Journal of Cleaner Production 187 (2018) 485–495

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

In the lab: New ethical and supply chain protocols for battery and solar alternative energy laboratory research policy and practice

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ARTICLE INFO

Article history:
Received 12 July 2017
Received in revised form
8 March 2018
Accepted 8 March 2018
Available online 14 March 2018

Keywords:
Ethical procurement
Supply chain
Battery storage
Conflict minerals
Critical materials
Higher education

ABSTRACT

Ethical procurement of laboratory supplies is a neglected, but vital issue for the ethical development of new alternative energy technologies. This is important from the earliest development stages in alternative energy research due to potential impacts from the commercialization of products into global mass production. The authors constructed a framework for examining risk-based, supply chain due diligence in higher education laboratory research. The focus was on materials which present ethical risks - including 'conflict minerals' and 'critical materials', with the latter including rare earth elements. These materials can potentially have security of supply issues and/or cause social, conflict and environmental impacts including human rights abuses. The authors applied the framework to one year's procurement of materials at two Australian universities' laboratories, researching battery storage and solar energy and identified suppliers, and suppliers' policies on procurement of materials with potential risks. In search of best-practices in higher education policies on laboratory procurement, the authors analyzed procurement and supply chain policies from four Australian universities involved in alternative energy materials research, and identified emerging international, higher educational procurement policies for conflict minerals. Key issues regarding critical materials, and regulatory approaches to conflict minerals were discussed, leading to proposed actions for Higher Educational leaders to enhance ethical alternative energy research procurement and subsequent product innovation. This reinforces the importance of research strategy including materials choices. In other words, "it is important to get it right at an early stage".

1. Introduction

The authors examined ethical procurement and supply chain issues in higher educational (HE) research laboratories, which are focused on developing alternative energy technologies such as battery storage and solar photovoltaic (PV) energy. The global supply chains of procured materials for research facilities span a continuum from mines, smelters/refiners and metal traders' exchanges, to research facilities, manufacturers and retailers (OECD, 2011, 5). Just as ethical issues have arisen with supply chains of carbon-intensive energy such as coal, including labor, environmental and human rights abuses related to mining, the authors examined ethical risks associated with materials used in alternative energy research supply chains; and the potential benefits of using risk-precautionary practices in HE, alternative energy laboratories (Guess and Husted, 2016).

In HE laboratories, the amounts of materials used in research are usually small, which may explain why ethical procurement and

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https://doi.org/10.1016/j.jclepro.2018.03.097
0959-6526/

chain of supply practices for laboratory procurement have gained so little attention to date. It is also at the research stage that ethical controversies surrounding the use of materials may dictate due diligence steps be taken, or caution against the use of particular materials, both in the laboratory and in anticipation of commercial product development.

On 4 November 2016, the *Conference of the Parties to the United Nations Framework Convention on Climate Change* (The Paris Agreement) entered into force. This Agreement commits the signatories to strengthening developing countries' abilities to deal with climate change impacts by putting in place "appropriate financial flows, a new technology framework and an enhanced capacity building framework" (UNFCCC, 2017). Aligned to this, the authors of this paper defined ethical procurement as encompassing a range of practices. These practices include that materials: need to be ethically sourced; they must be sufficiently available; their sourcing should not cause or exacerbate conflict; and in terms of equity and access and the transition to a post-fossil carbon future, alternative energy products should enable remote, poor and developing country communities' access to affordable energy sources (Delisio, 2015; Sauer and Seuring, 2017; Thai, 2006). Brown and Taylor (2014) have linked climate change to issues of justice and ethics, which underpin obligations on high-emitting countries to develop harm avoidance processes, and enable access to new technologies for poor, vulnerable countries and communities. Alternative energy research and development is key to this agenda.

The authors first constructed a framework for classifying materials used in alternative energy research focused on conflict and critical materials. The framework drew on a conceptual discussion of corporate social responsibility (CSR) debates on procurement, supply chains and 'conflict minerals'. Conflict minerals can finance violent conflict and human rights abuses because they are mined in conflict-affected and high-risk areas such as the Democratic Republic of Congo (DRC) and surrounding countries. The authors, drew on EU resources (European Commission, 2014, 2017, 2018), US research by the US Department of Energy (US DOE, 2010, 2011) and (US Department of the Interior, 2018) and research conducted by Geoscience Australia (Skirrow et al., 2013), to arrive at a definition of 'critical materials', which are 'critical' to economic development, the production of alternative energy technologies and security of supply issues, such as rare earth elements like cobalt and lithium.

As a note on terminology, the term 'materials' was used as a generic umbrella term by the authors to denote elements, minerals/metals and ores. The terms conflict minerals and critical materials are recognized in public discourse worldwide. Conflict minerals are commonly defined as wolframite (tungsten); columbite-tantalite (also known as coltan from which tantalum is derived); cassiterite (tin); and gold; or their derivatives. These are known as 3 TG. Other minerals or their derivatives could be assessed as conflict minerals in the future if found to finance conflict (OECD, 2016). Conflict minerals have received regulatory attention internationally including Section 1502 of the US Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act, 2010) in the US, and more recently, the EU's legislation on conflict minerals which comes into force in 2021 (European Parliament, 2016). Lists of critical materials vary by country and over time. Critical materials have not yet received such regulatory attention as conflict minerals, but there has been growing international attention to developing strategies to increase critical materials' security of supply (Ali et al., 2018; CMI, 2014; Ciupagea, 2013; US Department of the Interior, 2018).

Having developed the classificatory framework, the authors' second stage of research documented the materials used in two Australian research laboratories, which conduct alternative energy research in the Australian Research Council Centre of Excellence for Electromaterials Science (ACES, 2017).[1] Both laboratories' procurement records for one year were examined, and publicly available data was used to identify their main laboratory materials' corporate suppliers. The authors examined the suppliers' policies on procurement, their supply chains and commitments to social and environmental responsibility. The procurement policies of four Australian universities involved in minerals research were also analyzed for reference to conflict minerals, critical materials and related issues, to investigate the extent to which current policies address such materials; after which international developments in best practice HE procurement in this field were examined.

1.1. Background: ethical procurement and supply chains in alternative energy industries

Ethical procurement and supply chains are a major issue in CSR research and practice, driven by scandals in for example, mining and electronics industries (AI and AW, 2016: Hodal, 2012) and in garment manufacturing (Kaufman et al., 2004; Motlagh, 2013; Wilkins, 2013). Concerns have focused on human rights, labor conditions, environmental impacts, and on the use of toxic or harmful products (Delisio, 2015; Seay, 2012; Thai, 2006; United Nations Group of Experts (2004)).

In the alternative energy and electronics industries, products such as new generation lithium-ion battery energy storage systems (such as the Tesla Powerwall) use, for example, lithium, cobalt and tin. Critics highlight ethical issues related to the use of these materials and their potential links to conflict, human rights abuses, poor labor standards, environmental impacts and security of supply issues (Ali et al., 2017, 2018; Thomas, 2016, 2017). Magnets used in electric/hybrid vehicle motors and wind turbines, also have security of supply issues due to their use of the rare earth elements, neodymium and dysprosium.[2] This, along with these materials' potential toxic environmental impacts from waste products produced during mining and processing, drew attention to the need to ensure these magnets' ethical production, as their use increases with higher numbers of electric vehicles and wind turbines (Bourzac, 2011). Toxic environmental impacts occur with all types of materials' mining and processing; and cleaner production processes are increasingly being used to prevent or minimize toxic emissions. Yet it is essential that the growing production of 'cleaner' products like electric vehicles for the post-fossil carbon era, implement best-practice now, and into the future.

Such examples illustrate how organizational performance and global supply chains are now subjected to more specific tests for transparency, accountability, human rights, environmental and ethical probity; and for cleaner production in terms of toxic materials generated during production. Some independent non-governmental organizations (NGOs) such as Global Witness are functioning as global watchdogs, which conduct audits and social media campaigns. For companies, CSR and sustainability performance and reporting have gained traction due to enhanced

[1] This is an Australian Government-funded consortium of six Australian universities and five universities from Ireland, South Korea, Germany, Japan and the United Kingdom.

[2] Neodymium (used for magnets) and other rare earth elements, were identified as critical to a clean energy future (US DOE, 2011). Growth in magnet demand concerns many governmental leaders, from a supply and price perspective. In terms of price, neodymium oxide increased from under $US10/kg in 2001 to around US239/kg in 2011 (Hughes and Cole, 2014, 296–301; Bourzac, 2011). The cost and unavailability of neodymium and dysprosium have delayed the use of direct-drive units in utility-scale wind turbines, which therefore continue to use gearbox-driven units, despite their higher failure-rates (CMI, 2014).