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TRACKING ENVIRONMENTAL IMPACTS IN GLOBAL PRODUCT CHAINS – RARE EARTH METALS AND OTHER CRITICAL METALS USED IN THE CLEANTECH INDUSTRY

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ABSTRACT

Metals form a central part of the global economy, but their extraction and supply are linked to several environmental and social concerns. The study aims to create a picture of the supply chain of Rare Earth Metals (REMs) and other critical metals used in the clean technology (cleantech) sectors of electric vehicles and solar panels. The study examines how Nordic cleantech companies are aware and acting on the challenges related to the lifecycle of these metals and what are the potentials to minimise environmental and social impacts. Recommendations of the study can be summarised as three initiatives: establishment of an awareness platform and roundtable initiative (short-term), research and information gathering (mid-term), and development of closed-loop solutions (long-term).

INTRODUCTION

Metals in various forms and uses are a central part of the global economy and have become increasingly important. Metals are also needed in the transition to a low-carbon and resource efficient economy.

Despite the fact that many metal extraction operations have become more sustainable over the past 20 years, especially in the developed countries, many environmental problems still exist. Mining sites are an environmental security concern both locally and regionally.

Manufacturers of end products are not necessarily aware of the potential adverse impacts created in the raw material extraction and processing phase. One of the major challenges for companies is tracing the origin of the metals used in their products. Metal supply chains are complex and involve various different actors such as miners, traders, refiners and manufacturers.

Gaia and U&We AB conducted a study commissioned by the Nordic Council of Ministers to create a picture of the supply chain of selected Rare Earth Metals (REMs) and other critical metals used in the clean technology (cleantech) sectors of electric vehicles and solar panels

(photovoltaics) and the environmental problems related to them. The final report (Pathan et al, 2013) was published in March 2013.

METHODS

Main methods used in the study were literature review, web survey to Nordic cleantech companies, case studies including in-depth interviews with selected actors, as well as analysis. The survey examined the traceability of metals used in cleantech products, actions to reduce environmental impacts, substitutes and replacements, as well as cooperation with suppliers. The aim of the case studies was to identify the environmental performance of selected companies and their use of critical and rare earth metals. The case study companies were Volvo (Sweden), ABB Finland, Innotech Solar (Norway) and Beneq (Finland).

RESULTS

REMs are used in cleantech applications due to their unique chemical, magnetic and electrical characteristics. Despite their name, they are not actually considered rare but have significant environmental impacts in the raw material extraction and processing phase. (Sadden, 2011). The major negative environmental impacts from the production of REMs stem from the mining and chemical processing of the metals (Majeou-Bettez et al, 2011).

In electric vehicles, REMs are used in many applications, for example in the permanent magnets of electric motors. The use of REMs in photovoltaics is more limited, although electric system components may contain some REMs to a certain extent. (Eriksson & Olsson, 2011).

The PV industry, even when looking at the PV system as a whole does not rely on REMs although system components such as inverters, batteries, and mounting systems might contain some REMs to a certain extent. From the environmental perspective, raw materials used in PVs come with the environmental burden of the mining and production of primary metals (zinc, copper, lead etc.). Current discussions on environmental issues in the PV industry are primarily focused on energy payback times and recycling of PV modules and materials.

Traceability of REMs and critical metals, and accountability for social and environmental impacts in their extraction, is challenging. The metals are often procured through long supply chains and from regions with limited regulatory requirements for transparency. There is also insufficient information on how the impacts of metals extraction are specifically allocated to REMs and critical metals used from a life cycle assessment perspective. Although the supply chain is long, much can be done to make the supply chain more responsible and sustainable both in the raw material phase of the supply chain and in the end-of-life phase by improving the re-use and recycling rates of metals.

DISCUSSION

Cleantech solutions are still under development, and they have been in use for only short periods of time and in limited quantities. As the use of cleantech technologies spreads, so does the importance of developing effective methods for re-using cleantech technologies and recycling materials. Currently, recycling of REMs and critical metals are often not profitable

because the substances are found in small quantities and in complex systems. Increasing metal recycling rates is a key part of the path to sustainable metals use.

The recycling of PV modules and materials is already discussed, and recycling of PV modules is becoming mandatory through the European Union Waste Electrical and Electronic Equipment Directive (WEEE Directive). For REMs used in electric vehicles, the recycling requirements come through producers' responsibility that requires certain recyclability for the whole vehicle. However, as the amounts of REMs used are relatively small, they do not necessarily fall under the required recycling rates as they are formulated in current EU directives such as the WEEE-directive and ELV-directive.

CONCLUSIONS

To mitigate the potential problems related to REMs and critical metals companies will need to develop their knowhow and procurement processes. The resource requirements for adequate development can become prohibitive, especially for small and medium-sized companies. In practice, sector wide guidelines or checklists could be developed.

Transparency as well as environmental, societal, and economic impacts over the whole life cycle of current and alternative metals used could be addressed. In the short-term, this can be accomplished through awareness raising activities and information sharing, and in the mid-term through further data gathering and research. The Nordic Council of Ministers and the Nordic governments could also use their influence to increase transparency and sustainable extraction in the countries of origin for REMs and critical metals.

Support could be funnelled through existing industry organisations. Specialist support on developing and following up on requirements to suppliers can be found through membership of organisations specialising in social and environmental compliance in the supply chain such as the Ethical Trading Initiative, Business Social Compliance Initiative and the UN Global Compact's Supply Chain Sustainability Programme.

On the basis of this study, the recommendations to develop sustainable metal use in the Nordic area can be summarised as three initiatives:

1) Awareness platform and roundtable initiative (short-term): Establish an information sharing and collaboration roundtable for interested parties. The Nordic Council of Ministries could support the roundtable directly by providing financial or organisational re-sources for such initiative, or by supporting the establishment of the roundtable. In addition the Nordic countries could use other communication measures to increase awareness on potential issues in the supply chain of REMs. In practice, sector wide guidelines or checklists could be developed.

2) Research and information gathering (mid-term): The use of clean-tech will increase as companies strive to develop effective solutions to meet global environmental challenges. To better understand and to enable the mitigation of the negative environmental and social impacts of REMs, further research and information on the impacts of metals use in the whole value chain is needed. Sustainable REMs and other critical metals use could benefit from a Nordic research project or program.

3) Closed-loop solutions development (long-term): As an alternative, there is at least in theory a lot of potential in the re-use of compo-nents and recycling of materials. A long-term goal would be closed-loop processes, where re-use and recycling completely replace the need for mining and new material intake to the process. The con-crete initiatives could include support for R&D&I activities in re-use and recycling of REMs and other critical metals in cleantech.

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