. This is because of the long time span of the batteries coming into the recycling markets. There needs to be proper separation and segregation of rare earth-related components for optimum recovery.

31. Rare earth magnets are fragile and fracture very easily. It is estimated that between 20-30% of the rare earth magnet is scrapped during manufacturing because of breakages or waste cuttings such as swarf and fines.

32. There are potentially a number of extraction processes but none of them developed commercially due to drawbacks on yields and cost. The most attractive appears to be treatment with liquid metals. Little progress has been made in 15 years or so. Therefore there is potential to undertake some development not only to avoid possible supply shortage but also to retain the rare earths in the UK.

33. The UK will also host the next EU Innovation Forum in March 2011 which will consider and help raise awareness of resource security issues.

34. The UN Environment Program has also called for a global drive to recycle rare earth metals, warning that supplies of rare earths may be exhausted within 40 years.

4. Are there substitutes for those metals that are in decline in technological products manufactured in the UK? How can these substitutes be more widely applied?

35. In terms of rare earths, there are currently no reliable substitutes. Other metals have been tested, but with no success. Research is on-going; however the likelihood of developing viable alternatives in the near future is remote.

36. It also very much depends on the need of the process or product it is being used for. Some low carbon technologies have very specific material needs and alternatives are not always readily available. We need to support/encourage UK companies to assess their own particular situation, understand the resources they use and mitigate risks to supply. There may be more of an issue for smaller companies than large who may generally have a better awareness of the issues.

37. This is possibly an opportunity to encourage/support UK businesses to develop alternatives, new processes, develop new markets etc. For example no feasible replacement for the rare earth magnets used in electric vehicle motors has been discovered. Minimisation of rare earths in existing magnets will only result in small reductions in material usage compared with the overall demand.

38. The reduction or replacement of dysprosium usage is a high priority on many research agendas as this element will suffer the tightest resource constraints. Both design and technological solutions to achieve this should be investigated.

39. Electric motors which do not require permanent magnets are the most likely way of reducing or eliminating rare earth in electric vehicle magnets. However, for technical reasons rare earth technology is favoured in the current generation of hybrid vehicles.

40. Despite some historic expertise, negligible research into magnetic materials now occurs within the UK. When compared to the efforts of Japan, China and the USA, public and private funding of research in this area is minimal.

41. The demand for Rare Earths in batteries will naturally decline as manufacturers shift from NiMH batteries towards lithium-based technology. (Consequently, this may cause supply issues around lithium.) Even with improvements NiMH batteries are unlikely to compete with lithium-based alternatives in performance terms.
42. Many alternative battery technologies are being investigated as improvement of battery performance is a key consideration in the future development and implementation of electric vehicles. None of these is heavily reliant on rare earths at the current time.

43. The UK has reasonably strong research in this area, though may not have the manufacturing base to exploit developments in a commercial setting.

5. What opportunities are there to work internationally on the challenge of recovering, recycling and substituting strategically important metals?

44. There are existing and forthcoming initiatives at EU level such as the resource efficiency flagship initiative, Raw Materials Initiative, Low Carbon Roadmap to 2050, and work on Sustainable Materials Management, which all provide good opportunities on particular aspects. The UK Government is working to ensure these are all joined up to provide a coherent approach under the EU 2020 Strategy.

45. Work is planned under FP7 Nano-sciences, Nano-technologies, Materials and new Production Technologies looking at novel materials for replacement of critical materials (platinum group metals and rare earths).

46. The EU has launched a Consultation aimed at business to gather information on the EU interest with regard to export restrictions on raw materials that might impact EU business in China, the EU or third countries.

Department for Business Innovation and Skills
20 December 2010

Supplementary written evidence from Professor Robert Watson, Chief Scientific Adviser, Department for Environment, Food and Rural Affairs (SIM 00a)

Please find the responses to the questions from Graham Stringer, M.P.

REACH

The primary aims of REACH are to enhance protection of human health and the environment, and to increase industry competitiveness and innovation. This is done by making industry responsible for what they place on the EU market through the hazard assessments and advice on safe use and risk management they include with their registrations.

Manufacturers or importers of so-called “new substances” have had to notify data on potential risks since the 1980s. However, there are also about 30,000 chemicals on the EU market that predate that requirement for notification and which are manufactured or imported in amounts of 1 tonne or more a year. Only a few hundred of those “existing substances” have been subject to full risk assessment and there are significant gaps in publicly available knowledge about even the highest production volume substances (1,000+ tonnes). That is an alarming knowledge gap that REACH exists to fill.

It is too early to say to what extent the aim of increasing industry competitiveness and innovation will be achieved. By placing new and existing substances on an equal footing, REACH removes a strong signal against innovation. In addition, REACH puts a much greater emphasis on finding safer alternatives for dangerous chemicals, which will also be a strong incentive for innovation through the supply chain.

Licence Costs

An importer or manufacturer of a substance, eg titanium, must register it with the European Chemicals Agency (ECHA) in Helsinki. Registration means producing a dossier of information, including:

— intrinsic properties and hazards of the substance;
— amount of manufacture/import;
— identified uses and uses advised against;
— guidance on safe use; and
— information on exposure.

One of the key objectives in REACH is to obtain and share information about the properties of substances being manufactured, supplied and used in the EU. This ensures that registrations use existing data rather than commissioning new studies. REACH prohibits the duplication of animal testing. This data sharing can then be followed up by a joint registration. Alternatively a registrant can go it alone.

A registrant has to pay a fee to ECHA. The highest fee payable is €31,000 (by a large company which manufactures/imports more than 1,000 tonnes of a substance each year and which chooses not to participate in a joint registration). A range of reduced fees is available for joint registrations, lower tonnages and smaller companies, with €120 being the lowest fee.

No registration fees or licences are required under REACH before a downstream user can handle a substance.
REACH provides for manufacturers and importers of a substance to join together in Substance Information Exchange Forums in order to share data, avoid duplication of any new testing, and prepare a joint registration. However, in addition manufacturers of some substances have set up consortia to manage the data gathering, although these are not a requirement of REACH. Letters of access to unofficial consortia cannot be policed by REACH although they would, of course, be subject to competition law.

**Thallium and Landfill**

A specific reference to Thallium going to landfill was also made. Under REACH, restrictions can be placed on the manufacture, marketing or use of dangerous substances. No such restrictions exist in the case of thallium or its compounds. In addition producers of recovered substances do not have to register under REACH if the substance has also been registered as a virgin material. It is therefore difficult to see how REACH can be responsible for thallium waste ending up in landfills.

More generally on the avoidance of strategic metals going to landfill, one of the alternatives approaches we do favour is improved resource use and secondary recovery as a way of companies both handling risk and developing alternative sources of supply for key materials. We need to do more to move the focus up the waste hierarchy to prevent waste originating and to increase secondary recovery of valuable materials.

This is something we are already examining. For example, we have tasked WRAP, in our draft strategic steer, to increase their focus on materials efficiency, thus avoiding waste at the very outset, but also ensuring maximum economic benefit from those materials used. They are working with businesses and looking at the opportunities presented by new business models and the barriers to the recycling of precious metals, such as actual product design to aid in the easy separation and recyclability of materials.

Professor Robert Watson  
Chief Scientific Adviser  
Department for Environment, Food and Rural Affairs  
16 March 2011

**Written evidence submitted by The Institute of Materials, Minerals and Mining (IOM3) (SIM 03)**

1. **Overview**

The Institute of Materials, Minerals and Mining (IOM3) is in broad agreement with the Terms of Reference defined, in the form of five questions, put forward by the Parliamentary S&T Committee.

Comments on each of the Terms of Reference / Questions are given below. It is suggested that, before the answers to the five questions can be delivered with sufficient confidence to define actions, additional information is likely to be needed and discussions need to be initiated with overseas supply chain partners. IOM3 is willing and able to assist with the gathering of the required information from its international network and to facilitate the discussions.

2. **Terms of Reference**

2.1 Is there a global shortfall in the supply and availability of strategically important metals essentials to the production of advanced technology in the UK?

Given the downturn in the global economy there is probably not an immediate shortfall. However, the concentration of production of certain materials, in particular rare earth metals, in China, means that many industries in the UK are extremely vulnerable. The recent incident where China cut off supplies to Japan in response to a maritime incident is an illustration of the potential problems.

2.2 How vulnerable is the UK to a potential decline or restriction of supply of strategically important metals? What should the Government be doing to safeguard against this and to ensure supplies are produced ethically?

It is recommended that these two questions should be separated in the Terms of Reference.

2.2.1 Vulnerability—The UK is as vulnerable as other countries, e.g. Japan, the USA and those in the EU that have advanced technology industries which depend on supplies of materials which are supplied by a single country.

2.2.2 Safeguards—The UK could in collaboration with international partners encourage and co-fund the reopening of mines that were recently closed because of low cost competition from China. The UK could also, in collaboration with partners in Europe, establish facilities for the ethical recycling of discarded products that contain extractable strategic metals. Both options require detailed studies to determine the viable options in terms of locations and investment.
2.3 How desirable, easy and cost effective is it to recover and recycle metals from discarded products? How can this be encouraged? Where recycling takes place, what arrangements need to be in place to ensure it is done cost-effectively, safely and ethically?

For the mature metals sectors there is a well developed recycling infrastructure which, because of the intrinsic value of the metals, is economically, highly viable. Metals recycling in the automotive, construction sectors are highly advanced (levels > 90% for some metals), domestic waste stream management strategies are also improving metals recycling from packaging. Electrical goods are now subject to the WEEE directives and are increasing being recycled. The challenges for increased metals recycling are based around consumer behaviour, separation technologies and also by the design for dismantling of techniques which are now increasingly common in product design.

The recycling industries’ business models are similar to any mainstream businesses, some operating with ISO9001 and or ISO14001. All will be subject to the usual H&S, COSHH and Environmental regulations. Some will have fully developed CSR policies in line with increasing customer interest.

High technology industries rely on materials that are very precisely defined in terms of composition and processing. Recycled materials of unknown provenance are not attractive alternatives. A new industry could be created which recycles safely and ethically the valuable strategic materials contained in junked electronic products. More details studies are needed to define the cost effectiveness of closely controlled recycling including design for recycling.

2.4 Are there substitutes for those metals that are in decline in technological products manufactured in the UK? How can these substitutes be more widely applied?

Substitution is almost always difficult and expensive, not least because of the long term investment in the refinement and testing of the incumbent materials. Hence substitution costs are often less dependent on the relative raw material costs than on the demonstration of equivalent performance in the end product. In addition many products would need to re-designed to accommodate the substitute material.

In many electronic the products the unique properties eg of neodymium magnets have enable the miniaturisation of many end products and substitutes are not obvious.

2.5 What opportunities are there to work internationally on the challenge of recovering, recycling and substituting strategically important metals?

International collaboration is essential if any effective solution is to be found to the current threat. The Institute of Materials, Minerals, and Mining is uniquely placed through its UK and International Membership to facilitate discussions and is willing to do so.

3. Conclusion

In the long term, concerted action, such as plans to re-open mines and recycle materials more effectively, by countries threatened by supply problems of strategically important materials, is needed to secure a less vulnerable supply chain for the advanced technology industries in the UK and other countries.

Norman Waterman FIMMM
Chairman External Affairs Group
IOM 3

Louis Brimacombe
Chairman Sustainability Group
IOM 3

14 December 2010

Supplementary written evidence from The Institute of Materials, Minerals and Mining (SIM 03a)

Q. In response to question 28, Dr Rickinson refers to the export of large volumes of copper scrap (800,000 tonnes in 2005) mentioned by Dr Pitts, am I right in thinking that Dr Rickinson believes that this is due to copper theft? I guess the process is that the copper is stolen and then sold to a scrap yard from where it is then exported. Are you able to comment on the following questions:

— What proportion of the total scrapped copper in 2005 does the 800k tonnes represent?
— Roughly what proportion of scrapped copper is thought to come from theft?
— Why are there no facilities for recycling copper in the UK?

Within the responses to question 28 and the future of 800,000 tonnes of exported non ferrous metals suggested by Dr Pitts, I would expect that the largest volume of this would be aluminium. I have no direct knowledge of the proportions involved, but within a range of non ferrous materials, aluminium, copper, titanium, brass/bronze and nickel would probably feature. I will try to get you a more precise estimate of current exports and proportions from the British Metal Recycling Association.
Q. In response to question 31, Dr Rickinson states in regard to copper recycling that: “processes have been developed in which the UK could invest without necessarily going through a melting route”. Could you please elaborate on these a little?

Your second question relates to the absence of facilities for recycling copper in the UK. To be specific, the logistic network to collect and segregate copper scrap is in place within the UK, but the downstream investment to remove the polymer and other sheath materials from the copper and then to remelt and cast this is not in place. Commercial and environmental concerns are important here. Insulated cable can be granulated and the plastic coating removed from the copper to use both materials in a controlled recycling loop. By contrast, an easier solution is to burn the plastic coating off the copper cable directly in the melting furnace. This creates environmental issues which, within the UK, would be expensive to overcome. Where such environmental policies are reduced, the opportunity exists to recover the copper at the expense of losing the polymer material. I would suggest therefore that no melting facilities are available in the UK due to the high investment cost required to satisfy all legislation and to make a commercial return on this investment.

Regarding your comment on the matter of question 31, my reference here is to various processes that can be categorised as metal extrusion. Generating a supply of polymer free, and clean copper scraps, the copper granules can be cold extruded through a die. During extrusion, friction forces will rapidly increase the temperature of the copper causing diffusion bonding of the metal particles in the extruded shape. Providing the metal is clean, and following subsequent heat treatment, high purity, high conductivity copper can be formed which is suitable for further drawing to wire and cable and tube forms. The manufacture of drawn wire and cable from copper coil is still very active in the UK, so this extruded recycled material could be directly used in the UK. Currently, we understand the coil for wire drawing is imported from Poland, China and India.

Dr Bernie Rickinson
The Institute of Materials, Minerals and Mining
15 February 2011

Written evidence submitted by The Environmental Sustainability Knowledge Transfer Network (ESKTN) (SIM 07)

DECLARATION OF INTERESTS

The Knowledge Transformation Networks (KTNs) are funded by the Technology Strategy Board. Their purpose is to promote innovation in the UK. The Environmental Sustainability KTN focuses on developments that can make the UK economy more sustainable. It has no vested interest in the subject of this inquiry. In this response we aim to present a balanced view derived from interactions with our membership of more than 3,000 registered users.

Is there a global shortfall in the supply and availability of strategically important metals essential to the production of advanced technology in the UK?

1. The supply of metallic minerals and global markets tend to respond to the demand. If demand exceeds supply the price increases which stimulates investigations into the use of alternate minerals and the development of new deposits. However the processes involved in discovering and developing a new deposit or substitute material can take many years so there is a lag in the response to demand which tends to result in shortages and price peaks (followed by subsequent price falls when supplies meet or exceed demand).

2. The availability of a metal was in the past determined by price and technology. The richest and most accessible deposits of minerals are exploited first and when these are exhausted lower grade and less accessible resources will be developed if the technology is available to produce the material at a satisfactory price. The cost of energy and environmental impacts are now important elements. The development of lower grade deposits usually requires the utilisation of more energy per tonne of mineral produced. If fossil fuels are used to generate the energy this will increase the “carbon footprint” of the mineral and together with high energy input costs this could have an impact on the demand for a metal.

3. UK manufacturers would like equal access to metals. If this is the case then, even if the price is high, availability is roughly equal for all users and so there is fair competition. However if the supply of a particular mineral or metal is controlled by a small number of entities (be they countries or companies) there is a risk that they may exploit their monopoly/oligopoly to control the market or favour certain clients.

4. If the UK is to be in a position to access strategic metals it must develop policies that recognise the relative risks associated with global supply chains and assist UK businesses to manage these risks. Since the size of the UK market may be small in terms of global demand the UK should be pro-active in engaging in the development of EU policies. The UK needs to be recognised as key player in specific roles within the EU because it would not be possible for each EC member country to aim to be self-sufficient for all strategic metals.

5. However it is not just a question of access; availability in the appropriate form is also important. For example the Nuclear Industry needs large forgings which cannot be produced in the UK at present (the loan
guarantee request from Sheffield Forgemasters aimed to address this). Similarly if the UK is to be a leader in Additive Layer Manufacturing a supply chain for metal powders is essential.

How vulnerable is the UK to a potential decline or restriction in the supply of strategically important metals? What should the Government be doing to safeguard against this and to ensure supplies are produced ethically?

6. One problem here is how strategically important metals are defined. In the past this term may have referred to metals with critical roles in military applications. A broader approach would consider materials that are important to the performance of an advanced systems, machines or new technologies. Rare Earth Elements are currently in the news in this respect.

7. A recent EU Study looked at “critical raw material”:

“With regards to geological availability, the Group observes that, as geological scarcity is not considered as an issue for determining criticality of raw materials within the considered time horizon of the study, eg 10 years, global reserve figures are not reliable indicators of long term availability. Of greater relevance are changes in the geopolitical-economic framework that impact on the supply and demand of raw materials. These changes relate to the growing demand for raw materials, which in turn is driven by the growth of developing economies and new emerging technologies. Moreover, many emerging economies are pursuing industrial development strategies by means of trade, taxation and investment instruments aimed at reserving their resource base for their exclusive use. This trend has become apparent through an increasing number of government measures such as export taxes, quotas, subsidies etc. In some cases, the situation is further compounded by a high level of concentration of the production in a few countries. This report analyses a selection of 41 minerals and metals. In line with other studies, the report puts forward a relative concept of criticality. This means that raw material is labelled “critical” when the risks of supply shortage and their impacts on the economy are higher compared with most of the other raw materials.”

8. There are fewer facilities for the primary production of metals in the UK than in the past so businesses must import more of the strategic metals required in forms that are suitable for their manufacturing operations or rely on suppliers of the products that contain the strategic metals. Thus from a strictly nationalistic point of view although the UK may not appear to be directly dependent on the supply of strategic metals this should not disguise the fact that the efficiency and competitiveness of important sectors of the economy (ITC, Advanced Materials, Aerospace, Military, Renewable Energy, etc) are reliant on them—even if this may not be apparent because they are imported incorporated in components of machines and products (invisible imports).

9. During normal trading conditions this situation has not resulted in major problems but in abnormal conditions, such as major conflict or other disruption to international trade, the UK would be vulnerable. This situation was recognised after WW1 and strategies to source minerals were developed that mitigated the problems experienced during WWII. However at present the UK does not have a national strategy for mineral/metals supply. The EU has taken cognizance of the security of supply issues and has identified 14 minerals as being critical to the economy of the EU. In the global market it would be difficult for the UK to have a strong position in relation to securing mineral supplies so it is recommended that it develops a policy that aligns with that of the EU. The UK can make some contribution to developing European resources (an Australian company is currently working on the development of a Tungsten mine in Devon).

10. Since many of the UK imports of “strategic metals” are invisible the systems for managing end-of-life materials are important as is the development of policies that promote the efficient utilisation of these important elements.

11. In addition to the security of the supply of energy and mineral resources the UK and EU must also promote ensure the development of the appropriate human resources, technological know-how and infrastructure. Unless all of these issues are addressed the supply of strategic materials could be constrained in the future. Examination of one specific metal that is considered to be strategic in the US will illustrate these issues. Magnesium is a metal that has a wide range of applications; it is particularly useful for applications where “light-weighting” is an important factor (it is less dense than Aluminium) and the utilisation of this metal will probably expand in a low carbon economy. Over the past 10–20 years China has become the dominant supplier of magnesium metal. It now produces more than 80% of global metal output whilst primary magnesium producers in Norway and France have been shut down. A nother high technology magnesium smelter in Canada closed because it could not compete with low cost imports from China. The sole remaining producer of primary magnesium in North America is only viable because local prices are supported by import duties placed on magnesium from China.

12. With regard to ethical sourcing the leading mining companies based in the UK participate in the sustainable mining programmes and policies of the International Council for Mining and Metals (ICMM). However there are potential problems with “invisible imports” because of the difficulties ensuring the traceability of metals incorporated in the parts or components of machines and equipment. If the broader context of carbon management is included in the ethical considerations then engagement with the EU could be used to expand development work with mineral producing countries to ensure that world class standards for safety, environmental management and economic management are applied in all countries that partner with the EU.
13. About 70% of the Earth’s surface is covered by water. As land based reserves of oil became depleted, oil companies began off-shore developments. Mineral exploration has also gone off-shore and was partly responsible for the recent disputes between Japan and China. The potential for off-shore “mining” has been discussed for many years and the first industrial developments have been reported. It is important that the UK engages in this process to ensure that these resources are developed in a way that does not cause significant environmental degradation. Two of the leading marine minerals companies have UK connections (Neptune Minerals and Nautilus Minerals).

How desirable, easy and cost-effective is it to recover and recycle metals from discarded products? How can this be encouraged? Where recycling currently takes place, what arrangements need to be in place to ensure it is done cost-effectively, safely and ethically?

14. In terms of resource efficiency it is very desirable but in the past some primary producers have viewed metal from secondary sources as a potential source of competition. Now many primary metal producers also process secondary materials. There are a number of stages in the chain of utility where metals can be recovered/recycled. The following diagram from a publication from the International Panel for Sustainable Resource Management (Metal Stocks in Society) give a good illustration of these:

Key (Note—one additional “stock” added to represent process losses)
1 Metal in virgin ore bodies.
2 Metal in tailings.
3 Metal in Processor stockpiles.
4 Metal in Government stockpiles.
5 Metal in Manufacturer stockpiles.
6 Metal in-use stocks (in the “Technosphere”).
7 Metal in Recycler stockpiles.
8 Metal in Landfill stockpiles.
9 Metal Losses (in transit, in off-gases, effluent streams, etc).

15. It can be difficult to recover some of the metals that go into the manufacture of products and systems because of the number and complexity of the components and sub-assemblies and the joining techniques employed. It is particularly difficult to do this efficiently where there are a wide range of metals used in components and sub-assemblies or the valuable elements are present in low levels or are associated with incompatible materials. It is important that engineers and designers are trained to optimise material selection and to consider the fate of all the materials employed at the end of the product life. If more sustainable ways of managing metals are not adopted the global demand for primary metals will continue to grow and put increasing pressure on prices and supplies. Better management of information on the composition of components and assemblies would facilitate more intelligent management of end-of-life materials.

16. In Japan there is a national body that supports Japanese access to raw materials (JOGMEC) and they have a strong National Research Institute for Metals (NIMS). Within this organisation they have a specific
group working on strategic materials (Center for Strategic Natural Resources). In 2009 they developed an innovative system for recycling mobile phones and in 2010 they reported on the recovery of cobalt and gold from urban waste.

There is also a Research Center for Materials, Cycles and Waste Management at their National Institute for Environmental Studies (NIES). "Sustainable Material Cycles" is one of NIES’s priority programmes and their research objectives include:

- Projecting the amount of recyclable resources and waste that will be produced in the next 10 to 20 years and setting strategic targets using relevant indicators for material-cycle management.
- Designing concrete scenarios including technologies and policies, and identifying the specific issues to be solved to achieve such targets at both the local and national level.

17. The transitions that have occurred in the UK economy are such that the UK is no longer a significant importer of many primary ores (the main exceptions are iron, aluminium, lead & nickel). The fact that a large proportion of the components and equipment utilised is imported means that significant quantities of secondary metals are available when these imported items reach the end of their useful life. The UK is currently a net exporter of scrap metals—some in a semi-processed state. This scrap is then processed (or discarded) in other countries.

Are there substitutes for those metals that are in decline in technological products manufactured in the UK? How can these substitutes be more widely applied?

18. Given the rapid development of some Asian economies there is continued growth in total global demand for all metals even if the intensity of use of some metals has declined in developed economies.

19. There are some applications where technological change can reduce the use of metals for specific applications (fibre optic cable replacing copper wire, mobile phone networks, etc). In other cases optimising design can reduce the quantities of metal required to deliver a specific function. All manufacturers must strive for innovations that can provide them with advantages in the global market. Where the UK can be innovative is in the development of new materials, the exploration of new forms of materials and the utilisation of materials for new technologies. If the UK is to be competitive on a global scale it must train material scientists and ensure that all engineers and designers are trained in the concept of sustainable materials management (SMM). Economies that have been successful in building their technological base (Japan, South Korea & Taiwan) have supported R&D in materials and encouraged businesses to develop new materials and applications.

What opportunities are there to work internationally on the challenge of recovering, recycling and substituting strategically important metals?

20. Clearly there are other organisations and countries that are examining the issues relating to the supply of strategic materials (see recommended references below). Scandinavian countries have important metals and minerals industries and countries like Germany, Holland and Belgium are developing systems to support a transition towards more sustainable materials management. Here in the UK the Institute of Materials, Minerals and Mining (IOM3), in association with the Environmental Sustainability KTN, Tata and other sponsors, recently held a conference on “Innovation Towards Sustainable Materials”. The head offices of several global mining organisations (Anglo American, Rio Tinto, etc) are based in London and many other mining and metallurgical groups are listed or source financing in London. Mining companies are working towards more sustainable practises and their programmes of continuous improvement in global mining operations through the international organisation, the ICM, should be encouraged and supported.

21. There is one specific opportunity that the UK should endeavour to make a significant input to in a current EU Framework 7 funding call. The aim is to establish a network to co-ordinate R&D in the EU:

“The objective of the ERA-NET is to step up coordination of research programmes in the field of industrial production and supply of raw materials. This should be achieved in line with the integrated strategy proposed in the EU Raw Materials Initiative (RMI) by improving use of the EU mineral resources through innovative exploration, extraction and processing technologies; and by reducing the EU’s consumption of raw materials through new industrial processes increasing resource efficiency, recycling and substitution.”

22. With regard to secondary metals there are opportunities to look at how these can be recovered from existing products that at the end of their useful life. As indicated above the Japanese are very actively developing technologies for managing secondary materials. Given the similarity between these two island economies, both reliant on imports, it would make sense to identify mutually beneficial collaborative research programmes with the appropriate Japanese entities. A TSB funded mission to Japan is planned for 2011.

23. It also important to move from “end-of-pipe” solutions and the UK businesses can differentiate themselves and become more resource efficient by ensuring that future designs are developed in ways that support remanufacturing, recovery and recycling. DEFRA have supported the Centre for Remanufacturing and Re-use (CRR) and it is important that the potential for re-manufacture and re-use are built in to products and systems at the design stage. To enhance the ability of UK manufacturers to compete in the global market it is...
important that the UK develops policies that help to maintain existing expertise and develop new areas that support the EU agenda for sustainable materials.

24. Despite the decline in the metals industry in the UK there is still production of significant quantities of steel and aluminium from primary and secondary sources. It is important that the existing capacity and know-how is retained and extended. Some examples are listed below:

- Carbon Steels for the automotive and construction industries (Tata Steel, CELS A, Thamesteel, etc).
- Alloys steels, including stainless steel for advanced applications (Sheffield Forgemasters, Outokumpu, Doncasters, Goodwins, etc).
- Nickel alloys for aerospace, chemical and specialist applications (VA LE, Special Metals Wiggin).
- Aluminium & aluminium alloys (Rio Tinto Alcan, Aleris, LSM, Novelis etc).
- Lead from primary and secondary materials (X strata Zinc, Enthoven).
- Platinum group metals from secondary materials (Johnson Matthey, BASF /Englehard).
- Rare Earth Element & alloys (Great Western Mining Group/LCM).
- Magnesium (Magnesium Elektron).

25. There is potential for improving the way in which metals are recovered from secondary sources (end-of-life products and “waste” streams). It is important to devise efficient ways of harnessing the optimum value from “invisible” metal imports. The recovery of some metals is relatively simple but the thermodynamic properties of some alloys means that the constituents are difficult to separate or purify. These factors must be taken into account when materials are specified for a specific component and application. It is important we develop ways of tagging components with some means of identification that can record the properties of the materials that have been used to make them. It would then be easier to identify the valuable metal(s) at end-of-life and recover the maximum value from the constituents.

26. At present the UK exports significant tonnages of metal scrap, in various forms. Between 2004–08 the UK was a net exporter of steel copper, aluminium and lead (~ 36 million tonnes total, of which 31 million tonnes was iron and steel). Income from these scrap sales was about £8 billion although these could be viewed as exports of carbon credits.

27. This inquiry is very timely because if the UK is to transform into a low carbon economy it must put in place a coherent policy for sustainable materials management (SMM). If life cycle thinking is employed at the product design stage this improve effective metal utilisation, reducing the overall energy and carbon burdens. To date the focus has tended to be on energy generation and “greenhouse” gas emission issues but policies to promote SMM would accelerate the transition to a low carbon economy. These should stimulate a more efficient approach to metal utilisation and enhance the UK’s capacity to manage strategic metals. There are significant quantities of these strategic metals in the “technosphere” and countries like Japan and Sweden are conducting R&D into ways of recovering valuable metals from “mines above the ground”, “urban mines”, and landfills.

28. The UK cannot turn back the clock but with the correct policies it could become a leader in the development of products designed using “life cycle thinking” and play an important role in the development of SMM. The ES-KTN and the Sustainable Development Group of the IoM3 are working to promote this approach.

The Environmental Sustainability Knowledge Transfer Network
17 December 2010

Supplementary written evidence submitted by The Environmental Sustainability Knowledge Transfer Network (ESKTN) (SIM 07a)

Q. In response to question 41 (see the transcript of the session), you mentioned that mining companies “wouldn't even look at deposits in Europe because they know it is going to take them 10 or 15 years to go from discovering the deposit to getting into production”. You implied that a large chunk of this time was taken up by the planning process. Are you able to expand on this a little? For example, how much of this time is because of the planning process and why does it take so long?

I will try to expand on this point in general on the understanding that this is generalised interpretation of the situation rather than a detailed review of specific cases (which would be difficult to do in the case of the UK because I cannot recall the opening of any new metallic mineral mine in the UK in recent years). If you read the response below in conjunction with some of the Oral evidence given by Professor Manning I hope this will clarify the situation. Please also refer to the attached paper, by UK experts, which looks at both mining and quarrying in the UK.

The whole process of identifying a mineral deposit is itself an expensive process and risky process. Ideally mining companies would like to identify large deposits of high grade material. Exploration geologists conduct surveys to identify signs of potential for deposits and then they must conduct detailed exploration work to determine if the deposit might be economically viable. This can include extensive drilling and mineral
processing test work. Mineral exploration companies are unlikely to invest in development work in locations where the mineral exploration rights are unclear and/or there is a high probability that an operating permit may not be granted—or will be only be received after long delays. This is probably the case in many European countries. This is partly due to issues related to population density and land use and these are less of a problem in parts of Scandinavia where they have encouraged some mineral development.

As Professor Manning points out the distribution minerals is determined by geology and a mining industry cannot be developed where there are no mineral deposits. The EU Study on Critical raw Materials points out that the EU is highly dependent on imports of many metals but unlike the USA and Japan does not have strategy for managing supplies. It suggests that where possible the EU should look for potential to reduce dependence on imports. This could be achieved by identifying and developing new deposits which would require significant investment in exploration. It may also be necessary to look at the development of smaller and/or lower grade deposits and research is required to look at mining and processing methods that could make these processes viable.

If we look at the issues relating to the development of a project in the UK these could be summarised as:

- Mining not seen as an important part of the economy.
- The perception is that the easy deposits have already been exploited and there is little chance of finding a large rich deposit.
- Uncertainty about the rights to prospect.
- Uncertainty about the mineral rights.
- Complications in the planning process—local/national/EU regulations, interpretation of Environmental Impact data, potential for objections and delays.
- Classification of land as of some form of special interest (archaeological, habitat, etc).
- Tax scenarios (mine development is encouraged in some countries).
- Availability of expertise and cost of personnel.

It has also been suggested that the lack of clear statement from central government as to the importance of minerals which leaves the planning process (and the courts, who might review the legality of a planning decision in terms of national policies) open to pressure of “yes, but not here”. This probably takes us onto the wider question of the general public’s perception of mining operations. These are often based on historical descriptions of operations and incidents but the modern mining industry takes its responsibilities seriously and aims to develop mineral using the most sustainable methods available (see attached paper and information on Sustainable Development from the ICMM).

So in many ways the cards are stacked against developments in the EU relative to other parts of the world where mining can be seen as an important part of the economy. However if the EU/UK wants to reduce its dependence on imported materials it must consider developing the appropriate strategies. Policies to support R&D in minerals and the development of appropriate deposits could reduce supply risks. Developing a mining project to the stage when investors are prepared to fund a project is a difficult and expensive process—local conditions that make it more difficult will deter development activity.

Tony Hartwell
The Environmental Sustainability Knowledge Transfer Network (ESKTN)
8 February 2011

Written evidence submitted by The Geological Society of London (SIM 10)

1. The Geological Society is the national learned and professional body for Earth sciences, with 10,000 Fellows (members) worldwide. The Fellowship encompasses those working in industry, academia and government, with a wide range of perspectives and views on policy-relevant science, and the Society is a leading communicator of this science to government bodies and other non-technical audiences.

2. We are grateful for the opportunity to submit evidence to this inquiry. Given its broad scope, we have not attempted to provide detailed information regarding particular strategically important metals, and have focused on general principles. We understand that the British Geological Survey (BGS) is taking a lead role, through NERC, in a coordinated response from the Research Councils. The Minerals Section of BGS constitutes an important component of national capability in this area, as a centre of expertise and as the source of vital strategic data (see for example their UK Minerals Yearbook, and their publication World Mineral Production 2004-2009).

3. The Geological Society’s response has been prepared on the basis of contributions from its Fellows and others, and in particular from the Mineral Deposits Studies Group (MDSG), which is an affiliated specialist group of the Society but includes non-Fellows among its membership.
4. The Geological Society is currently preparing a public statement on the rare earth elements, which will be aimed both at policy-makers and at interested members of the public, and which we expect to publish in Spring 2011.

Is there a global shortfall in the supply and availability of strategically important metals essential to the production of advanced technology in the UK?

5. There is no definitive list of “strategic metals”. They are generally taken to include the rare earth elements (REEs), platinum group metals, tantalum, niobium, indium, lithium and tungsten, among others. Some would include more common metals such as tin, not because there is concern over continuity of supply, but because the volumes in which it is used mean that the volatility of its price has significant economic impact. Some non-metallic elements such as phosphorus can also be considered “strategic”. More generally, the significant strategic drivers are likely to vary between metals and across different usages. Economic importance is not the only factor—environmental protection, national security and other benefits may also be significant. Particular importance is now quite rightly attached to the resource implications of low carbon energy technologies (more efficient electromagnets for wind turbines, extensive use of photovoltaic panels, catalytic converters in vehicles, etc). The economic and technical barriers to extraction, substitution and recycling of different metals, and in the context of differing uses, vary. In some senses, the supply of all important minerals and other resources (energy, water) is strategically important, and raises the need to weigh economy of use, security of supply and environmental factors, and to make judgments which are hybrids of the technical, social and political.

6. It is important to distinguish between “reserves”—that is, the known resources in the ground which can be extracted economically using existing technology—and the total physical resources in the Earth’s crust. We are confident that known reserves of metals which might be considered strategically important are small compared to the total amount in the ground. The primary constraints to their supply are therefore economic, geographical, legal and technical. Which ore deposits are considered to be “reserves” will depend not only on fixed factors (the geographical distribution and concentration of metals), but also on variable ones—commodity prices (increased prices may make a metal economic to extract at locations where it wasn’t before), the discovery of new exploitable resources (which is dependent on research and exploration work), regulatory regimes and improved technology for extraction.

7. Global metals production levels can also respond to price, but the long lead time from the instigation of an exploration programme by a company to mine production—typically at least 10 years (with success far from certain)—severely restricts market responsiveness, particularly when existing production is concentrated at a few sites. For instance, 95% of global production of REEs is located at a small number of mines in China, although there are known reserves elsewhere, and every prospect of finding more. This leaves the global market vulnerable not only to price changes but also to artificial constraints on supply.

8. The REEs have similar physical and chemical properties. They tend to occur together in the same deposits, and are difficult to separate. (The same is true of the platinum group metals.) In considering the supply and economics of the REEs, the proportions of particular elements in a deposit is significant. Those in which the level of Heavy REEs (those of higher atomic number) is unusually high tend to be more economic, because they are of lower overall abundance in the Earth’s crust than Light REEs, and because they can have lower associated separation and enrichment costs.

9. Internationally, extraction and processing are associated with significant environmental impacts. These may arise from the nature of the mining process itself (eg some large open-pit mines such as at Bayan Obo, China), the association of metals with radioactive elements (eg REEs with uranium) or toxic pollutants, and refining processes. Standards in some countries have been low—recent attempts to improve them are of course welcome, but may lead to increased prices.

How vulnerable is the UK to a potential decline or restriction in the supply of strategically important metals? What should the Government be doing to safeguard against this and to ensure supplies are produced ethically?

10. In addition to the UK’s dependence on China for REE supply (in common with other countries), we rely almost entirely on the import of other strategic metals used in UK industry. Only very small proportions of strategic metals used in UK industry are produced in the EU (where unfettered availability is most reliable), and many are produced in a limited number of countries. For example, compared to its imports, the EU produces only 1.3% of antimony, 10% of tungsten and no niobium, tantalum, platinum group metals or REEs (BGS European Mineral Statistics 2004–2008). The UK currently has essentially no metalliferous mining activity, despite its historical importance.

11. There is considerable potential to reduce our vulnerability with regard to some strategic metals through domestic production. We believe that the UK has significant potential reserves of some metals, such as indium and tungsten in south west England. The country remains underexplored by modern mineral exploration methods, due to the lack of current mining activities. However, the UK has the advantage of a world renowned mineral deposits research community, including not only university scientists, but also those in BGS, NERC isotope facilities, and the Mineralogy Department of the Natural History Museum. Their research addresses the formation of metal deposits and developing successful exploration strategies for locating them, coupled with safe, efficient and environmentally sound exploitation of these deposits, and scientists in this field have been
active in international scientific bodies (such as the Society of Economic Geologists) and publications. UK leaders of the global industrial community include Dick Sillitoe, a world renowned ore deposit consultant, and Graham Brown, Head of Exploration at Anglo American. Moreover, there is a thriving UK-based mining and exploration industry, which comprises over 15% by market value of the FTSE 100 and around 25% of AIM; in addition London is a key market for emerging mining companies to raise capital, including those active in strategic metals extraction. Companies such as Anglo American and Rio Tinto extensively recruit UK geology graduates.

12. There is a continuing need for sustained high-quality research in a number of areas. It is essential to the search for new reserves, to improving the efficiency and safety of extraction and processing, and to mitigating and remediating environmental impacts. The geological origins of major deposits of REEs such as Bayan Obo, for instance, have been disputed, but recent research has been resolving some of the uncertainty. Unless we understand the origins of these deposits, we cannot build an effective predictive model to inform the search for new potentially economic deposits, and the assessment of known ones. There is potential also to identify new source mineral species (that is, distinct minerals as characterised by their chemical composition and crystalline structure) beyond the restricted number currently used, which reflect historical practice and the state of existing processing technology—as new extraction and processing technologies emerge, other mineral species may become viable. This depends on an understanding of the nature and behaviour of the complete geodevity of natural minerals—an area in which the Natural History Museum plays a key national role alongside the universities. There are some claims that it may be possible to extract strategic minerals from the sea floor, or by concentrating them from sea water itself—the high level of UK expertise in oceanography, and the potential marine resources available to us, make this an attractive area of research. It is also vital that appropriate high-quality strategic data are gathered, on UK, EU and global reserves, production and end-uses—an important aspect of BGS’s national capability role, which is also of international significance. Some Fellows have expressed the view that this area is relatively neglected by NERC with regard to research funding, and that if the next generation of mineral deposits researchers is not nurtured, the community will lose critical mass and not be self sustaining. Research in this area will not attract talented early career scientists if its funding is uncertain. If our expertise and national capability in this area is not maintained, we are likely to lose out to other countries in term of potential economic benefit, security of supply, and influence over the development of technologies and standards for environmental protection. As well as ensuring sustained funding of research and data gathering, we would urge Government to support the training of geologists at undergraduate and postgraduate level to ensure that this research community continues to thrive.

13. Government should also address the inconsistency between national mineral supply objectives and local planning policy and practice. There are reserves in the UK which have been identified as economic to exploit, but whose development has been prevented by planning hurdles. With modern mining and extraction techniques coupled with high levels of environmental safety awareness and protection, we believe that it should be possible in most instances to satisfy reasonable concerns as well as to deliver local and national economic benefit. We would be happy to provide details of specific instances if this is of interest to the committee. A further potential legal obstacle under English law is the separation of mineral rights from land ownership.

14. The current increased focus on the supply and use of strategic metals is welcome. To be of value, it must be sustained. Government should pursue a joined up strategic approach, which recognises the shared and distinct features of the political economy of different metals and applications. Significant effort is being devoted to this area, and an important and fruitful involvement in REE research, for instance, at the Baoitu Rare Earth Research Institute, and is gaining international acclaim for such work. Not all of it is shared internationally. In the USA, the Mountain Pass mine, which was previously the source of much of the world’s REE supply but which closed in 2002, is currently undergoing expansion and modernisation, and is expected to return to production during 2011. REE deposits are also being investigated elsewhere in the USA, as well as in Australia, Canada and South Africa.

How desirable, easy and cost-effective is it to recover and recycle metals from discarded products? How can this be encouraged? Where recycling currently takes place, what arrangements need to be in place to ensure it is done cost-effectively, safely and ethically?

15. The Geological Society is not generally well placed to comment on classical recovery and recycling (that is, from products), nor on the technological development of substitutes. We note the importance of considering the whole product cycle, including recycling, at the design stage (so called “cradle-to-cradle” design), particularly with reference to degradation and disposal of materials.

16. A potentially significant future source of strategic metals, in addition to primary ore extraction and the recycling of products, is to extract them from industrial waste materials. For example, a research team at the University of Durham led by Professor Jon Gluyas is taking a novel holistic approach to multiple resource cycles, and delivering highly promising results. If waste material can be used to generate a valuable commodity, so that the “back end” of one resource cycle becomes the “front end” of another, it may be possible both to make net gains in economic and energy efficiency, and reduce overall environmental impacts. They are investigating waste streams such as spent oil shales, fly ash and slags, not only to identify potentially economic metal content (REEs, transition elements and platinum group elements), but also to reuse the waste materials to sequester CO2 (potentially even acting as a net carbon sink), or to create new synthetic materials (for
instance, to use as an absorbent and photo-catalyst for the degradation of oil spills at sea). They have shown that the retorting process for generating oil from shale, for example, leaves increased REE concentrations in the residual shale—and that the relative level of enrichment is greater for Heavy REEs (see paragraph 8). While these do not approach the concentrations in primary ores, which are typically five times higher or more, it may be possible to extract these metals economically, given that there are no extraction costs, particularly if in future the processes for extraction of both the oil and REEs can be refined to maximise overall efficiency. There are 100 million tonnes of oil shale spoil heaps in West Lothian, representing a significant potential resource, though not all is available for use under current planning regulations. Such an approach would be of particular value in the context of REEs, where there is currently limited capacity for recycling given their growing use and the relatively small total quantities which exists in products which might be recycled.

17. The expertise of academic and industrial Earth scientists with regard to assessment and efficient processing of primary metal ores (and of the waste streams from other processes as outlined above) is likely also to be of value in some cases of classical recycling of products.

Are there substitutes for those metals that are in decline in technological products manufactured in the UK? How can these substitutes be more widely applied?

18. We note that the use of specific REEs has shifted in some cases over recent years—for example, neodymium has tended to replace samarium in rare earth magnets (neodymium being naturally more abundant). Development of potential substitutes must be informed by their resource implications, including mineral resources. This again depends on our understanding of the full geodiversity of minerals, and on the research underpinning it.

19. We are not aware of any viable substitutes at present for strategic metals in a number of key technologies—in particular, platinum group metals in catalytic converters, and REEs (particularly neodymium) in supermagnets used in wind turbines and hybrid cars.

What opportunities are there to work internationally on the challenge of recovering, recycling and substituting strategically important metals?

20. There is potential for the UK to take a leading role in research into the recovery of strategic metals from the waste streams of other resource cycles, discussed above, and in its development through to industrial application. This could also deliver economic benefit.

21. The BGS has an excellent track record of disseminating best practice regarding economically and environmentally efficient extraction processes globally, particularly in the developing world, and it is to be hoped that it will be possible to continue this invaluable work in future.

Concluding Remarks

22. The Geological Society is delighted that the committee has chosen strategically important metals as the subject of an inquiry, and we hope that the Government will also recognise the need to consider these issues. We would be pleased to discuss further any of the general points raised in this submission, to provide more detailed information, or to suggest oral witnesses and other specialist contacts, should this be of interest.

The Geological Society of London
17 December 2010

Supplementary evidence submitted by The Geological Society of London (SIM 10a)

1. During oral evidence on 26 January 2011 the Committee asked the Society to clarify paragraph 13 of our submission dated 17 December 2010.

"With modern mining and extraction techniques coupled with high levels of environmental safety awareness and protection, we believe it is possible in most instances to satisfy reasonable concerns as well as to deliver local and national economic benefit. We would be happy to provide details of specific instances if this is of interest to the Committee".

2. This additional Memorandum provides such details by giving selected examples. In exploration and production all these operations make a significant positive contribution to their local as well as their national economy.

Cononish (Scotgold Resources Ltd, Grampian Region)

3. Current resources at Cononish are estimated at 163 kozs and 596 kozs of Au and Ag respectively (in Measured, Indicated and Inferred categories). The contained metal content at current prices is valued at approximately £140 million making the operation highly profitable. (The resource estimate does not include Te as previous explorers did not assay for Te—but reserves are probably of the order of 7 tons which would significantly contribute to European production; global use is less than 200 tpa) An independent consultant's
report indicates an exploration target of an additional 0.5Mt to 1Mt of ore within a few kilometres of Cononish. There is an exploration target of 0.5Mt to 5Mt at Beinn Udlaidh based on breccia pipes and Scot Gold Resources Ltd is probably quite close to defining a few more targets in the next three to six months of a similar size to Cononish within a 15 km radius of Tyndrum. Their wider exploration area covers some 4,000 km² which is believed to be prospective for gold and other metalliferous deposits. At present, the company employs four staff directly and two others as consultants on exploration and would hope to increase this as things move forward. To date probably in excess of £4 million has been spent and the cost of investigatory work completed previously on Cononish and the surrounding area probably amounts to £5–10 million, much of this sum being spent locally. The exploration potential of the Dalradian rocks of the Scottish Highlands is well documented and demonstrated in equivalent rocks elsewhere (for example, Sweden, Norway, Canada and US) and success in developing a working mine at Cononish will attract further exploration.

4. Based on present resource estimates the mine in production will employ 52 people year-round in full time positions with an annual wage bill in excess of £2 million. The necessary skills are largely available locally. The estimated impact using ONS multipliers suggests a contribution of around £50 million to the UK economy overall. This does not consider downstream value added to possible products. Although at an early stage, the company is looking at a partnership to promote some form of Scottish Gold Jewellery manufacturing locally or in Scotland using this unique product. Additionally the local community are most supportive of the proposals and wish to set up some form of “tourist” attraction based on historical mining in the area and obviously Scotland’s only gold mine—this hopefully will add post-closure more sustainable benefit in the area.

5. In terms of satisfying planning and environmental legislation, the initial application was turned down largely because of concerns about “visual” impact in the National Parks but since refusal Scotgold Resources has been working to meet these concerns by reducing the size of the tailings facility and by incorporating some underground disposal. For environmental reasons, a gravity/flotation process rather than the use of cyanide will be employed. Plant has been designed at additional cost to minimise the footprint—modularised and contained in a single building rather than a traditional design. The location demands the highest environmental and planning standards and it is perhaps significant that the Scottish Environmental Protection Agency withdrew their objection. The company is currently sufficiently encouraged to re-apply for planning permission.

6. Although Cononish is planned to be a small mine, and there are few of equivalent size in the UK, there are many mines operating profitably in similar “legislative” regimes where the highest standards of environmental and societal protection are required. Examples can be found in Canada, Australia and Sweden.

7. The Committee is welcome to visit the mine if it would find that useful. (Based on narrative provided by C J S Sangster of Scotgold Resources Ltd)

Other examples

8. Although not concerned with metalliferous mining, the following examples illustrate that extraction and restoration is compatible with meeting the highest environmental planning requirements.

NEEDINGWORTH SAND AND GRAVEL (HANSON AGGREGATES, CAMBRIDGESHIRE)

9. Extraction is expected to span over 30 years, during which time 28 million tonnes of sand and gravel will be removed. The restoration will be phased over the extraction period to include Britain’s biggest reedbed (460 ha) along with open meres, wet scrub and grassland, within a 700 ha nature reserve (in conjunction with RSPB).

WICKEN SILICA SAND (SIBELCO UK, NORFOLK)

10. The site is a modern extraction and processing site and is the largest quarry in the UK for the supply of sand for glass making. Sands for foundry castings are also supplied from the site. The restoration of the quarried areas has been an ongoing activity for much of the past 100 years and large areas have been reinstated to woodland, lakes, heathland and grassland. Many of these areas are open for public access, some are operated as leisure businesses and some of the heathland restoration areas are actively managed with limited or controlled access in the interests of nature conservation. Several Sites of Special Scientific Interest (SSSIs) are present in the vicinity, including part of the old quarry workings at Leziate. Adjacent to this geological SSSI is an RSPB nature reserve, following a donation of land from WBB Minerals. The Wicken North restoration area has won an award from the Norfolk Branch of the Campaign to Protect Rural England (CPRE).

PLENMELLER COAL (UK COAL, NORTHUMBERLAND)

11. Coal has been extracted in the area of Plenmeller since the late 19th century. In 1987, planning consent was issued to British Coal (now UK Coal Ltd) for opencast coal extraction, and digging started in 1988. Following a public enquiry, planning consent was issued on the condition that approximately 190 ha of the site were restored to upland heathland incorporate cotton grass, mat-grass, heath rush, heather and sphagnum moorland plant communities. Despite being in the early stages of habitat establishment, the site is already attracting many important species of birds such as Lapwing, Curlew, Redshank, Grey Partridge, Merlin and Hen Harrier. Local people enjoy these birds and their habitat using the many footpaths throughout the site.
Ballidon Limestone (Tarmac, Peak District National Park)

12. Ballidon is located within the Peak District National Park, approximately 10 km north of Ashbourne and 21 km south west of Matlock. The quarry first became operational in the 1950’s. The current site Biodiversity Action Plan (BAP) describes a five-year programme of ecological restoration and management works which will contribute to the long-term restoration extending to 2037. Being located within the Peak District National Park and adjacent to Ballidon Dale Site of Special Scientific Interest (SSSI), land-forming has had to screen the quarry from, and at the same time blend into, its surrounds. The restoration at Ballidon is specific to the Quarry, but the approved plan does aim to be sympathetic to the surrounding area in terms of landscape and flora. The site BAP aims to contribute to the Peak Park BAP targets.

Geological Society of London
16 February 2011

Written evidence submitted by the British Metals Recycling Association (SIM 14)

Introduction

1. The British Metals Recycling Association (BMRA) is the trade association for ferrous and non-ferrous metal recycling companies throughout the UK and represents some 300 businesses from multi-national companies to small family-owned enterprises, which between them handle over 95% of the metal recycled in the UK. This £4-5 billion industry processes over 15 million tonnes of metal annually into valuable secondary raw material for metals manufacturing both here in the UK and in a wide variety of export markets.

2. We welcome the Committee’s inquiry examining the importance of strategically important metals. This is an area that has attracted increasing attention over the past twelve months and due consideration must be given to what remedies, if any, are required. The BMRA strongly believes that care must be taken over which metals are defined as strategically important and, particularly, that the definition is not extended to metals that are not rare but whose markets are volatile. Moreover, besides being a well regulated low carbon industry, the value of the materials handled by metals recyclers mean that operators observe the highest environmental and public health standards.

Question 1: Is there a global shortfall in the supply and availability of strategically important metals essential to the production of advanced technology in the UK?

3. The widespread use of the listed metals in consumer and industrial products is a relatively recent phenomenon and therefore there is not a significant volume recovered through the Waste Electrical and Electronic Equipment (WEEE) recycling market at this time, although these opportunities will increase as equipment comes to the end of its useful life.

4. Our understanding of the primary sources of most of those metals described as strategically important is that these are plentiful although the extraction process may have a very high cost attached to it or the deposit concentrations are very low, making extraction at the prevailing price uneconomic. We have no evidence that the metals listed are intrinsically “scarce” only that the availability of them (in the medium term) will be determined by the price that the market is prepared to pay for them. In other words, the market for these metals will behave in exactly the same way as all other metal or commodity markets.

5. We would also ask the Committee to resist requests from some interested parties to broaden the list of “strategically important metals” to include metals that are in no sense “rare” but whose markets are volatile.

Question 2: How vulnerable is the UK to a potential decline or restriction in the supply of strategically important metals? What should the Government be doing to safeguard against this and to ensure supplies are produced ethically?

6. UK manufacturers that employ metals that are subject to market volatility in their manufacturing processes need to secure their sources of supply by using the variety of market mechanisms that are readily deployed in these situations, such as hedging, forward purchase or stockpiling. Historically manufacturers have always looked at opportunities for substitution in order to avoid over reliance on a single material or source of supply.

7. There is a real danger that any intervention by a single government on behalf of a manufacturer or processor will disrupt and distort the market in that commodity. Naturally the manufacturer wishes to secure a source of supply at the lowest possible price but that should not be the basis for a market distortion. The UK should resist some of the narrower interests present in Europe at this time who would seek to restrict the export of valuable recycled metals in order to artificially deflate the price of this material to European manufacturers, who in turn wish to export the goods.

8. This pressure to restrain free international trade in secondary raw materials will have wide ranging consequences for the UK — not only in undermining the position of UK metals recyclers as Europe’s leading exports of recycled metal but also in encouraging protectionist behaviour more broadly.
Question 3: How desirable, easy and cost-effective is it to recover and recycle metals from discarded products? How can this be encouraged? Where recycling currently takes place, what arrangements need to be in place to ensure it is done cost-effectively, safely and ethically?

9. It is highly desirable that we maximise the recycling and recovery of metals from all end-of-life products for the benefit of the environment and the economy. The recycling of metals is generally cost effective and it is notable that BMRA members buy every ton of “waste” metal that they process, unlike any other part of the waste industry.

10. A number of mechanisms are being employed to encourage an increase in recycling and recovery rates for such materials as packaging, WEEE and end-of-life vehicles (ELV) with considerable success. Notably the European target for the recovery of ELVs is currently 85% and rising to 95% in 2015. The UK is on target to achieve its increased ELV targets.

11. WEEE recovery rates are much lower and are largely determined by the effectiveness of municipal collection rates, but of the WEEE available to UK recyclers around 90% is recovered in some of the most sophisticated WEEE recycling facilities in the world operating to the very highest ethical and environmental standards.

12. BMRA would be pleased to host a visit by members of the Select Committee to UK ELV and WEEE recycling facilities.

Question 4: Are there substitutes for those metals that are in decline in technological products manufactured in the UK? How can these substitutes be more widely applied?

13. No comment.

Question 5: What opportunities are there to work internationally on the challenge of recovering, recycling and substituting strategically important metals?

14. The processes involved in recycling and recovery of strategically important metals are already well established although the market is limited at present (See Para 2) and will be deployed by a relatively small number of multi-national companies who specialise in the mechanical separation of metals and then their thermo-chemical recovery. The market is truly international and highly competitive. On this basis we do not anticipate any great demand for collaborative working.

British Metals Recycling Association
December 2010

Written evidence submitted by The Royal Society of Chemistry (RSC) (SIM 17)

1. The Royal Society of Chemistry (RSC) welcomes the opportunity to respond to the House of Commons Science and Technology Select Committee’s consultation on strategically important metals (SIMs).

2. The RSC is the largest organisation in Europe for advancing the chemical sciences. Supported by a network of 46,000 members worldwide and an internationally acclaimed publishing business, its activities span education and training, conferences and science policy, and the promotion of the chemical sciences to the public.

3. This document represents the views of the RSC. The RSC has a duty under its Royal Charter “to serve the public interest” by acting in an independent advisory capacity, and it is in this spirit that this submission is made.

Is there a global shortfall in the supply and availability of strategically important metals essential to the production of advanced technology in the UK?

4. While this document addresses the SIMs highlighted by the committee, the Government’s latest procurement policy should expand to include other strategically important elements of the periodic table, such as phosphorus and helium.

5. The total stock of metal-containing minerals in the Earth’s crust is finite, but it is also extremely large. A “reserve” is the stack of metal for which the location and tonnage is known and which can be extracted economically using existing technology. Reserves typically represent a small fraction of the total amount in the Earth’s crust. Current concern regarding access to SIMs is partly based on published reserves—which, in turn, is based on best estimates of the accessible deposits—together with the rate at which they are being consumed and the threat of reduced supply. Lithium reserves, for example, are estimated to be depleted in 45 years, indium 20 years and platinum 42 years.6

6. While there are further sources of metals than are suggested by these figures, the sources are neither evenly distributed nor, in many cases, easily accessible. For example, many metals are dissolved in the oceans, and, as yet, economically viable extraction technology is not currently available, though lithium may be accessible from oceans using main group metal coordination chemistry.8

7. The OneGeology portal9 is a major international initiative that brings together information on mineral deposits. This is a useful assessment of the mineral deposits present within the Earth’s crust that may be exploited as future reserves. Over the longer term, it is scientific and technological advances in understanding the chemistry of ore deposit formation that will provide the necessary facility to locate and extract metals. For example, a significant proportion of the world’s uranium reserves are located in a single deposit in Australia that remained undiscovered till 30 years ago.

8. The reality is that despite increasing metal production over the past 50 years, reserve levels have remained largely unchanged.10 Indeed, recent reports suggest there is ample supply of rare earth metals in US deposits.11,12 Consumption and reserves are continually changing in response to movements in markets and scientific advances. Reserve levels depend on the scientific knowledge used to locate mineral deposits and on the price of the target mineral. As scientific understanding improves, reserves become replenished from previously undiscovered resources.

9. Most metals occur in graded deposits; if prices rise, then reserves will extend to include lower grade ore; if prices fall, then reserves will contract to include only higher grade material. The reasons for high costs relate to low concentrations and to chemical similarity between some elements, which makes separation difficult. The lower grade ores will incur a higher cost to obtain the groups of metals, although the separation costs should remain consistent. Declining production is generally driven by falling demand and prices, not by scarcity.

10. Metal deposits are unevenly distributed across the globe, and patterns of supply and demand are continually shifting. The advancement of technologies that rely on these metals, both within the UK and globally, are putting pressure on reserves and supply. It is likely that this will lead to tighter controls on export by the countries that currently control reserves.13 This is of particular concern for the UK, as only 5% of the known worldwide metal reserves are found in Europe.14

11. A key strategy for the guarantee of future global supplies will be investment in new, greener technologies to find and extract these metals from alternative sources. The extraction and processing of metal is energy-intensive and the carbon emitted as a consequence may represent a significant environmental limit to our resource use. We can expect to see major research and innovation directed towards breaking the current link between metal use and greenhouse gas emissions. Examples of where low carbon technology may be headed include in situ leach mining (uranium) and microbial bio-leaching of metals from extracted ores (copper and nickel).

12. A robust strategy to manage import of metals to the UK is important and urgently required. The British Geological Survey monitors the import and export of metals within the UK and works alongside similar external organisations that monitor these resources globally. Additional monitoring to track the distribution, use and destination of these metals once in the UK would be useful. It would also help to advance technologies in reclaiming, recycling and reusing metals already imported.

13. It may be possible to increase domestic supplies of strategic metals. The UK Mineral Reconnaissance Programme provides information on potential sources of strategic metals in the UK and whether these can be economically mined.15

14. There is an opportunity for the UK to develop means of recovering higher grade metals present within waste sites. As demand for metals increases, so does price. As such, lower grade ores are increasingly sourced to meet demand. Such a strategy would enable the UK to reduce its dependency on foreign imports of SIMs. This would need to be accompanied by a change in business and consumer attitudes towards recycling waste materials (see below).

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9 OneGeology, http://www.onegeology.org/
14 Houston Museum of Natural Science, http://earth.rice.edu/mtpe/geo/geosphere/topics/minerals/wmetalreserves.html
How vulnerable is the UK to a potential decline or restriction in the supply of strategically important metals? What should the Government be doing to safeguard against this and to ensure supplies are produced ethically?

15. The UK is almost exclusively dependent on the import of metals for its technology sector. As global demand of strategic elements increases, the UK is likely to become vulnerable to shortfalls in supply. Particular metals of importance to UK industry include:
   - lithium (battery technology and pharmaceuticals),
   - platinum (catalysis, pharmaceuticals, jewellery, catalytic converters),
   - indium (flat panel components),
   - gold (electrical equipment, pharmaceuticals, jewellery etc), and
   - rare earth metals (lasers, magnets, pharmaceuticals, electronics, superconductors, lasers).

Further details of these metals, their uses and estimated reserves are highlighted in Appendix 1.

16. A strategy that encourages the UK industrial sectors to reduce, replace and recycle its SIMs, alongside developing alternative technologies based on substitute materials, would reduce UK dependence on SIMs. Such approaches are currently being developed within other countries.

17. The Japanese technology industry, like the UK’s, is highly vulnerable to changes in supply of imported SIMs. In 2007, the Japanese government published its “Element Strategy”, containing four key strategies to reduce, replace, recycle and regulate the use of rare metals within industry. Additionally, support of the underpinning chemical and physical science research is identified as key for the development of technologies that use sustainable alternatives.16

18. China, India, Russia and the USA are among nations that are establishing policies that regulate supply and export in order to control reserves of strategic metals. While these policies do not currently restrict the export of metals, they are geared to increasing export duties that will result in an increase in the cost of supply to the UK. 17

19. The EU commissioned a report—“Critical raw materials for the EU”—that highlights the EU dependence on imported metals for its technology industries18 and identifies the need to establish a trans-European policy to safeguard supplies.

20. These examples highlight the need for the UK government to develop its own strategy.

21. In the short term, the UK would benefit from appropriate monitoring of imported SIMs, particularly with regard to their distribution within manufacturing and attendant products. The RSC would be willing to work with Government and other stakeholders to establish networks of expertise for developing such a framework.

22. In the longer term, investment in research from both Government and industry is essential for the development of alternative technologies that do not rely on SIMs.

How desirable, easy and cost-effective is it to recover and recycle metals from discarded products? How can this be encouraged? Where recycling currently takes place, what arrangements need to be in place to ensure it is done cost-effectively, safely and ethically?

23. Currently, there is less incentive to recycle and recover strategically important metals as technology costs generally outweigh the ease of sourcing new imports. However, high-value metals, such as gold, are of concern, especially when they can become widely dispersed thereby making recovery difficult.

24. The UK would benefit from the strategic development of new recycling and extraction methods, which will require financial support of the underpinning research. The key areas to focus on are recycling, reducing, recovery. This management of waste products could produce continued supplies of metals in the longer term.

25. Recycling offers the opportunity to maximise the use of supplies already within the UK. Efficient recycling depends critically on product design, and this needs to encompass design for re-use, re-manufacture as well as recycling. These demand that designers, chemists and engineers work together to ensure that all the components, including the metals, are economically recovered at the end of the product life cycle. A key goal to ensure recycling is adopted more widely across the manufacturing sector is that products developed from recycled components meet the same quality standards as those made from originally sourced materials. Specified design would allow for easy recycling, while appropriate standards and sufficient labelling would help to specify the quality of recycled materials.

26. Orangebox is an office furniture design company setting a good example. Their business model encompasses a cradle-to-cradle approach to product design. Incorporating an end-of-life pick-up recycling

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service, the entire production process is designed to have minimal energy impact. Orangebox have been supported by Chemistry Innovation Knowledge Transfer Network, an organisation that brings together designers, businesses, chemists and engineers to promote cradle-to-cradle product design. This pioneering approach needs to be extended to other businesses.

27. A 2010 Johnson Matthey review of global statistics for platinum supply and demand suggests that future supplies of platinum (and other metals such as ruthenium, rhodium, iridium and palladium) recovered from automotive catalysts, jewellery and electronics are likely to increase. Improved recovery and recycling processes will enable the recovery of greater quantities of these metals to meet demand.

28. IBM is another company that monitors its metal recycling and waste management practices. Their Global Asset Recovery function tracks all material that is returned at the end of product life, recording what is recycled and what sent to landfill. In the past three years, their major de-manufacturing locations have recycled more than 55,800 tonnes of product waste including over 37,800 tonnes of ferrous and non-ferrous metals; only a fraction of a percent went to landfill. Where products contain strategically important materials, we should ensure that there are sufficient drivers for suppliers take back their products at the end of life to ensure recycling occurs ethically and safely.

29. Recycling gold from electronic equipment is challenging, but vast improvements in recycling techniques are being made. Its low chemical reactivity and excellent electrical conductance make gold difficult to replace in high-end electrical equipment. While there is significant interest in the development of copper alloys, which may provide cheaper alternatives, there remain significant technical barriers.

30. Indium is another metal that is difficult to reclaim. The process is energy- and time-consuming and takes several weeks to obtain a reusable form of the metal. New processes are required to make this more cost-efficient in order for industry to adopt these methods.

31. Neodymium gradually loses some of its magnetic properties when recycled, making it less effective when reused in a new product. Therefore, alternative materials are required together with more efficient recycling processes.

32. Reduction in the quantities of metals incorporated into products would allow the UK to extend the lifetimes of the imported metals supplies. One example of such an approach is the smaller quantity of platinum deployed in catalytic converters developed by the Mazda Motor Corporation, which required the inputs of chemists, engineers and designers.

33. Metals can be recovered from landfill sites. However, there are issues whether current sources of waste metals within the UK hold enough reclaimable metal to meet technological demand and whether recovery is cost effective. Landfill sites contain many redundant electrical equipment components. These items are important and potential sources of SIMs, including gold, neodymium, lithium etc. Currently there are no cost-effective ways to extract these metals. For example extracting indium from even one brand of television requires several different processes since each set originates from different suppliers and is designed slightly differently. Consistent design features will a key improvement required to enable sustainable and efficient metal recovery in the future. Rather than export most of our waste, as we do presently, government should consider ways in which SIMS are retained within the country for re-processing. This should include investigation as to whether current waste materials within land fill sites could be incinerated to allow recovery of metals from the reduced ash. This could be a potential further inquiry.

34. Additionally, other, less obvious, sources of recoverable metals need to be explored—for example the high levels of platinum present in road dust.

Are there substitutes for those metals that are in decline in technological products manufactured in the UK? How can these substitutes be more widely applied?

35. In such instances, there is no foreseeable method to replace certain metals with alternative materials. In such instances, use of reduced metal quantities is a short to medium term solution that will assist in reducing metal consumption although it does not eliminate metal dependence. As mentioned elsewhere, product design will prove critical in this regard.

36. While some SIMs are being replaced by alternative technologies, this remains a long-term strategy that will require continued research investment to develop many viable alternatives.

37. Sourcing alternatives for indium is a high priority, as the estimated limit to sources is four years. Indium is used in light emitting diodes (LEDs) in televisions; these are gradually being replaced by organic LED versions.26 Samsung for example are producing 3-D TVs using this new technology, though production is based in South Korea.27

38. In the UK, Plastic Logic and Oxford Advanced Surfaces Group Plc—spin-out companies from Cambridge and Oxford Universities, respectively—are developing “plastic electronics” from non-metallic materials for use in display technologies.28,29

39. There is potential to replace the lithium used in batteries with alternative materials such as disodium sulphide. Similarly, it may be possible to replace platinum in solar technologies with graphene (a sheet form of carbon one atom thick).30 However, additional research is required before these alternatives become commercially feasible.

40. In the USA, copper-coated graphite compounds are potential future replacements for platinum in solar cells.31 Should this technology prove to be viable, it is attractive because copper and graphite are non-scarce elements.

What opportunities are there to work internationally on the challenge of recovering, recycling and substituting strategically important metals?

41. There is an opportunity for the UK to take the lead in reducing, recovering and recycling strategically important metals. At a national level, the UK’s world-class science base and industries can develop technologies to reduce reliance on imported metals. Globally, we can work with other countries to implement legislative measures that can regulate supplies.

Leading by example

42. The UK has a long established record in world-class research. As such, there is a huge opportunity for the UK to be at the forefront of the development of stewardship strategies for SIMs, alongside innovation in alternative technologies that either utilise more abundant elements or alternative materials.

43. The UK can develop waste management strategies to recycle those metals already in circulation, thereby enabling the country to reduce its dependence on imports on a shorter timescale. Using our strong product design networks, the UK can develop new products that encompass ease of recycling with aesthetic appeal to the consumer. Scientists and engineers will play an important role in harnessing ways to reclaim metals within refuse sites. Collaboration between industry and academia will ensure that new processes are cheap, practical and effective.

44. There is an opportunity for the UK to become world-leaders in material recycling and reuse. Some UK companies are already leading the way. Axion is a company that recycles plastics, from discarded clothes hangers for instance.32 The recovered materials are exported to China (where they were originally sourced) to be re-manufactured into new products for re-export to the UK. This kind of recycling is an example of how a cradle-to-cradle lifecycle approach to product design can provide economic benefits to the companies that adopt it.

International collaboration

45. Global strategies to acquire and regulate the use of strategic elements are urgently required and many countries are now legislating to mitigate the effect of dwindling supplies. The UK could learn from other countries who are already implementing policies to reduce their reliance on imported metals.

46. A report produced for the Japanese government in 200733 lays down four principles for the use of rare metals and regulated elements: reduction, replacement, recycling, and regulation. On the basis of these principles, Japan has defined their element strategy as one of the most important priorities for science and technology research.

47. In November 2010, representatives from the US Department of Energy (DOE), national laboratories, industry, and Japanese institutes gathered for a roundtable discussion on strategies with regard to rare earth elements. with an emphasis on those used in clean energy technologies.

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26 Chemical Sciences in Society Summit 2010: sustainable materials, workshop discussions.
32 Axion Group, http://www.axionrecycling.com/
48. In December 2010, the US DOE launched its Critical Materials Strategy. The report examines the likely role of rare earth metals and other materials in clean energy technologies. The DOE describes plans to:
   — develop its first integrated research agenda addressing critical materials;
   — strengthen its capacity for information-gathering on this topic; and
   — work closely with international partners, including Japan and Europe, to reduce vulnerability to supply disruptions and address critical material needs.

The Royal Society of Chemistry
22 December 2010

APPENDIX ONE

<table>
<thead>
<tr>
<th>Metal</th>
<th>Group</th>
<th>Where mined</th>
<th>Finite Limit / yr</th>
<th>Uses</th>
<th>Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platinum</td>
<td>Pt Platinum Metals</td>
<td>S Africa, N &amp; S America</td>
<td>42</td>
<td>Catalysis, pharmaceuticals, surgical implants, jewellery, electrolysis, catalytic converters</td>
<td></td>
</tr>
<tr>
<td>Ruthenium</td>
<td>Rh Platinum Metals</td>
<td>S Africa, N &amp; S America</td>
<td>42</td>
<td>Electronics, jewellery, pens, cathodes, radiotherapy</td>
<td></td>
</tr>
<tr>
<td>Rhodium</td>
<td>Rh Platinum Metals</td>
<td>S Africa, N &amp; S America</td>
<td>42</td>
<td>Catalysis, jewellery, electronics</td>
<td></td>
</tr>
<tr>
<td>Osmium</td>
<td>Os Platinum Metals</td>
<td>S Africa, N &amp; S America</td>
<td>42</td>
<td>Fountain pen nibs, phonograph needles (early makes), Fingerprint detection, surgical implants</td>
<td></td>
</tr>
<tr>
<td>Iridium</td>
<td>Ir Platinum Metals</td>
<td>S Africa, N &amp; S America</td>
<td>42</td>
<td>Deep water pipes, catalysis, spark plugs, source of gamma radiation</td>
<td></td>
</tr>
<tr>
<td>Palladium</td>
<td>Pd Platinum Metals</td>
<td>S Africa, N &amp; S America</td>
<td>42</td>
<td>Jewellery, catalysis, dentistry, watches, spark plugs, electronics, blood sugar testing</td>
<td></td>
</tr>
<tr>
<td>Lithium</td>
<td>Li Andes in S America</td>
<td>45</td>
<td>Batteries, energy storage</td>
<td>Disodium sulphide</td>
<td></td>
</tr>
<tr>
<td>Indium</td>
<td>In China, USA, Canada, Russia</td>
<td>4</td>
<td>Thin layer solar cells, glass coatings in TVs, semiconductors, light emitting diodes, medical imaging of antibiotic therapy</td>
<td>Organic light emitting diodes</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Metal</th>
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<th>Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold⁴⁴,⁴⁵</td>
<td>Au</td>
<td>Transition metal</td>
<td>China, S Africa, S America, Australia</td>
<td>36</td>
<td>Electronics, pharmaceuticals⁴⁶,⁴⁷, jewellery, food, cosmetics</td>
</tr>
<tr>
<td>Scandium⁴⁴,⁴⁵</td>
<td>Sc</td>
<td>Rare Earth metal</td>
<td>Asia, Australia, N America</td>
<td>Not estimated</td>
<td>Light alloy for aerospace components, additive in Mercury-vapour lamps</td>
</tr>
<tr>
<td>Yttrium⁴⁴,⁴⁵</td>
<td>Y</td>
<td>Rare Earth metal</td>
<td>Asia, Australia, N America</td>
<td>Not estimated</td>
<td>Laser, high-temperature superconductors, microwave filters</td>
</tr>
<tr>
<td>Lanthanum⁴⁴,⁴⁵</td>
<td>La</td>
<td>Rare Earth metal</td>
<td>Asia, Australia, N America</td>
<td>Not estimated</td>
<td>High refractive index glass, flint, hydrogen storage, battery-electrodes, camera lenses, fluid catalytic cracking for oil refining</td>
</tr>
<tr>
<td>Cerium⁴⁴,⁴⁵</td>
<td>Ce</td>
<td>Rare Earth metal</td>
<td>Asia, Australia, N America</td>
<td>Not estimated</td>
<td>Chemical oxidizing agent, polishing powder, yellow colours in glass and ceramics, catalyst for self-cleaning ovens, fluid catalytic cracking catalyst for oil refineries</td>
</tr>
<tr>
<td>Praseodymium⁴⁴,⁴⁵</td>
<td>Pr</td>
<td>Rare Earth metal</td>
<td>Asia, Australia, N America</td>
<td>Not estimated</td>
<td>Rare-earth magnets, lasers, core materials for carbon arc lighting, colourant in glasses and enamels, additive in didymium glass used in welding goggles</td>
</tr>
<tr>
<td>Neodymium⁴⁴,⁴⁵</td>
<td>Nd</td>
<td>Rare Earth metal</td>
<td>Asia, Australia, N America</td>
<td>Not estimated</td>
<td>Rare-earth magnets, lasers, violet colours in glass and ceramics, ceramic capacitors</td>
</tr>
<tr>
<td>Promethium⁴⁴,⁴⁵</td>
<td>Pm</td>
<td>Rare Earth metal</td>
<td>Asia, Australia, N America</td>
<td>Not estimated</td>
<td>Nuclear batteries</td>
</tr>
<tr>
<td>Samarium⁴⁴,⁴⁵</td>
<td>Sm</td>
<td>Rare Earth metal</td>
<td>Asia, Australia, N America</td>
<td>Not estimated</td>
<td>Rare-earth magnets, lasers, violet colours in glass ceramics, ceramic capacitors</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Metal</th>
<th>Group</th>
<th>Where mined</th>
<th>Finite Limit / yr</th>
<th>Uses</th>
<th>Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europium</td>
<td>Eu</td>
<td>Rare Earth Metal</td>
<td>Asia, Australia, North America</td>
<td>Not estimated</td>
<td>Red and blue phosphors, lasers, mercury-vapor lamps</td>
</tr>
<tr>
<td>Gadolinium</td>
<td>Gd</td>
<td>Rare Earth Metal</td>
<td>Asia, Australia, North America</td>
<td>Not estimated</td>
<td>Rare-earth magnets, high refractive index glass or garnets, lasers, x-ray tubes, computer memories, neutron capture</td>
</tr>
<tr>
<td>Terbium</td>
<td>Tb</td>
<td>Rare Earth Metal</td>
<td>Asia, Australia, North America</td>
<td>Not estimated</td>
<td>Green phosphors, lasers, fluorescent lamps</td>
</tr>
<tr>
<td>Dysprosium</td>
<td>Dy</td>
<td>Rare Earth Metal</td>
<td>Asia, Australia, North America</td>
<td>Not estimated</td>
<td>Rare-earth magnets, lasers</td>
</tr>
<tr>
<td>Holmium</td>
<td>Ho</td>
<td>Rare Earth Metal</td>
<td>Asia, Australia, North America</td>
<td>Not estimated</td>
<td>Lasers</td>
</tr>
<tr>
<td>Erbium</td>
<td>Er</td>
<td>Rare Earth Metal</td>
<td>Asia, Australia, North America</td>
<td>Not estimated</td>
<td>Lasers</td>
</tr>
<tr>
<td>Thalium</td>
<td>Tm</td>
<td>Rare Earth Metal</td>
<td>Asia, Australia, North America</td>
<td>Not estimated</td>
<td>Portable X-ray machines</td>
</tr>
<tr>
<td>Ytterbium</td>
<td>Yb</td>
<td>Rare Earth Metal</td>
<td>Asia, Australia, North America</td>
<td>Not estimated</td>
<td>Infrared lasers, chemical reducing agent</td>
</tr>
<tr>
<td>Lutetium</td>
<td>Lu</td>
<td>Rare Earth Metal</td>
<td>Asia, Australia, North America</td>
<td>Not estimated</td>
<td>PET Scan detectors, high refractive index glass</td>
</tr>
</tbody>
</table>

Written evidence submitted by the Design Council (SIM 19)

1. EXECUTIVE SUMMARY

1.1 The Design Council welcomes the opportunity to respond to the House of Commons Science and Technology Committee inquiry into strategically important metals.

1.2 The Design Council is the UK’s national strategic body for design and government advisor on design.

1.3 Our response is built on the breadth of our experience and expertise of working with business, universities and the public sector. Our views are drawn from our Design Industry Research 2010 and a strong evidence base from our design support programmes for SMEs, including technology start ups, and technology transfer offices in leading universities to help develop new products, services and commercialise new technology.

1.4 Recover, reconstruct and rekindle should be the keywords for a new, more environmentally conscious economic recovery.

1.5 With 80% of the environmental impact of today’s products, services and infrastructures being determined at the design stage, designers have a critical role to play in tackling these issues more comprehensively, fully integrating a green approach into their standard practice.

1.6 There should be a greater integration of design and design thinking methods with STEM and business curricula at all education levels.

1.7 Government should embed cradle-to-cradle thinking and look at an innovative approach to devising end-of-life strategies as part of its Growth Review, bringing innovation, technology, manufacturing and skills closer together.

1.8 Our response highlights: the value of design to UK plc, how design could help tackle resource and material scarcity through designing for deconstruction, nonpollution and designing to last and how strategic use of design could help changing business models and improving supply chains.

2. VALUE OF DESIGN

2.1 The UK has a world leading design industry worth £15 billion to the UK economy. An estimated 232,000 designers work in the UK, this is a 29% increase on 2005. The industry is mainly made up SMEs and 93% of design businesses work for clients in the UK.

2.2 The importance of design as a tool for innovation, productivity and economic growth is accepted. Research has consistently shown a link between the use of design and improved business performance across key measures including turnover, profit and market share. Between 1995 and 2004, the share prices of design-conscious companies outperformed other firms by 200%. For every £100 a design-alert business spends on design, turnover increases by £225.

2.3 The UK creative industries, including design, are a major and growing contributor to the UK economy. The UK design industry is renowned worldwide and a draw for big business. Multi-national base their design centres in the UK to take advantage of the skilled design professionals and leading edge design, including Yamaha Music Corporation, Nissan, Samsung, Nokia and Motorola.

2.4 Research indicates £15 billion was spent on UK design in 2009 via in-house design teams and freelancers and consultancies and the added value of design to the wider economy is greater than for any other sector in the creative industries. The UK needs to play to this strength.

2.5 The UK government has made a strong commitment to knowledge driven-economy rooted in new discoveries and with a strong emphasis on green technology. They have ring-fenced the science budget, committed to establishment of new Technology Innovation Centres, and announced a new Green Investment Bank. However, our research and practical experience at the Design Council has shown that design is too often the missing link in turning new discoveries into workable business propositions.

3. GREEN CHALLENGE

3.1 Inevitably, as oil prices keep rising and the rate of oil production enters terminal decline, materials and resources will become ever more expensive, pushing further the drive for more environmental efficiency.
3.2 According to Dr Mike Pitts at the Royal Society of Chemistry, since 1900 the UK has increased its consumption of consumables by 40 times. The mass of raw materials extracted to make them comes from an even bigger mass of minerals (it takes 1.5kg of raw material to make just one toothbrush, and the US landfills 25 000 tonnes of toothbrushes every year), creating a huge amount of CO2 emissions in the process.59

3.3 Dr Pitts talked at Greengaged in 2008 about other “peaks” in mined materials. He presented a memorable slide of the periodic table—a visual representation of every known element on the planet—showing how, if we continued using and designing without easy (and safe) disassembly and recycling, we would banish a big chunk of these essential building blocks to landfill very soon. Five to 10 years’ time, in some instances.

3.4 So there is need for more responsibility in the way we choose materials, and for a wider outlook for new opportunities to turn waste into someone else’s raw material.

4. Designing for Deconstruction and Nonpollution

4.1 What designers can bring to the party is much more than a reactive approach. Generic principles such as efficiency, nonpollution, whole-life design and dematerialisation, can be used in any area of design. The more creative and more ingenious we are, the quicker and bigger the positive environmental paybacks. However, our design industry is slow on the uptake of designing for deconstruction.

4.2 Mobile phones are case in point. Our wish to upgrade to the next model is fuelled by tantalising ads and seductive designs. Would this be such a problem if we designed the phone so all the materials could be separated out? It becomes an issue when considering how many different elements are built into modern mobile phones. It is not to say that elements like indium or gold will disappear completely, but designing in such a way that we cannot get them out is irresponsible for future needs. In 2005, more than $400 million (£255 million) worth of metals were locked away in unused mobile phones, according to Pitts.

4.3 Appreciating raw materials is one half of the process—the other is understanding production cycles and reconfiguring them for optimum environmental efficiency. Innovation in sustainable technology is happening at such a fast rate that it is hard to keep up, but keep up we must, for new, sustainable technology requires knowledgeable designers.

4.4 Examples abound in the field of packaging. Nick Cliffe from Closed Loop plastics recycling plant reinforces the need to understand what is actually able to be recycled with what can technically be recycled, illustrating that you cannot just substitute one material for another without understanding the consequences.61

4.5 For example, many designers and clients now opt for a bioplastic bag. This is plastic with added degrader in the mix (usually titanium). But this plastic is getting into the recycling stream before the recycling infrastructure is ready, often resulting in contaminated batches.

4.6 Some designers still don’t understand the consequences of decisions that are sometimes purely concerned with aesthetics. Simple things like co-moulding two different plastics in a toothbrush design or laminating a piece of paper can predetermine its painful and slow landfill demise. This will be where new alliances for the design, waste and materials industries can flourish.

4.7 Some industries—such as the automotive sector, with its design of better vehicles—have become much more efficient. And in areas where products are directly accountable for using or emitting pollutants, there have been improvements. Other positive impacts have come from legislation: the waste disposal drive from Europe, through the EU Waste Electrical and Electronic Equipment Directive, and higher landfill taxes have forced alternative thinking on a product’s afterlife.

5. Designing to Last

5.1 Companies can strive to build more durable products to ensure they last longer.

5.2 As an example, the furniture company Vitsoe has become a market leader with a product designed to last a lifetime. The 606 Universal Shelving System’s stated aim is to “help people live better with less that lasts longer.” Its highly flexible modularity allows owners to install and extend their shelving easily themselves. For a nominal fee Vitsoe also offers a service dismantling and rebuilding its system for relocation.

Also, designing product components for easy removal and replacement encourages people to repair parts rather than replacing the whole object when it breaks down.

5.3 The Aeron ergonomic chair shows how successful these principles can be. It has 66% recycled parts and 100% of its aluminium parts are recycled, making it about 95% less destructive to materials, energy, water and air. All its plastic parts are labelled with International Standards Organisation (ISO) recycling symbols and the chair is easy to disassemble, with 94% recyclable parts. Repair is simple and the chair has a 10-year lifespan—about double that of an ordinary office chair. It has been a worldwide success and has been recognised as a design classic by the Museum of Modern Art in New York.

59 Thomas, S. Recovery mission: Vision 2011, Design Week, December 2010
61 Thomas, S. It’s time to act, Sustainable Design Supplement, Design Week, 2010
6. Designing to Recycle and Remanufacture

6.1 At the moment, when waste is re-used, it is often downgraded. Cars are routinely melted down without separating out useful metals such as copper, meaning these become unusable in the resulting alloy.

6.2 Xerox, as well as saving resource by making multi-functional products that scan, copy, fax and print, also remanufacture their old products. They estimate that this results in their products having up to seven lives. Xerox began remanufacturing operations in the early 1990s and is now a world leader in this field.\footnote{Remanufacturing and Product Design, Caspar Gray, 2006 http://www.cfsd.org.uk/CfSD/Remanufacturing%20and%20Product%20Design.pdf} Evidence suggests remanufacture can be twice as profitable as manufacture, but few companies currently use it.\footnote{Caspar Gray interview with Rolf Steinhilper, 2006}

6.3 Another example is a design-led business Remarkable pencils. In 1996 entrepreneur Edward Douglas Miller decided to make pencils from recycled plastic cups. His company Remarkable rethought waste, and developed a new product design, supply chain and manufacturing process. Remarkable collaborated with a specialist university research unit and also with external design agencies to come up with a brand identity that communicated the essence of the company’s values. Since its launch Remarkable has sold more than 100m pencils and has achieved listings with numerous high profile retailers. Douglas Miller said: “Design was integral to the whole thing.”

7. Changing Business Models and Improving Supply Chains Through Strategic Design

7.1 In the long term the green economy will see the UK develop new industry sectors, in which product and service design will be crucial. In a knowledge based economy, the UK will also need to develop whole new business models, supply chains and ways of working, and here the use of strategic design methodologies will be vital.

7.2 Over the last three years the Design Council has used its roster of world-class Design Associates to work with 1,800 CEOs and their Boards to strengthen management awareness of design as a strategic tool. On average every £1 spent delivers £10 of economic value recorded in profits, sales and jobs as Gross Value Added (or GVA).

7.3 One recent example is a young company that has invented a mouldable silicon called Sugru that can be used to repair household goods. With help from their Design Associate, the MD has gone from a standing-start to attract investment and her product has just been named by TIME magazine as one of the best inventions of 2010.

7.4 A radical re-design was undertaken by the car manufacturer Riversimple, who undertook to transform its business model not just its product, production process or supply chain. Riversimple designed a new car through “open source” and they are going to lease this rather than sell it. This has moved Riversimple from manufacturing into service provision, making them an exemplar manu-service company.

7.5 Industry has utilized design skills to improve the sustainability of the whole supply chain. In an effort to reduce the impacts of cars on the environment and society, Toyota has created an “Eco-Vehicle Assessment Systems” (Eco-VAS). Eco-VAS is a design tool, which Toyota’s engineers use to measure vehicle impacts through their “life cycle” — during their design and production, distribution, use and disposal.

8. Appendix

8.1 Definitions of Design

Ingenious Britain’s definition (2010): “Design is not simply aesthetics; it’s the rigorous process that links new technologies to business—creating things that work properly.”

The Cox Review (2005): “Design is what links creativity and innovation. It shapes ideas to become practical and attractive propositions for users or customers. Design may be described as creativity deployed to a specific end.”

Design as a driver of user-centered generation (2009), the EC Commission’s working document: “Design for user-centred innovation is the activity of conceiving and developing a plan for a new or significantly improved product, service or system that ensures the best interface with user needs, aspirations and abilities, and that allows for aspects of economic, social and environmental sustainability to be taken into account.”

Design Council
20 January 2011
Written evidence submitted by The Minor Metals Trade Association (SIM 20)

INTRODUCTION

The Minor Metals Trade Association (MMTA) was established in 1973 and is the leading international business organisation promoting the minor metals, ferro-alloys and rare earth elements industry as a whole. Today the MMTA is the world’s largest industry body dedicated to these strategically important metals.

The MMTA is dedicated to enhancing membership value and promoting the use of and trade in the metals its members are involved in. At the heart of the MMTA are its members: producers, consumers, traders, warehouses & forwarders, samplers & assayers and financial, information and legal services, all of whom have an important part to play in the smooth running of the minor metal industry. We have 150 member companies in 30 countries and our industry has a collective annual worth of more than 10 billion dollars.

1. Is there a global shortfall in the supply and availability of strategically important metals essential to the production of advanced technology in the UK?

Those strategically important metals that have historically been called “minor” metals are reaching maturity; industrially, economically and politically. The UK is one of the world’s leaders of advanced technologies that consume these elements.

Strategically important metals (minor metals) are often by-products of base metals (such as copper, aluminium and zinc) and therefore their production is not as responsive to changes in price which is the normal way for market conditions to reflect supply and demand of commodities.

In Europe at present, whilst on the one hand the EU are looking to promote strategic raw materials in REACH they are simultaneously creating de facto import tariffs which are destroying the industry for strategic raw materials in Europe. REACH [Registration, Evaluation, Authorisation and Restriction of Chemical substances] legislation adds bureaucratic costs to every strategically important metal produced or imported into Europe in quantities of over one tonne per year. REACH, unintentionally, has been a highly destructive regulation and it is not even fully implemented yet.

2. How vulnerable is the UK to a potential decline or restriction in the supply of strategically important metals? What should the Government be doing to safeguard against this and to ensure supplies are produced ethically?

Barring force majeure it seems unlikely that production of these metals will decline on a global scale given overall growth in mining and mining investment of recent years. There are a small number of metals whose use is being phased out, such as mercury and cadmium, as they can be highly toxic in uncontrolled environments.

Restrictions for political reasons are matters for the UK government to ease through diplomacy. Particular attention should be given to those elements with a high Herfindahl Hirshman Index (HHI), for example gallium, germanium and antimony.

3. How desirable, easy and cost-effective is it to recover and recycle metals from discarded products? How can this be encouraged? Where recycling currently takes place, what arrangements need to be in place to ensure it is done cost-effectively, safely and ethically?

It is highly desirable to obtain the maximum possible benefit from the potential to recycle minor metals. Secondary production of minor metals from recycling (“urban mining”) is a major growth area for MMTA members, despite the fact that many minor metals are consumed in dissipative uses and cannot be recovered.

Recycling could be assisted through streamlining WEEE regulations and orientating them to be supportive of the industry, especially keeping in mind the REACH regulations which cover the finished goods.

4. Are there substitutes for those metals that are in decline in technological products manufactured in the UK? How can these substitutes be more widely applied?

Many minor metals are employed for their elemental properties (for example rhenium allows jet engines to burn at higher temperatures) which are very difficult to find in substitutes. There are some applications where you’d be hard-pressed to find substitutes, for example certain uses of cobalt where there are particular characteristics that, to some degree, are irreplaceable without sacrificing performance qualities of the end product. On the other hand, the picture is constantly changing with new technological advances and whilst cobalt’s participation in the mobile power business at one stage was viewed as irreplaceable, today there are alternatives.

When considering the use of substitutes it would be negligent not to include due diligence analysis of whether those substitute components have similar sourcing and ethical problems to the materials they replace.
5. What opportunities are there to work internationally on the challenge of recovering, recycling and substituting strategically important metals?

International standards on the movement and disposal of recycling feedstock would help create a level playing field for European and UK industry. Attention should be given to alleviating the unintended negative impact that REACH legislation is having on UK industry.

This inquiry is a step in the right direction for the UK government, both in terms of raising its own awareness and in building bridges with industry. However, there is still a long way to go if the UK wants to become the global leader in the secondary production of minor metals.

The Minor Metals Trade Association
26 January 2011

Supplementary evidence from Minor Metals Trade Association (MMTA) (SIM 20a)

Q. What legislation is it that means you must pay £70,000 for a letter of acceptance to import Titanium?

The EU Chemical Directive (dubbed REACH—Registration, Evaluation and Authorisation of Chemicals) is a pernicious law that came into existence over the last few years.

It is a cradle to grave directive governing the import into the EU of all substances (with a very few strange exceptions, such as oil, coal and uranium—powerbase too big perhaps?). Pure elements, compounds, alloys have been swept into this law.

In my own case, as a small British family company, founded in 1953, with net worth £2 million, the cost of full registration of all the elements that we have hitherto been occupied with would cost as much as the net worth of our company.

The way the law works is that for certain elements/substances which are thought not to require the later stages of evaluation and authorisation, a lead registrant must undertake, as per a consortia, to carry out certain tests on that element—mutagenicity, aquatic toxicity, carcinogenicity etc... in the example I have given of Titanium, there is a consortium of interested parties (consumers, producers etc) who will have come together to institute these tests.

These tests run into hundreds of thousands of pounds and the consortia recoup its money from others, like ourselves, who later wish to trade the metal but are not so strongly funded as to be in the consortia. In our case, we then obtain the right to trade the element via what is called a “Letter of Access”. This price is set at a figure which relates to the overall cost of the registration, evaluation or otherwise of that element, divided proportionately by the numbers of those who wish to have access. We just asked for the cost of this LOA and it was estimated at £70,000.

I gave Titanium as an example as it is a common element needed in wide areas of UK and European industry. We trade over 20 different substances per year.

The effect of these punitive costs, apart from the reduction of the market and tendency to create monopolies (because the number of small firms like ours will be reduced) is to deter use of the metal and free availability of it in the market place, driving up costs in UK and Europe and making us (yet again) less competitive with China and other parts of the world who do not have the same standards.

All would be fine if any of us believed that the EU Chemical Directive would serve the purpose to which it was intended—ie protect EU Citizens lives from the inadvertent contact with harmful effects of substances.

In practice the law is just a pernicious and draconian tax, with lawyers, accountants and laboratories earning very large sums to the detriment of innovation in Europe.

When I said that I felt that this law heralded a dark age in Europe, I meant what I said. It has been the main driver in the last five to 10 years deterring investment in manufacturing and scientific use of substances in Europe.

Anything at all that could be done to mitigate or roll back this law would be in the best interests of the UK.

There is much more to be said here—about, for example, the way testing is carried out on animals quite unnecessarily because the tests themselves on some elements are 4th form science—but the law also dictates that previous knowledge on elements and substances may not be used and only new tests according to good lab practice as determined also by EU should be used.

Let me give you just one example— in the case of Rhenium, its toxicity was tested on rats in 1934, nine years after this element was first discovered and separated. This information was deemed invalid and new costly tests now have to be carried out. Translate this across to the millions (truly millions) of substances and you can see why they are building tower-blocks in Brussels to house the bureaucrats needed to implement this law.
I was one of those who represented our industry in Strasbourg at the time the law was in process and no one wanted to hear our case and this law went through on a show of hands.

I have written this in haste at the start of my trading day. But it is very kind of you and your committee to be asking the right questions!

Anthony Lipmann
Minor Metals Trade Association
17 February 2011

Written evidence submitted by Anthony Lipmann, Managing Director, Lipmann Walton and Co Ltd and former Chairman, Minor Metals Trade Association (SIM 20b)

RE: ORAL EVIDENCE: STRATEGICALLY IMPORTANT METALS,
16 FEBRUARY 2011

I attach a small number of corrections to my oral evidence.

QUESTION 73

In the heat of the moment I quoted an incorrect figure for the cost of a letter of access for the permission to import Titanium into Europe under EU Chemical Directive (Reach) legislation. The law works per substance and the cost of these letters of access vary according to (a) the original cost of compliance and testing of the substance divided by the number purchasing the information (b) the tonnage band in which you as the importer fall. In the above instance, and I attach evidence from Titanium Metal Consortium, our company would fall into the band of < 1,000 mt which means our letter of access would cost €40,000 (Euros) and not £70,000 as I mentioned in evidence. I apologise for this error but hope that it still makes the point that, translated across numerous substances or metals, the fees are punitive. [I repeated my error under Question 107]

QUESTION 81

As I referred to JP Morgan by name, I thought best to attach an article dated 4.12.10 from The Daily Telegraph which refers to the matter in question. The point I was making was that at the MMTA we have rules to prevent any trading entity to also own MMTA approved warehouses as this could lead to a conflict of interest. The LME rules, which allow very large member companies, who are involved in trades on the exchange for their own account, to own LME-approved warehouses, is a conflict of interest—and is manipulative. The context of my comments was that the cause of over-priced metals is, in many instances, unrelated to any shortage in nature or production, but rather poor legislation and perverted systems.

QUESTION 103

Under Charles Swindon’s evidence Hansard has recorded the word “bans” which should be “bands”—which refers to the tonnage bands which apply to the relative force of the EU Chemical Directive when applied to companies who import metals and substances into Europe. For example some metals under the EU Chemical Directive are not regulated under a band of 1 mt, and the costs of registration and letters of access alter according to whether the tonnage imported per year is > 1,000 mt, < 1,000 mt, < 100 mt, < 1 mt. In our case, even though we are unlikely to import as much as 100 mt of Titanium per year, we must still pay for a letter of access that applies to < 1,000 mt. (see email 29.11.2010 timed 02.24 from Titanium Metal Consortia attached)

Anthony Lipmann
Managing Director
Lipmann Walton and Co Ltd
2 March 2011

65 Not printed here
Written evidence submitted by Chatham House (SIM 21)

1. Is there a global shortfall of in the supply and availability of strategically important metals essential to the production of advanced technology in the UK?

Much of the answer to this and following questions depends on time-horizon (short-term, mid-term, long-term): assessments of what constitutes a strategic metal (for military applications or for broader industrial development, eg low carbon technologies); and global trends in economic growth and technological development, as well as developments in global politics and openness of trade.

The potential difficulties arising in the short-term, medium-term and long-term are qualitatively different. In the short-term the question is principally one of security of supply, stocks, price and possible restrictions on exports on the part of a major exporter, which becomes acute in a situation where there is insufficient diversification of suppliers. In the medium-term the principal question is one of whether sufficient investments will take place to support supply, and whether these will be sufficiently diversified. Short-term resource scarcity (eg REMs) may not be permanent if other sources are brought on-line—but this takes time (10–15 years at least). There is also the question of investment in potential substitutes, alternative technologies/processes and the construction of political and other alliances to achieve a reasonable confidence that the market power of any single producer has been reduced to a reasonable level. In the long-term, genuine issues of physical scarcity apply, and the key objective becomes substitutes/processes should the problem be one of actual scarcity and, above all, the maintenance of the principle of open markets on the other, should the problem be more related to concentration of supply.

On a global scale there is no short-term geological scarcity of metals that might be termed strategically important. Over the longer-term, in recognition of natural global resource consumption patterns that are not sustainable, there are broader challenges relating to geological scarcity that come into play for different metals over radically different time horizons.

However, as EU and US agencies have identified in recent reports, and as Japan has directly experienced, there is a fundamental generic problem that arises from market concentration of production or processing of particular minerals. This risks politicisation, or the perception of politicisation.

The exemplar here is the apparent Chinese restriction of exports of Rare Earth Minerals (of which China is responsible for 97% of exports) to Japan. However, it is unclear whether this was a political decision in the midst of an interstate disagreement, or whether it simply reflected a lack of supply for Chinese manufacturers, or whether it is part of a broader long-term strategy to persuade manufacturing companies to move their operations to China in order to avoid any supply interruption risk. The answer may be a combination of all three. The bigger issue may not be China deliberately using market dominance as a political tool in other areas, but simply the shift of China up the manufacturing value chain with the consequent reduction of minerals available for export.

As with Russia’s supply interruptions of natural gas to Ukraine, it may be hard to determine a single strand of intentionality—whether genuinely geopolitical or simply commercial—in such cases. And while this matters in the short-term it may not matter in the longer-term. Supplier countries may ultimately lose out from supply interruptions, however motivated, if their actions are perceived to justify diversification of suppliers, or renewed investments elsewhere, or enhanced recovery and recycling programmes.

2. How vulnerable is the UK to a potential decline or restriction in the supply of strategically-important metals? What should the Government be doing to safeguard against this and to ensure supplies are produced ethically?

Britain is no more directly exposed to a potential decline or restriction in strategically important metals than other advanced economies. Indeed it may be marginally less exposed in the sense that it has a smaller advanced manufacturing sector than Germany or Japan—though this may change in the future if an economic strategy of developing low-carbon technologies and industries is successful. Most strategic metals are imported into the United Kingdom embedded in components or finished products.

The enmeshment of global supply chains and production creates both a strength and weakness. The strength is that Britain is unlikely ever to be alone in terms of being exposed to a shutdown in the supply of strategically important metals. A politically driven shutdown would tend to involve a large number of consumer countries. The weakness of global supply and production chains, from a British perspective, is that it may be difficult to reliably identify vulnerabilities—particularly where it is not the mineral itself which is used by British manufacturing, but a mineral embodied in a component manufactured elsewhere.

On a political level, Britain would do well to build awareness and alliances within the European Union context, help craft legislation to encourage better resource use and recycling (at home and in the EU) and support diversification of supplies of minerals, particularly from reliable market-based economies (US, Canada, Australia, Greenland) with neither political incentive nor likely economic incentive to restrict supply. Monitoring of natural resource dependencies at the European level would be useful, as would coordinated stockpiling. Britain may want to be active in establishing firmer global protocols on trade in minerals and natural resources, including those deemed strategic/sensitive. The UK/EU should develop scenarios to better understand the second and third-order consequences of supply shutdowns, for whatever reason.
But a political/policy response should be complemented with facilitation of investment in materials' innovation, support for recycling, and scientific research into possible substitutes. Britain's long-term economic future—and its relationship to many resource-exporting countries—is linked to its scientific and technological capacities.

3. How desirable, easy and cost-effective is it to recover and recycle metals from discarded products? How can this be encouraged? Where recycling currently takes place what arrangements need to be in place to ensure that it is done cost-effectively, safely and ethically?

The desirability of recovery and recycling depends on the metals, the costs (both economic and environmental) of recovery and recycling, the perceived criticality of the metal, and its perceived scarcity.

Some recycling and recovery may happen in the UK, but it may be equally or more important to build recycling and recovery at the EU level, creating broader EU regulations and incentives. The Japanese approach is far ahead of the EU in this area.

4. Are there substitutes for those metals that are in decline in technological products manufactured in the UK? How can these substitutes be more widely applied?

Metals used for specific purposes are generally used because they are either the best metal to use (at that price), or because their qualities are hard to replicate or indeed unique. In some contexts substitution may be fairly easy, or may result in only minor losses in performance, which may in turn be compensated for by shifts in product design. In advanced contexts where performance has to be maximised there may be no substitutes. Research is key, not only as a means of improving UK resilience but also as a means of capturing potential economic opportunities arising from materials' scarcity.

5. What opportunities are there to work internationally on the challenge of recovering, recycling and substituting strategically important metals?

The exchange of information on critical materials within the context of multi-lateral organisations (NATO, EU) would appear central. Establishing broader trade protocols for natural resources offers another multi-lateral approach, particularly through the WTO. Knowledge-sharing in recycling techniques and regulations could prove useful.

The scale of the EU economy offers the opportunity to create a substantial market for recovered or recycled materials. At the higher end of advanced manufactured products, where it is quality and technology rather than price that affects the competitiveness of specific products it seems unlikely that additional regulation would have a strong negative impact on European competitiveness, but this would have to be substantiated by specific impact research.

Charles Emmerson
Senior Fellow
Chatham House
10 February 2011

Supplementary written evidence from Rt Hon David Willetts MP, Minister for Universities and Science, Department for Business Innovation and Skills (SIM 00b)

Strategically Important Metals

Thank you for inviting me to appear before your Committee on 2 March regarding strategically important metals.

I promised to respond to questions from Graham Stringer MP regarding the implementation and costs of the REACH and WEEE regulations.

REACH

Professor Robert Watson, Defra's Chief Scientific Adviser has already written to you explaining the primary aims of REACH, which is to enhance protection of human health and the environment, and to increase industry competitiveness and innovation. He argued that it is too early to say to what extent the aim of increasing industry competitiveness and innovation has been achieved; the first registration deadline was 30 November 2010, and the process is being phased in until 2018. It will be important to review the outcome of these first registrations and learn any lessons for the two further stages due in 2013 and 2018.

Defra will be conducting an in-depth national study later this year. This will inform their response to the European Commission's EU-wide review of REACH next year.

Sectors of industry joined together in consortia to provide the scientific data required to be generated for REACH registration. Letters of access to their data are a commercial matter between those in the consortia...
who have had to incur costs in generating the data and those seeking to use the data for their own products/purposes. Such arrangements would be subject to competition law, and could be investigated if there was sufficient evidence of anti-competitive practices. The OFT is responsible for enforcing competition law and has significant powers to investigate and act where it finds companies abusing a dominant position or behaving anti-competitively.

BIS worked alongside Defra on the REACH negotiations and we consider the regulations to be balanced and proportionate.

Waste Electronic and Electrical Equipment (WEEE)

I am pleased to attach an extract from the Impact Assessment giving the costs and benefits of UK WEEE Regulations, as requested by Mr Stringer. I also attach the impact assessment of the European Commission’s proposal to “recast” the WEEE Directive, currently under negotiation in Brussels.66

Department for Business Innovation and Skills

31 March 2011

Annex

CURRENT COSTS AND BENEFITS OF UK WEEE REGULATIONS—EXTRACT FROM IMPACT ASSESSMENT

1. The cost of collecting, treating and recovering WEEE depends on a wide range of factors including the volume and composition of WEEE; the quality of WEEE; the value of materials in WEEE; and the means of collecting, treating and reprocessing WEEE.

2. Discussions with a number of Producer Compliance Schemes (PCSs) operating under the UK Regulations suggest a range of costs for collecting, treating, and recovering different categories of WEEE. Though the UK Regulations apply across 13 categories of EEE, WEEE is usually considered in terms of five broad categories. These are: cooling appliances (Category 11—“Cooling”); large household appliances (Category 1—“LDA”); display equipment (Category 12—“Displays”); mixed WEEE (Categories 2, 3, 4, 5, 6, 7, 9, 10—“Mixed”); and gas discharge lamps (Category 13—“GDL”). The range of average costs we have received are shown in Table 1 below. The average costs we use are taken as the mid-point of these ranges.

<table>
<thead>
<tr>
<th>Category</th>
<th>Average cost range (£ per tonne)</th>
<th>Middle of average cost range (£ per tonne)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDA</td>
<td>10–20</td>
<td>15</td>
</tr>
<tr>
<td>Mixed</td>
<td>120–180</td>
<td>150</td>
</tr>
<tr>
<td>Displays</td>
<td>220–280</td>
<td>250</td>
</tr>
<tr>
<td>Cooling</td>
<td>150–185</td>
<td>168</td>
</tr>
<tr>
<td>GDL</td>
<td>1,500–2,000</td>
<td>1,750</td>
</tr>
</tbody>
</table>

3. Using the middle of the average range of costs suggests that for the volume of separately collected household WEEE collected, treated and recovered in the UK in 2008, total costs were in the region of £58 million. It is recognised that the costs for non-household WEEE are more varied than for household WEEE and are therefore more difficult to “average”. However, if the average costs in Table 1 reflected the costs for non-household WEEE, then the total costs for non-household WEEE separately collected in the UK in 2008 would have been in the region of £8 million.

4. There were additional costs relating to the following: producer registration fees were in the region of £2 million; PCS administration costs were also in the region of £2 million (assuming an average charge of £400/producer); monitoring and enforcement costs (public sector costs) were in the region of £3 million; licences for approved treatment facilities (ATFs) and approved exporters (AEs) dealing with WEEE were in the region of £0.35 million; and costs under the Distributor Takeback Scheme (DTS) were in the region of £3 million (presuming the total costs of the DTS are spread evenly over three years). This gives an estimated total cost of the UK WEEE Regulations of just over £76 million in 2008.

5. In terms of the benefits of the UK WEEE Regulations, there is less readily available information on the monetary value of these. The 2006 RIA estimated that the monetary value of climate change benefits from the additional separate collection, treatment, recycling and recovery of WEEE could be in the region of £4–16 million in 2008.

6. In addition to this, there will be benefits currently from avoiding the possible leaching of materials and the possible emission to air of materials from diverting WEEE from landfill and incineration. These are, however, difficult to quantify in monetary terms in relation to WEEE specifically. The separate collection of

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66 Not printed here
WEEE in the UK is also likely to be contributing positively to sustainable consumption and production, and having positive “spillover” effects on other forms of waste and the issue of waste generally. These, however, are also difficult to quantify in monetary terms.