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Clean Steel Fund: call for evidence

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CREDS (the Centre for Research into Energy Demand Solutions), is a research centre established in 2018 with a vision to make the UK a leader in understanding the changes in energy demand needed for the transition to a secure and affordable, low-carbon energy system. Working with researchers, businesses and policy makers, our work addresses a broad range of issues. Our vision is for research in the UK to rise to the challenge of transforming the energy demand sector.

CREDS responds to consultations and calls for evidence from government, agencies and businesses, providing insight and expertise to decision-makers.

This response was created for the call for evidence from the Department for Business, Energy and Industrial Strategy on creating a 'Clean Steel Fund', and was written on behalf of CREDS by Dr Jonathan Norman, Alice Garvey and Prof John Barrett (Sustainability Research Institute, University of Leeds). The consultation ran from 29 August – 21 November 2019.

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Introduction

The evidence given below is largely drawn from a recent (and ongoing) assessment of the opportunities for energy efficiency, fuel switching and material demand reduction within the UK steel sector. Additional information is also provided related to previous work by the authors on material efficiency. The work has been conducted as part of the Materials and Products theme of the Centre for Research into Energy Demand Solutions (CREDS). In the near future the work will be submitted to a peer-reviewed journal and will be available as a final version. The authors are happy to discuss the contents of the response further if this is helpful.

Some important points regarding the modelling approach taken:

- The technology scenarios modelled are: retrofit (efficiency improvements), replacement (best available technology), fuel shifts (greater relative production via electric arc furnace (EAF)), breakthrough technologies (MIDREX; Top Gas Recycling Blast Furnace, TGR-BF), and hydrogen substitution. The UKERC Usable Energy Database[1] was utilised in the construction of these scenarios. The database includes information on technology options in terms of expected energy requirements, costs and timeframes for commercialisation.
- Carbon Capture and Storage (CCS) options were intentionally omitted as many existing scenarios of steel production rely heavily on CCS to reach emissions targets, but its large-scale adoption is still considerably uncertain.
- The model assessed whether the technological options achieved a scale of mitigation in line with a net zero/1.5°C cumulative budget for the sector, on both a production and consumption-based emissions basis.
- A material efficiency tool was created to evaluate what level of demand reduction would be required to close any remaining mitigation gap.

The evidence given here focuses on the main conclusions of this work in relation to the Call for Evidence.

Responses to call questions

Q10 What estimates do you have on the costs and availability of these three technology options for reducing emissions?

Provisional results from our recent study suggest:

[1] Griffin, P.W., Hammond, G. and Norman, J.B. 2013. Industrial Energy Use from a Bottom-Up Perspective: Developing the Usable Energy Database (Beta version). [Online]. [Last accessed 23 October 2019]. Available from: https://ukerc.rl.ac.uk/DC/cgi-bin/edc_search.pl/?WantComp=43.

- Only one technological scenario aligns with a 1.5°C budget without requiring demand reduction, this is a retrofit scenario with high levels of ambition and is dependent on assumptions of future production growth and existing technology baselines. All other scenarios require demand reduction to be within budget. Material efficiency opportunities can maintain the service provided by steel whilst reducing absolute production requirements.
- The cumulative emissions budget is of primary importance, the challenge is not to only hit a final reduction target.
    - Breakthrough technologies cannot deliver the required cumulative reductions required, with current expectations around their rates of commercialisation.
    - Improved energy efficiency and material efficiency are in many cases currently available from a technological perspective and are important to pursue immediately. Behavioural practices (e.g. car sharing) can reduce demand without the need for new technologies.
    - Material efficiency can have maximum impact by prioritising these strategies at an earlier stage, whilst emissions intensity of production is higher.

Material efficiency opportunities have been assessed at the economy level by a number of studies involving the authors of this response[2,3,4]. Material efficiency opportunities exist throughout the supply chain from production of steel to final consumption of steel-containing products. Opportunities can target[2]:

- **Putting less in**: reducing the need for high impact inputs to produce products - with examples including improving yields throughout manufacturing and better designing products to only use the material that is required and not over-specify.
- **Getting more out**: reducing need for products – with examples covering more intensively used and longer life products (including the reuse and refurbishment of products and components) to reduce the need for new material production.

These studies indicate that the potential emissions savings through material (and resource) efficiency could make significant contributions to meeting the fourth and fifth UK carbon budgets[3,4]. The CCC has recognised the potential of this, incorporating resource efficiency approaches into its recent Net Zero report[5]. Steel is not the sole focus of these studies but savings in the steel sector play an important role. More detailed estimates of a number of savings (such as through light-weighting vehicles and material efficient construction

[2] Cooper, S. J. G., J. Giesekam, G. P. Hammond, J. B. Norman, A. Owen, J. G. Rogers and K. Scott. 2017. "Thermodynamic insights and assessment of the 'circular economy'." Journal of Cleaner Production **162**: 1356-1367.
[3] Scott, K., J. Giesekam, J. Barrett and A. Owen. 2019. "Bridging the climate mitigation gap with economy-wide material productivity." Journal of Industrial Ecology **23**(4): 918-931.
[4] Peake, L. 2018. Less in, more out: using resource efficiency to cut carbon and benefit the economy. Green Alliance and CIE-MAP. [Online]. https://www.green-alliance.org.uk/less_in_more_out.php
[5] Committee on Climate Change. 2019. Net Zero – The UK's contribution to stopping global warming. CCC. [Online]. https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/

practices) related to the steel sector are available in these works[2,3]. Material efficiency approaches applied to vehicles, machinery, electrical equipment and construction can have significant effects on the requirement for steel[2].

Q13 Are there any additional policies that government should consider to support the steel sector in the shift to decarbonisation pathway?

Our policy recommendations are split into three areas: improving data availability; maximising opportunities for fuel switching; and maximising opportunities for material efficiency.

- **Improving data availability**

A major challenge for an assessment of potential savings within the steel sector (and for any industrial sector) is a lack of detailed data on the current use of energy, particularly at the technology level. Improving such data availability would allow policy makers, businesses and academics to more accurately and efficiently assess the decarbonisation opportunities. The authors of this response are currently finalising a report that assesses current limitations of industrial energy data in the UK and makes recommendations to provide a more effective data strategy. This will be available Q1 2020.

- **Maximising opportunities for fuel switching (increased EAF production)**

With 97% of UK steel scrap exported, there are resources available for a shift to greater EAF production, particularly in a context of new international tariffs on scrap imports. Developing improved logistics for more efficient scrap utilisation could simultaneously encourage greater EAF capacity, greater resource efficiency, and with shifts to more EAF capacity, greater domestic use of UK scrap. Better scrap processing capacity could provide streams of diverse scrap qualities.

- **Maximising opportunities for material efficiency**

Cross sector recommendations
Due to the complex supply chains of products and services steel is not used in isolation from other materials and a successful material and resource efficiency policy should not be constrained to the steel sector. Resource efficiency opportunities that target the users of steel can also improve the material efficiency of other materials[2]. For example, a vehicle of lightweight design will reduce the requirement for aluminium, rubber, plastics etc in addition to steel. Engaging the users of steel throughout its supply chain to the end consumer is important for maximising material efficiency. Three steps were recently suggested as actions for government to improve resource efficiency across the economy[4]:

1. Establish sector specific resource efficiency partnerships. The sectors targeted should be on the consumption side (e.g. construction, vehicles…), rather than the production

side (e.g. steel). These partnerships should "identify best practice, challenges and opportunities and set sector specific standards, to achieve whole lifecycle savings of both carbon and materials".

2. Demonstrate and disseminate innovation. This could be a technology, process or business model with significant potential savings, or the large-scale deployment of existing material and resource efficient opportunities.
3. Regulate where necessary. Sector specific targets for whole life carbon emissions and material use should initially be voluntary, but if sufficient progress is not made should become statutory.

Steel-specific recommendations

In regards to policy options that specifically target the steel sector. Milford et al.[6] identify several, including: creating business opportunities for deconstruction, re-use, maintenance of steel products and scrap processing, as well as influencing consumers through extending product lifetimes and encouraging shared ownership. The public acceptability of shared ownership and lifetime extension initiatives has already been suggested as high[7]. The Energy Transitions Commission recommend carbon prices and 'green steel mandates'[8]. Consumer-focussed material efficiency measures can influence steel production overseas, as well as in the UK, due to the high level of international trade in the sector. Incentivising domestic consumption could ensure actions taken in the UK maximise emissions reductions in the UK. Public procurement is already a major policy for the steel industry in the UK. Incentivising consumption of UK steel in private companies or enabling the development of steel types/qualities which are usable in UK manufacturing could further support this.

6 Milford, R.L., Pauliuk, S., Allwood, J.M. and Müller, D.B. 2013. The roles of energy and material efficiency in meeting steel industry CO2 targets. *Environmental Science and Technology*. **47** (7), pp. 3455–62.

7 Cherry, C., Scott, K., Barrett, J. and Pidgeon, N. 2018. Public acceptance of resource-efficiency strategies to mitigate climate change. *Nature Climate Change*. **8**, pp.1007–12.

8 Energy Transitions Commission 2018. *Mission Possible: Reaching net-zero carbon emissions from harder-to-abate sectors by mid-century* [Online]. Available from: http://www.energy-transitions.org/mission-possible.