

MINING AND CLIMATE CHANGE

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1. Introduction

Mineral resources¹ are essential inputs into a variety of economic and social activities, and are “fundamental determinants of our quality of life”.² Minerals are not only deemed to be important, they are discursively positioned as “critical” to contemporary social forms, as manifest in a new generation of reports on “strategic” and “critical” minerals.³ While minerals such as iron ore, aluminium, coal, copper, chromium, construction sand and many others have been central to the processes of industrialization and urbanization that have swept the globe since the nineteenth century, a new suite of “green minor metals” are fundamental to the development of future sustainable technologies relevant to climate change mitigation and adaptation. These include the use of indium, germanium, tantalum, platinum group metals, tellurium, cobalt, lithium, gallium, and rare earth elements in renewable energy and energy efficiency applications.⁴

Despite the recognized cyclicity of the industry, the value of the global metal and industrial minerals mining industry has steadily increased, from US\$214 billion in 2000, to US\$644 billion by 2010,⁵ and to US\$766 billion by mid-2013.⁶ The formal component of the global mining sector incorporates private, public and state-owned companies, ranging from global companies with an asset base in excess of US\$10 billion, to “junior juniors”, who operate with an

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¹ The term “mineral resources”, in line with the definition provided in the Mineral and Petroleum Resources Development Act 28 of 2002 (MPRDA), is used inclusively to mean substances, whether in solid, liquid or gaseous form, occurring naturally in or on the earth, or in or under water, formed by or subjected to a geological process. Scientifically, minerals are usually described as naturally occurring combinations of different chemical elements. There are more than 3000 known minerals, but only about 100 have economic, social or cultural applications.

² National Academy of Sciences *Minerals, Critical Minerals and the U.S. Economy* (2007) Washington, D.C.: National Academies Press, vii.

³ See National Academy of Sciences, n 1 above; Resource Efficiency Knowledge Transfer Network *Material Security: Ensuring Resource Availability for the UK Economy* (2008) Chester, U.K.: C-Tech Innovation; US Department of Energy *Critical Minerals Strategy* (2010) Washington, D.C.: US Department of Energy; European Commission *Critical Raw Materials for the EU* (2010) European Commission Ad-hoc Working Group on defining Critical Raw Materials, Brussels, Belgium; IZT and Adelphi *Kritische Rohstoffe für Deutschland* (2011) Berlin: KfW Bankengruppe. For an historical overview and critique of the “critical raw materials” approach see B. Buijss, L.A. Tercero Espinoza & H. Sievers “Limits to the critical raw materials approach” (2012) 165 (WR4) *Proceedings of the Institution of Civil Engineers: Waste and Resource Management* 201–208.

⁴ M. Buchert, D. Schüller & D. Bleher *Critical Metals for Future Sustainable Technologies and their Recycling Potential* (Sustainable Innovation and Technology Transfer Industrial Sector Studies UNEP).

⁵ International Council on Mining and Metals *Trends in the Mining and Metals Industry* (2012) Inbrief Series: Mining’s contribution to sustainable development, United Kingdom: ICMM, 7.

⁶ HSBC *Global Mining Index* (2013).

asset base of below US\$5 million.⁷ Alongside the formal mining sector there is a huge artisanal and small-scale mining sector, employing an estimated 80 – 100 million people (compared to an estimated 2.5 million people employed in the formal sector).⁸ Most of the published peer-reviewed research on mining and climate change, however, focuses on the formal mining sector. Reference to the “mining industry” in the subsequent discussion must accordingly be read with this important caveat in mind. Moreover, it is also difficult, in climate change reporting, to distinguish between the mining industry *per se* (companies involved in mineral extraction) and firms having operations at various points along the mineral beneficiation stage. In this chapter, an inclusive approach has been followed. References to the mining industry should therefore be read as inclusive of firms operative in the metal industry.

Since the mid-twentieth century, the centre of gravity of global mining has shifted from developed to developing countries and the largest mines are now found in emerging economies.⁹ In addition to the firms operating these mines, their investors and financiers, responsibility for pushing greenhouse gas mitigation (GHG) reductions, and ensuring timely adaptation planning accordingly rests with developing nations. In a developing country context, national, regional and local governments may be heavily reliant on the mining industry, benefitting from the revenue streams (taxes and royalty rents), employment, linkages to up- and downstream industries, provision of infrastructure and social programmes that the industry may provide (or promise to provide). The mining industry may also be intimately bound up with the energy security of the state, as is the case in South Africa where 93% of electricity generation comes from coal.¹⁰ The state may accordingly be unwilling to impose radical measures aimed at moving towards a low carbon economy in light of the threat of “carbon leakage”,¹¹ i.e. the relocation of production and investment to regions having a more lenient regulatory regime.

As a significant user of energy and water in particular localities, and emitter of GHG, the mining industry is implicated in the anthropogenic forcing of climate and exacerbation of negative climate change impacts. For the industry itself, climate change poses both opportunities and risks. As far as opportunities go, these primarily relate to the effect of global warming on the easing of access to reserves in certain areas, most notably the Arctic.¹² The risks include a

⁷ International Council on Mining and Metals (note 5 above), 8.

⁸ Ibid.

⁹ Ibid 4–5.

¹⁰ A. Eberhard “The future of South African coal: Market, investment and policy challenges” (2011) Stanford Programme on Energy and Sustainable Development: Working Paper 100, 4.

¹¹ International Council on Mining and Metals *The cost of carbon pricing: Competitiveness implications for the mining and metals industry* (2013) United Kingdom: ICMM, 21.

¹² T.D. Pearce, J.D. Ford, J. Prno, F. Duerdan, J. Pittman, M. Beaumier, L. Berrang-Ford, B. Smit “Climate change and mining in Canada” (2011) 16(3) *Mitigation and Adaptation Strategies for Global Change* 347, 350. Mineral extraction activities in the Arctic are already wide-spread though operating conditions are difficult, see M. Dowdall, K. Vicat, I. Frearson, S. Gerland, B. Lind, G. Shaw “Assessment of the radiological impacts of historical coal mining operations on the environment of Ny-Ålesund, Svalbard” (2004) 71(2) *Journal of Environmental Radioactivity* 101–114; K. Dewing, R.J. Sharp, T. Muraro “Exploration history

range of physical climate-induced changes that may impact upon mining inputs, supply chains, markets, and core operations; as well as the risks imposed by climate mitigation and adaptation regulatory interventions, particularly carbon pricing regimes. The mining industry is also actively campaigning for carbon revenues to be “recycled” in a manner that supports the development of climate friendly technologies and helps “exposed” economic sectors and populations adjust to a carbon-limited future.¹³

This chapter offers both an international and a South African perspective on (1) the contribution of the mining sector to anthropogenic climate forcing; (2) the effects of carbon pricing on the mining sector and the recycling of carbon revenues; and (3) the extent to which the mining industry needs to develop strategies for climate change adaptation. The focus of the discussion is on the constitution of the problem by a variety of actors, and the policy and legal responses that have thus far manifested.

2. International perspective

2.1 The mining sector’s contribution to anthropogenic climate forcing

2.1.1 *Quantum and nature of the global mining industry’s GHG emissions*

Although it is difficult to find disaggregated statistics covering the global mining sector as a whole (and including both its formal and informal components), mining is a significant contributor to anthropogenic forcing of climate change. In the most recent report on the GHG of the world’s top 500 companies issued by the Carbon Disclosure Project, mining and metals form part of the “materials” sector (a category that includes companies providing and manufacturing chemicals and construction materials).¹⁴ In 2013 the materials sector was the third-highest emitting sector of Fortune 500 companies, responsible for 26.2 per cent of total G500 emissions; i.e. 953 MtCO₂e of scope 1 and 2 emissions.¹⁵ Moreover, while the GHG emissions of

and mineral potential of the Central Arctic Zn-Pb district, Nunavut” (2006) 59(4) *Arctic* 415–427.

¹³ International Council on Mining and Metals *Options in recycling revenues generated through carbon pricing: How 16 governments invest their carbon revenues* (2013) United Kingdom, ICMM, 8.

¹⁴ CDP (formerly the Carbon Disclosure Project) *What is driving climate change action in the world’s largest companies? Global 500 Climate Change Report 2013* (2013) United Kingdom: Carbon Disclosure Project, 34.

¹⁵ The definition of scope 1 and scope 2 emissions derives from the Greenhouse Gas Protocol, the most widely used accounting framework for greenhouse gas inventories developed by the World Resources Institute and the World Business Council for Sustainable Development. The *Corporate and Accounting Standard* (rev. 2013) forms part of this Protocol and distinguishes between GHG emissions of three different scopes: Scope 1 emissions occur from sources actually owned or operated by a company; e.g. boilers, furnaces, vehicles and other heavy duty equipment owned and operated by a mine; scope 2 operations are GHG emissions from the generation of purchased electricity; e.g. the emissions that occur from operating a smelter with purchased electricity; and scope 3 emissions arise from the activities of a company, but from sources not owned or controlled by that company (at 25).

other sectors declined, those of the materials sector increased by 13 per cent over scope 1 and 2 emissions in 2012.¹⁶

Irarrázabel similarly notes the lack of sufficient data available on the global mining industry's GHG emissions.¹⁷ While the largest mining companies typically publish their total annual GHG emissions in sustainability reports, comparing this information is difficult because they have different commodities in their portfolios.¹⁸ This points to a very important consideration in advocacy for a comprehensive mineral industry climate change response: although the value chain of mining, processing and production is broadly the same across the industry, the specifics of the chain and hence the emissions profile of particular mineral commodities (and even between commodities produced in different regions) will differ along a number of variables, including grade of ore, amount of ore, extraction technology, processing requirements, and accessibility of the mining site.¹⁹ In the case of scope 2 emissions, the emissions intensity of any particular product will also depend largely on the fuel used for the production of electricity in that nationality or region. The International Council on Mining and Metals (ICMM), for instance, found a wide range in the values reflecting the GHG intensity of copper, aluminium, coal and iron ore based both on a literature review of values in publicly available sources, and in data reported in ICMM member company's annual reports.²⁰

There is some comparative data on the mining industry's contribution to the total GHG emissions of various national jurisdictions. In its latest report on carbon pricing, for instance, the ICMM reported that in 2010 mining accounted for 14 per cent of Australia's direct and indirect GHG emissions (excluding metal production which accounted for another 12 per cent); two per cent of emissions in Canada; and one per cent of direct emissions in the United States of America.²¹

In addition to quantifications of the mining industry's GHG emissions, it is helpful to have some understanding of the processes through which they arise. In the case of direct (scope 1) emissions, Irarrázabel distinguishes between on-site direct emissions and methane (CH₄) emissions that occur as a result of coal mining.²² Methane emissions arising from coal mining constitute ten per cent of total anthropogenic methane emissions.²³ Coal mine methane is released from working mines as a result of longwall mining, when methane previously trapped within the coal seam is released into the air; and when the surrounding rock strata collapses after a coal seam has been extracted – the methane released from this debris (called “gob”) is known as

¹⁶ CDP (note 14 above) 34.

¹⁷ R. Irarrázabel “Mining and climate change: Towards a strategy for the industry” (2006)

24(3) *Journal of Energy and Natural Resources Law* 403, 410.

¹⁸ *Ibid* 412.

¹⁹ ICMM (note 11 above) 30.

²⁰ *Ibid* 35.

²¹ *Ibid* 19.

²² Irarrázabel (note 17 above) 409–410.

²³ United Nations Economic and Social Council, Economic Commission for Europe, Committee on Sustainable Energy *Project on development of coal mine methane projects in central and eastern Europe and the commonwealth of independent states* (6 December 2004) ENERGY/GE.4/2004/2.

“gob gas”.²⁴ Methane releases from coal mining arise from both working (underground and surface operations) and abandoned mines and may even be released post-mining when coal is transported and processed.²⁵ On-site direct emissions, on the other hand, can be divided into those that arise as process emissions or those that arise as energy-related emissions.²⁶ Process emissions include the emission of perfluorocarbons in the electrolysis process used in the aluminium industry, or the production of CO₂ and CH₄ in the sintering process used in the iron and steel industry. Energy-related emissions primarily arise from the combustion of fossil fuels, for example, the use of diesel for haulage in surface mining operations.²⁷

In the case of indirect (scope 2) emissions, the major uses of electricity during extraction and processing arise are related to comminution (crushing, grinding and other processes aimed at reducing average particle size), ventilation systems and water pumping.²⁸

2.1.2 *The mining industry’s efforts to mitigate GHG emissions*

To date the major impetus of the mining industry’s response to climate change has largely been focused on mitigation. In two separate studies of the Canadian mining industry’s response to climate change, for instance, Ford *et al.*²⁹ and Pearce *et al.*³⁰ found that a high proportion of respondents were indeed making efforts to reduce GHG emissions, as opposed to actions that were targeted towards adaptation.

The most common approaches adopted by global mining firms to reducing their GHG emissions include the preparation of GHG inventories, setting of GHG emission reduction targets, implementation of new technologies aimed at the reduction of on-site emissions, energy efficiency measures, energy recycling, energy switching (moving to less carbon intensive or renewable sources of power generation), offsets (including JI and CDM projects in terms of the Kyoto Protocol), and research and development. A majority of the companies falling within the materials sector on the Global 500 offer monetary incentives for achieving energy efficiency and emissions reductions targets, for example both BHP Billiton and Kumba Iron Ore are mentioned for incorporating performance against carbon targets in their annual remuneration reviews.³¹

²⁴ World Coal Association “Coal mine methane”, available at <http://www.worldcoal.org/coal/coal-seam-methane/coal-mine-methane/> (accessed 6 August 2014).

²⁵ Sourcwatch (Centre for Media and Democracy) “Methane released by coal mining”, available at http://www.sourcwatch.org/index.php/Methane_released_by_coal_mining (accessed 6 August 2014).

²⁶ Irarrázabel (note 17 above) 409.

²⁷ Ibid 410.

²⁸ Ibid 411.

²⁹ J.D. Ford, T. Pearce, J. Prno, F. Duerdan, L. Berrang-Ford, T.R. Smith, M. Beaumier “Canary in a coal mine: Perceptions of climate change risks and response options among Canadian mine operations” (2011) 109 *Climatic Change* 399–415.

³⁰ Pearce *et al.* (note 12 above).

³¹ CDP (note 14 above) 34.

The tensions, uncertainties and contradictions mining firms face in reducing GHG emissions in an inherently energy intensive industry are well-illustrated by the efforts of BHP Billiton, the world's largest mining company by market value.³² BHP Billiton's reputation as an industry leader in the field of climate change mitigation is based on a series of measures implemented since 1996, as documented on their company website.³³ At that time the Australia and UK based company (which is also listed on the Johannesburg Stock Exchange and operative in South Africa) acknowledged the scientific consensus on climate change and announced US\$1 billion in projects to address GHG emissions and improve energy efficiency. A year thereafter they produced their first public environment report detailing the GHG emissions of their operations and outlining their climate mitigation management strategies. In 1998 they introduced independent assurance of their Sustainability Report, which incorporated GHG data and set a public target to reduce their GHG intensity by ten per cent by 2000. This target was exceeded when in 2000 they reported a GHG intensity reduction of 12 per cent, equivalent to 6 MtCO₂e. In 2002, the company disclosed a target to reduce its GHG intensity by five per cent (achieving six per cent) by 2007; and in 2007 a further target to reduce this by six per cent by 2012 (achieving 16 per cent). During this time BHP Billiton participated in the first Carbon Disclosure Project, established a carbon pricing protocol, and committed a further US\$ 300 million to energy efficiency and GHG reduction improvements. In 2010 Marius Kloppers, a South African businessman and the chief executive officer of BHP Billiton at the time, urged the federal government of Australia to establish a clear price signal on carbon, arguing that there would be no "silver bullet" to resolving the long-standing problem of climate change and that the government needed to build upon a mosaic of interventions.³⁴ This position was reflected in BHP's inclusion of a price on carbon as one of its six principles for effective emissions reductions policies. Moving away from GHG intensity as a measure, in 2012 the company undertook to maintain total GHG emissions below their 2006 baseline, while continuing to grow the business.³⁵ The FY2006 baseline is however adjusted to take into account material acquisitions and divestments based on GHG emissions at the time of the transaction.³⁶ The management and technical innovations BHP has introduced to achieve these targets have included requiring the implementation and maintenance of an Energy and GHG Management Innovation Plan for all operations where emissions exceed or are anticipated to exceed 50 000 tCO₂e; reducing emissions generated in the grinding

³² Statista "Top 10 mining companies worldwide based on market value in 2014", available at <http://www.statista.com/statistics/272706/top-10-mining-companies-worldwide-based-on-market-value/> (accessed 8 August 2014).

³³ BHP Billiton "Greenhouse gas emissions", available at <http://www.bhpbilliton.com/home/society/environment/Pages/Greenhouse-gas-emissions.aspx> (accessed 8 August 2014).

³⁴ S. Tandon "BHP boss calls for price on carbon", available at <http://www.abc.net.au/news/2010-09-15/bhp-boss-calls-for-price-on-carbon/2261714> (accessed 8 August 2014).

³⁵ BHP Billiton (note 32 above).

³⁶ BHP Billiton "Improving our energy and greenhouse gas management" BHP Billiton case study, available at <http://www.bhpbilliton.com/home/society/environment/Pages/Greenhouse-gas-emissions.aspx> (accessed 8 August 2014).

process at its copper operations in Chile by replacing some of the milling equipment's steel parts with lighter steel-rubber parts, blending purchased diesel with five per cent biodiesel, and improving efficiencies in copper electrowinning refineries (which produce solid copper cathodes from a copper electrolyte solution) by eliminating the pre-stripping of copper from the process.³⁷

These measures have justifiably established BHP Billiton as an industry leader on climate change. And yet in late 2013 the company supported the conservative Abbott government's proposal to scrap the controversial Australian carbon tax. Rejecting suggestions that it had abandoned its previous stance on carbon pricing, BHP held that it still supported having a clear price signal on carbon, but that a carbon pricing policy needed to be both revenue neutral and trade friendly. The "problem" with the Australian carbon tax was that it resulted in Australian firms paying a higher cost for pollution than international competitors.³⁸

This stance possibly highlights the conditions upon which the mining industry is willing to participate in climate mitigation efforts: a determination to reduce GHG emissions and improve energy efficiency at their own pace, without external interventions that skew their allocation of market share or reduce their market value. Thus, the desire to maintain and grow market share and value is a key obstacle to mining companies supporting and complying with regulatory attempts to speed up the pace of climate mitigation. However, as Mehra notes, institutional investors and pensions funds are becoming increasingly aware of climate risks and the possibility of "unburnable coal". In this context, "BHP's size and visibility makes it more vulnerable than most" and she advocates that the company would do better to use its existing diversified strategy to move to a post-carbon age.³⁹

2.1.3 International policy responses

The United Nations and its various organizations have done a limited amount of work on mining and climate change. The Sustainable Energy Division of the United Nations Economic Commission for Europe (UNECE) established an Ad Hoc Group of Experts on Coal Mine Methane in 2005 to address the issue of methane emissions in coal mining, particularly in central and south-eastern Europe. Improved methane recovery at coal mines is regarded as a low-hanging fruit with important co-benefits that include improved mine safety, improvement in local and regional air quality, and local power generation. Under the guidance of the UNECE Committee on Sustainable Energy the ad hoc group of experts was tasked with carrying out activities related to development of coal mine methane projects, both at working and abandoned

³⁷ Ibid.

³⁸ ABC News "BHP Billiton voices concern over any delay to carbon tax repeal", available at <http://www.abc.net.au/news/2013-11-08/bhp-billiton-voices-concern-over-any-delay-to-carbon-tax-repeal/5077836> (accessed 8 August 2014).

³⁹ M. Mehra "BHP Billiton: Climate change leader or laggard?" *The Guardian*, 19 November 2013, available at <http://www.theguardian.com/sustainable-business/blog/bhp-billiton-climate-change-leader-laggard> (accessed 8 August 2014).

mines.⁴⁰ Following from this work, the UNECE in conjunction with the “methane to markets partnership” published a set of best practice guidelines on effective methane drainage and use in coal mines.

A number of global non-governmental organizations (NGOs) have also published work on climate change and coal, though the emphasis has fallen on the health and climate risks of coal-fired power stations. Both the World Resources Institute⁴¹ and Greenpeace⁴² have, for example, recently published works on trends and risks associated with coal-fired electricity generation. However, following the Intergovernmental Panel on Climate Change (IPCC’s) Fifth Assessment Report and the Warsaw Climate Change Conference in November 2013, the concept of “unburnable coal” has increasingly gained traction as a policy position amongst environmental NGOs. Responding to the Polish government’s decision to host the World Coal Summit at the same time and place as the meeting of UN climate negotiators, a group of 27 leading climate change scientists issued a statement on the world’s remaining fossil fuel budget. Assuming a more than 66 per cent chance of complying with states’ 2010 Cancun agreement (keeping global mean temperature increase below 2°C over pre-industrial levels), the world could only emit a further 1050 GtCO₂, the scientists said. This constitutes approximately only one quarter of all known fossil fuel reserves (including oil and gas). As the largest portion of this very small carbon budget would need to be used for harder-to-substitute transport fuels, the scientists concluded that unabated⁴³ coal for power generation would need to be substituted as quickly as possible for renewable technologies with near zero emissions.⁴⁴ The scientists stressed that it was misleading to talk about “high-efficiency low-emissions coal combustion technologies” as even the most efficient coal-fired power plants emit more than 15 times the amount of CO₂ per unit of energy, compared to renewable energy systems. They also warned that the current global trend of coal use (and thereby coal extraction and production) was consistent with a temperature increase exceeding 6°C, with risks for humankind on earth that could only be described as “catastrophic”.⁴⁵

The mining industry’s international policy response on mitigation has largely been voiced by the ICMM, an association of 22 of the world’s leading mining and metals companies and 32 national and regional mining associations and

⁴⁰ United Nations Economic Commission for Europe, Sustainable Energy Division “Coal mine methane”, available at <http://www.unece.org/fileadmin/DAM/energy/se/cmm.html> (accessed 8 August 2014).

⁴¹ A. Yang & Y. Cui “Global coal risk assessment: Data analysis and market research” World Resources Institute Working Paper (2012), available at <http://www.wri.org/publication/global-coal-risk-assessment> (accessed 8 August 2014).

⁴² Greenpeace *Silent Killers: Why Europe must replace coal power with green energy* (June 2013), available at <http://www.greenpeace.org/international/en/publications/Campaign-reports/Climate-Reports/Silent-Killers/> (accessed 8 August 2014).

⁴³ Unabated coal is coal burning without carbon capture and storage.

⁴⁴ O. Davidson, P.C. Frumhoff ... “New unabated coal is not compatible with keeping global warming below 2°C: Statement by leading climate and energy scientists”, available at <http://www.climateatoday.org/?p=4530> (accessed 8 August 2014).

⁴⁵ Ibid.

global commodity associations.⁴⁶ The ICMM has been an active participant in the United Nations Framework Convention on Climate change (UNFCCC) negotiations, employs a director of environment and climate change, and has developed a series of policy statements on climate change and climate change policy design along with more focused policies addressing adaptation, carbon pricing and carbon recycling.

In the ICMM's first *Climate Change Position Statement*, finalized in May 2006, mitigation was a strong focus. The ICMM recognized that climate change was a significant issue that merited a global response. The statement acknowledged that mining firms are significant users of energy, employ highly energy intensive processes, and produce energy products such as coal and uranium. It also pointed to the central tension necessitating consideration in demands to reduce the GHG footprint of the industry: the industry's products could play a role in reducing GHG emissions (materials used in renewable technology or energy efficiency for instance); there was a continuing growing global demand for energy that indexed increased reliance on fossil fuels; and supplies of clean, reliable and affordable energy were "fundamentally important for sustainable development", particularly in developing countries. In the position statement ICMM members nevertheless committed to meeting or exceeding "government requirements"; monitoring and reporting GHG emissions consistent with international standards such as the Global Reporting Initiative⁴⁷; and reducing GHG emissions as measured in absolute terms, through unit of production or in terms of energy efficiency.⁴⁸

The ICMM's 2006 position on climate change was superseded with the publication of a more elaborated *Policy on Climate Change* in November 2009. The ICMM once again voiced its support for a global solution to managing climate change and the development and implementation of a binding and effective global agreement. The *Policy* further evidenced the industry's support for existing pro-growth models of development, a preference for market-based solutions, and a concern that climate change mitigation measures should not constitute disguised forms of protectionism. The *Policy* stated, for instance, that ICMM members recognize the need "for a measured transition to a low emissions global economy reconciled with the *imperative* for energy security, *global economic growth*, and improved living standards and poverty alleviation".⁴⁹ Amongst other principles, the *Policy* stated that a global policy approach should minimize any prospect of carbon leakage and that a new international framework for climate change should be based on market-based policy measures that "provide for a measured

⁴⁶ ICMM "Our members", available at <http://www.icmm.com/members> (accessed 9 August 2014).

⁴⁷ The Global Reporting Initiative is a leading non-profit organization in the sustainability field that promotes the use of sustainability reporting as a vehicle for organizations to contribute to sustainable development. The reporting framework developed by the GRI is currently in its fourth version (known as "G4"). For further information see <https://www.globalreporting.org>.

⁴⁸ ICMM *Climate Change Position Statement* (10 May 2006), available at <http://www.icmm.com/publications?rootTagId=1162> (accessed 9 August 2014).

⁴⁹ ICMM *Implementing a global solution to managing a low emissions economy: Policy on Climate Change* available at <http://www.icmm.com/publications?rootTagId=1162> (accessed 9 August 2014), 1.

transition to a price on carbon” and that incentivize emissions reductions without creating distortions in trade and investment flows or compromise the international trade competitiveness of the industry.⁵⁰ The *Policy* also voiced support for the development and dissemination of low-emissions technologies, resource use efficiency and policy diversity and flexibility. Like the *Position Statement* of 2006, the *Policy* committed ICMM members to a number of climate change mitigation obligations (reducing GHG emissions, measuring progress and reporting results; promoting technical innovation and creativity in low-emissions technologies; and ensuring efficient use of renewable and non-renewable resources). It also acknowledged, for the first time, a number of obligations pertaining to adaptation: ICMM members should develop adaptation strategies appropriate to their operations along with contributing to the capacity of local communities and societies to adapt to climate change.⁵¹

In 2011, the ICMM’s *Policy on Climate Change* was in turn superseded by a set of *Principles for Climate Change Policy Design*.⁵² These principles acknowledged the changed international climate change policy context: It was now clear that a legally binding global agreement covering all major economies was a “distant project” and that in its stead a “patchwork regime” would emerge from the actions of particular states and even sub-national states and provinces. This would likely result in a “complex regulatory environment”, particularly for multi-national firms with cross-border operations. The *Principles* reiterate that the ICMM’s long-term objective remains “the eventual establishment of an integrated and globally effective carbon regime.”⁵³ To this end it advocates seven principles to guide national and sub-national specific climate change policies and measures.⁵⁴ The consistent implementation of such principles, the *Principles* hold, would ensure a measured transition to a low-carbon economy that would not detrimentally impact upon the local or international competitiveness of major industries and encourage the take-up of low carbon technologies. The thrust of the principles is therefore that climate change policies should be designed to ensure that the mining and metals industry plays its full part in contributing to sustainable development, *whilst ensuring it remained competitive in a low carbon economy*. Whilst seeking to influence the approach of the regulatory authorities, the *Principles* also notate the “minimum” ICMM member responsibility as developing GHG emission reduction strategies and implementing opportunities arising; ensuring efficient use of resources; supporting research and development in low-emission technologies; and measuring progress and reporting results.

⁵⁰ Ibid 2.

⁵¹ Ibid 1.

⁵² Available at <http://www.icmm.com/publications?rootTagId=1162> (accessed 9 August 2014).

⁵³ Ibid.

⁵⁴ The ICMM’s seven principles for climate change policy design are: (1) provide clear policies for a predictable, measured transition to a long term price on greenhouse gas emissions; (2) apply climate change related revenues to manage a transition to a low carbon future; (3) facilitate trade competitiveness across sectors; (4) seek broad-based applications; (5) be predictable and gradual; (6) be simple and effective; and (7) support low-emission, base-load generation technology development.

The international policy landscape on the mining industry's mitigation of GHG emissions is thus marked by the industry's insistence upon a "measured transition" to a low carbon economy and upon the imperative of national and international competitiveness. On the other hand leading climate change scientists and non-governmental organizations are highlighting the stark, dire choices that must be made if humanity is going to avoid global temperature increases exceeding 2°C over pre-industrial levels by way of concepts and regulatory impulses such as the global fossil fuel budget and unburnable coal. The chasm between these two positions is not only constituted by the industry's drive for profits, increased market value and market dominance – the source of much criticism of the mining industry – but also by the conundrum of humanity's reliance upon minerals for meeting, in particular, burgeoning energy needs, although the centrality of minerals in so many other aspects of contemporary lifestyles cannot be discounted either. How the chasm may be bridged is difficult to divine at this stage but may ultimately rest upon the willingness of consumers to pay higher prices for the dizzying array of products that are the outcome of mineral value chains, regulatory innovation driven by mineral scarcity, mechanisms for ensuring more equitable allocation of scarce minerals and mineral-based products, and the willingness of industry players to accept a certain degree of contraction in their market value and dominance.

2.2 Carbon pricing and the recycling of carbon revenues

2.2.1 *Effect of carbon pricing policies on the mining industry*

The tensions arising between the industry's desire for a self-governed measured transition to a low carbon economy, and other actors' desire for a faster and more urgent transition is nowhere more marked than in debates surrounding carbon pricing and the use to which carbon revenues are put. Thus, in recent years the regulatory instigation at national and regional levels of market-based mechanisms for setting a price on carbon has been of increasing concern for the mining industry.

Carbon pricing most commonly takes the form of a carbon tax or a carbon cap-and-trade system. In a cap-and-trade system the state controls the number of carbon emission rights that may be sold or given away and trade in such rights amongst emitters subsequently sets the price. A carbon tax system on the other hand involves the state renting out carbon emission rights at a fixed price. Contrary to the lay economic view that a cap-and-trade system is a market mechanism while carbon taxes are not, both approaches involve state regulation drawing upon market forces.⁵⁵ The relative advantages and disadvantages of carbon taxes versus carbon cap-and-trade systems are further considered in **chapter xx** of this volume.

In what is probably the most comprehensive overview of the impact of carbon pricing regimes on the mining industry to date, in a 2013 report (*The cost of carbon pricing: Competitiveness implications for the mining and metals*

⁵⁵ OzPolitic "Is carbon trading a market mechanism?" available at <http://www.ozpolitic.com/green-tax-shift/carbon-trading-market-mechanism.html> (accessed 9 August 2014).

industry)⁵⁶ the ICMM explored the competitiveness implications of carbon pricing on the mining industry. This report examines the extent to which carbon pricing regimes include the mining industry; the scope of state policies to address competitiveness and leakage; and the impact of carbon pricing policies on key financial metrics⁵⁷ of the industry. The overriding concern of the report is that differentiated national and regional carbon pricing mechanisms pose a risk to industry competitiveness in that they impose different carbon costs that sit alongside different costs for complying with other direct regulations, and different operational requirements and monitoring and reporting practices.⁵⁸

The report notes that carbon pricing regimes are currently in operation in a variety of jurisdictions. Cap-and-trade systems include the EU emissions trading system, the emissions trading systems in New Zealand, Quebec, California, Alberta, and the proposed emissions trading systems in South Korea and several provinces of China. Carbon taxes have in turn either been introduced or proposed in British Columbia, South Africa, Sweden and Norway. In Australia the Senate repealed the controversial carbon tax, (introduced by the Gillard government in July 2012), on 17 July 2014 and the federal government is now moving towards the introduction of an emissions trading system.⁵⁹ Switzerland, on the other hand, has a hybrid tax/emissions trading system in which companies can opt out of the tax by participating in the emissions trading system.⁶⁰

The policy diversity that is the source of the ICMM's concern essentially arises at three levels: (1) the extent to which emissions of the mining (and metals) industry are captured by the carbon pricing regime; (2) whether compensatory measures to cushion the effects of carbon pricing on emissions intensive and trade exposed industries (EITE) extend to the mining (and metals) industry; and (3) the uses to which revenues derived from carbon pricing are applied.

The extent to which the emissions of the mining and metals industry are captured by the pricing regime may be highly variable across regions and commodities, dependent upon: whether both scope 1 and scope 2 emissions are included (even if operational processes specific to mining are excluded the industry will be affected if electricity suppliers pass on increased costs); the gases included (for example, the inclusion of PFCs from aluminium production has now been included in Phase III of the EU emissions trading system); and emissions sources (for example, the inclusion of fugitive emissions from operational mines, as in Australia). In addition the manner in which coverage of the mining sector will manifest – increased costs – will depend on the carbon price. The impact of carbon pricing on particular commodities will also depend on the energy and emissions intensity of the

⁵⁶ See note 11 above.

⁵⁷ The ICMM examined the percentage of carbon costs relative to earnings before interest, tax, depreciation and amortization; annual capex; total cash costs; and sales.

⁵⁸ Ibid 4.

⁵⁹ Department of Environment, Australian Government "Repealing the carbon tax", available at <http://www.environment.gov.au/climate-change/repealing-carbon-tax> (accessed 11 August 2014).

⁶⁰ ICMM (note 11 above) 18.

particular commodity concerned and the generation mix of the electricity supply in particular states. In its quantitative analysis of the potential effects of the existing and proposed carbon pricing regimes on four key commodities (copper, iron ore, aluminium and coal) the ICMM demonstrated the high degree of cost variability situated at the centre of its concerns. For example, considering carbon costs as a percentage of earnings before interest, tax, depreciation and amortization (EBITDA)⁶¹, and assuming a 100 per cent “pass-through rate” for carbon-pricing induced increases in electricity, carbon costs arising from scope 1 and 2 emissions for aluminium production come in at 70 per cent of EBITDA for Australia, just below 60 per cent for South Africa, below 40 per cent for the EU, and below 20 per cent for Quebec and British Columbia.⁶² ⁶³ For iron ore production, however, the carbon costs are much lower and more evenly spread across regions: Carbon costs are estimated to constitute 0.5 per cent of EBITDA in South Africa, which compares favourably to British Columbia and Australia.⁶⁴

Proposed compensation measures, however, can significantly reduce these impacts.⁶⁵ Compensation measures may include free allocation of emissions allowances to industries that are most vulnerable, tax rebates and direct financial aid to such industries, and border tax adjustments.⁶⁶ Across the board, free allocation of allowances is the most common approach to cushioning the effects of carbon pricing on EITEs. However, there is considerable variation across states in the classification of industries, and segments of an industry, as EITE. All systems that define EITE industries, for example, include at least some forms of metal processing and production. Only a handful, however, classify mining activities as EITE.⁶⁷ In terms of the targeted commodities (copper, iron ore, aluminium and coal), only the European Union (EU) and Quebec classify the mining of these commodities as EITE, and South Africa only classifies gassy coal mines as such.⁶⁸ The EITE classification and the level of compensation provided accordingly introduce further variability into carbon pricing regimes.

The last source of potential variability relates to carbon revenue recycling, a topic on which the ICMM commissioned a separate report (*Options in recycling revenues generated through carbon pricing: How 16 governments invest their carbon revenues*)⁶⁹, also in 2013. Governments may use the revenues generated by carbon pricing policies in a variety of ways.⁷⁰ In some

⁶¹ This financial metric commonly provides an indication of a company's operational profitability.

⁶² ICMM (note 11 above) 41. The quantitative analysis of the effects of carbon pricing was based on publicly available data pertaining to ICMM companies.

⁶³ Canadian aluminium smelting operations would be more competitive as they are currently based on dedicated hyro supply and therefore have much-reduced scope 2 emissions.

⁶⁴ ICMM (note 11 above) 46.

⁶⁵ Ibid 50.

⁶⁶ Ibid 21.

⁶⁷ Ibid 22.

⁶⁸ Ibid.

⁶⁹ See note 13 above.

⁷⁰ When allowances are allocated for free to emitters in certain emissions trading systems no additional revenue is created. These schemes obviously fall outside the scope of “revenue recycling”.

jurisdictions carbon revenues may simply be another source of funding for general government expenditure. In 16 carbon pricing regimes currently operational in North and South America, Europe and Australasia⁷¹ carbon revenues are “recycled”, either through reinvesting the funds to support the development of low emission technologies, to assist specified vulnerable populations, or to buffer trade exposed economic sectors.⁷² Another group of measures involves introducing carbon taxes as part of a broader set of environmental tax reforms designed to be “revenue neutral”; i.e. carbon taxes are introduced as a package of tax reforms aimed at shifting the burden of tax from production (capital and labour), towards environmental externalities.⁷³ In North and South America, targeted low carbon investments are the most common form of revenue recycling,⁷⁴ whether in the form of investment in renewable technologies and energy efficiency, or in research and development associated with a low carbon regime.⁷⁵ In Europe and Australasia revenue recycling most commonly takes the form of support and protection for vulnerable populations.⁷⁶ This support does not, however, ordinarily extend to protecting EITE industries, where the modality of support is rather the allocation of free carbon allowances or statutory exemptions from a carbon tax.⁷⁷ The potential variability posed by revenue recycling policies has as a result not yet manifested.

2.2.3 International policy responses

In contrast to the mining sector’s mitigation of GHG emissions where the policy environment is more diverse, the international policy response on the effect of carbon pricing on the mining sector and the mining sector’s position vis-à-vis revenue recycling has largely been colonized by the ICMM.

In response to the various forms of variability that impact upon industry competitiveness outlined above, the ICMM recommends the adoption of seven integrated principles for climate change policy design. These principles are not geared toward a particular policy vehicle, but respect different political, economic, social, and physical contexts around the world.⁷⁸

The first principle advocates states to “provide clear policies for a predictable, measured transition to a long-term price on GHG emissions”.⁷⁹ This principle

⁷¹ Alberta Carbon Scheme; Bay Area Air Quality Management District GHG fee; Boulder Climate Action Plan Tax; British Columbia carbon tax; California Air Resources Board cap and trade program; Costa Rica carbon tax; Quebec carbon tax; Regional Greenhouse Gas initiative; Denmark carbon tax; Finland carbon tax; Netherlands carbon tax; Norway carbon tax; Sweden carbon tax; Switzerland CO₂ tax; UK climate change levy; Australia carbon price. See ICMM (note 13 above) 13.

⁷² Ibid 4.

⁷³ Ibid 18. This approach, pioneered by the Scandinavian countries makes carbon taxes more politically palatable. Some states (Finland and the Netherlands) are even aiming at “revenue negative” environmental tax reforms, which would see a tax shift going together with an overall tax reduction.

⁷⁴ Ibid 14.

⁷⁵ Ibid 16.

⁷⁶ Ibid 14.

⁷⁷ Ibid 18.

⁷⁸ ICMM (note 11 above) 52.

⁷⁹ Ibid 52.

responds to the lengthy time periods over which investments in the mining sector are planned and operated. In a context of high capital and operational costs, and fluctuating commodity prices and demand, governments would do well to provide a modicum of certainty by establishing long-term targets and objectives and outlining the future development of policies.⁸⁰ Secondly, linking to its work on carbon revenue recycling, the ICMM advises states to “[a]pply climate change-related revenues to manage a transition to a low carbon future”.⁸¹ Specifically, states should apply carbon revenues to the development and implementation of low carbon technologies, along with compensating exposed industrial sectors and vulnerable populations.⁸² To this end legislation should explicitly mandate the recycling of carbon revenues, along with a plan for the manner in which they will be used and allocated.⁸³ Invoking the spectre of carbon leakage, the third principle cautions that measures to facilitate trade competitiveness should be adopted alongside carbon pricing mechanisms. If compensation is chosen as the mechanism to ensure trade competitiveness, the ICMM report notes that it should include both the direct cost of being included in a carbon pricing scheme, as well as “indirect” carbon costs arising from the inclusion of suppliers, particularly electricity providers.⁸⁴ The ICMM’s fourth integrated climate change design principle harkens to the organization’s previous support for a global climate change regime. Aspiring to the possibility of “a global system with all sectors, gases and geographies subject to the same requirements and operational procedures, the principle is that climate change design should “seek broad-based application”.⁸⁵ Complementing the first principle, the fifth principle urges states to adopt “predictable and gradual”⁸⁶ climate change policies, while principle six focuses on the need for policies to be “simple and effective”. This is taken to be an incidence of clear incentives to reduce emissions; to ensure that the costs of administration do not outweigh environmental benefits; and to support environmental targets.⁸⁷ Finally, the significance of the electricity sector is acknowledged in principle 7: i.e., to support low-emission, base-load generation technology development.⁸⁸

While many of these principles would seem to be commonsense – the invocation that policies should be “simple and effective” for example – others are clearly oriented toward affording the mining industry special treatment and assisting mining players to retain their positions of power in a transition to a low-carbon future. Probably the most contentious of the ICMM’s proposals is the application of carbon revenues in support of exposed industries, which would go beyond existing levels of support in terms of free allocation of emissions allowances and tax exemptions.

2.3 The mining industry and climate change adaptation

⁸⁰ Ibid.

⁸¹ Ibid 54.

⁸² Ibid.

⁸³ Ibid.

⁸⁴ Ibid 56.

⁸⁵ Ibid 58.

⁸⁶ Ibid 60.

⁸⁷ Ibid.

⁸⁸ Ibid 64.

2.3.1 Scope of climate change impacts on the mining industry

Supplementing its work on carbon pricing and carbon revenue recycling, the ICMM recently produced a report on adaptation in the mining industry,⁸⁹ and this work has been complemented by various academic studies examining the scope of such risks or the perception thereof;⁹⁰ as well as the financial industry's emerging awareness of increased risk profiles.⁹¹ While the existing scientific literature on climate change impacts on mining operations focuses largely on the "northern"⁹² hemisphere, Damingos points out that the susceptibility of the mining sector to climate change should be of concern "to all mining companies operating worldwide, given that changes in rainfall patterns, evaporation rates, extreme weather events and other factors brought by climate change will have direct and indirect implications to each and every one of them."⁹³

Damingos' point of view sums up one of two clear reasons for the mining industry to become more knowledgeable about climate change impacts, which is that climate-induced impacts are already manifesting.⁹⁴ Various features of the nature of mining and the structure of the mining industry render it particularly vulnerable. These include: (i) geographical constraints – mining is unavoidably situated "on the ground",⁹⁵ frequently in challenging geographies and climates; (ii) although the lifecycle of mines is also cited as a reason *not* to be concerned about climate change impacts,⁹⁶ on the other hand it is argued that the sector relies on large fixed assets with long design outcomes, necessitating long-term planning;⁹⁷ (iii) the sector is dependent on long global supply chains vulnerable to climate change disruptions at numerous points;⁹⁸ (iv) the mining sector is heavily reliant upon water and energy for processing, both of which are sensitive to climate pressure and which may come under increasing competition from other sources; and (v) existing mining impacts on

⁸⁹ International Council on Mining and Metals *Adapting to changing climate: implications for the mining and metals industry* (March 2013) United Kingdom: ICMM.

⁹⁰ See Pearce *et al.* (note 12 above); Ford *et al.* (note 29 above); J.D. Ford, T. Pearce, J. Prno, F. Duerdan, L. Berrang Ford, M. Beaumier, T. Smith "Perceptions of climate change risks in primary resource use industries: a survey of the Canadian mining sector" (2010) 10 *Regional Environmental Change* 65–81; D. Damingos "Monetizing the impacts of climate change on the Greek mining sector" (2012) 17 *Mitigation and Adaptation Strategies for Strategic Global Change* 865–878. The Australian Commonwealth Scientific and Industrial Research Organization (CSIRO) has established a flagship project on mining adaptation for which more than thirty project reports have already been published (see <http://www.csiro.au/Organisation-Structure/Flagships/Climate-Adaptation-Flagship/adapting-mining-climate-change/Reports.aspx>, accessed 17 August 2014).

⁹¹ See for instance CDP & Eurizon Capital "Metals and mining: a sector under water pressure, Analysis for institutional investors of critical issues facing the industry" (July 2013) CDP.

⁹² This term is used here in the sense of the global north, even though certain jurisdictions that have examined the question of mining and climate change adaption are geographically located in the global south.

⁹³ Damingos (note 89 above) 866.

⁹⁴ Pearce *et al.* (note 12 above) 363.

⁹⁵ J. Hodgkinson, A. Littleboy, M. Howden, K. Moffat & B. Loechel *Climate adaptation in the Australian mining and extractive industries* (2010) CSIRO Climate Adaptation Flagship Working Paper #5, 3.

⁹⁶ Pearce *et al.* (note 12 above) 364.

⁹⁷ ICMM (note 88 above) 7.

⁹⁸ *Ibid.*

local communities may be exacerbated by climate change risks, placing the mine's "social licence to operate" in jeopardy.⁹⁹

The second clear reason is that investors and financiers are becoming increasingly concerned about these risks, spurred on by civil society pressure to disinvest from fossil fuel-based industries as a matter of moral principle.¹⁰⁰ Investor initiatives that are putting pressure on mining companies to disclose carbon-related risks include the Carbon Disclosure Project (CDP), the Investor Network on Climate Risk, and the Institutional Investor Group on Climate Change.¹⁰¹ In some cases, institutional investors have recommended withdrawal of investment in a number of mining companies (including Barrick Gold, Freeport McMoran and Rio Tinto) based on sustainability criteria.¹⁰²

The scope of climate change impacts on the mining industry can usefully be explored by examining the impacts on core operations, inputs (water, energy and human resources), and supply chains.¹⁰³

Core operations encompass the phases of exploration, construction, operations, closure and post closure. In the case of exploration, a changing climate could open access to reserves in previously inaccessible areas (e.g. the Arctic). Alternately, exploration in challenging geographies far removed from any supportive infrastructure could be rendered even more difficult. During the construction phase consideration of climate change impacts must call into question a long-standing underlying assumption of environmental impact assessment, and the formulation of engineering standards and building codes – that the climate is static over the lifecycle of the mine. Pearce *et al.* found for instance that most mine infrastructure in Canada had been designed on the assumption of an unchanging climate. "Infrastructure" in this sense included buildings and built structures, site hydrology, slope stability, tailings and water retention structures, and transportations networks. Pearce and his colleagues found very few instances where climate-related hazards had been identified *a priori*. Thus instead of a strategic approach to climate change adaptation, interventions tended to be reactive and ad hoc.¹⁰⁴ According to Hodgkinson *et al.*, "the production stage is likely to be the stage that is most at risk from climatic events and climate change in the future."¹⁰⁵ Mining companies face climate-induced risks during the operational or production phase from changes that unfold at both slower and faster timescales. Slower-unfolding actions may include hotter and drier conditions that facilitate erosion, subsidence or sea-level rise, while actions unfolding on a faster timescale include droughts, floods and other extreme events. These events impact upon both operational and capital expenditure. For example,

⁹⁹ Ibid

¹⁰⁰ See for instance H. Schücking, L. Kroll, Y. Leuval, R. Richter *Bankrolling climate change: A look into the portfolios of the world's largest banks* (2011) urgewald, groundwork, Earthlife Africa (Johannesburg) & Banktrack.

¹⁰¹ ICMM (note 88 above) 8.

¹⁰² CDP & Eurizon Capital (note 90 above) 6.

¹⁰³ With the addition of markets (not considered further in this section) these items of discussion are derived from the ICMM's framework of assessment for climate adaptation, see ICMM (note 88 above) 13.

¹⁰⁴ Pearce *et al.* (note 12 above) 363.

¹⁰⁵ Hodgkinson *et al.* (note 94 above) 3.

hotter and drier conditions may affect dust control operations (especially if the mine is situated at the rural-urban interface) leading to possible regulatory non-compliance, production stoppages, and investment in more rigorous and expensive dust control measures.¹⁰⁶ The economic costs of extreme weather events are not only borne by the mining sector. The 2010-2011 floods that affected Queensland's coal mining industry, for example, resulted in losses in excess of AUD 5 billion to Queensland's gross state product.¹⁰⁷ Post-closure, unanticipated climate-induced changes may overwhelm tailings structures and frequently the state has to step in to bear the costs. For example, changes in the amount of permafrost have caused tailings facilities at the old Clinton Creek asbestos mine in the Yukon, Canada to fail, and fish habitats in the upper Clinton Creek and Wolverine Creek have been destroyed. The cost of stabilizing the property has been estimated at between CAD17 and 35 million, with the cost borne by the federal government.¹⁰⁸

In addition to these operational risks, there are a number of climate-induced vulnerabilities related to water, energy and human resources as the most critical inputs to the mining process. Water is a critical input that can directly impact the value of a company and its capacity to deliver a stable rate of return. In their survey of water-related risk in the mining sector, the CDP and Eurizon Capital identified 12 categories of risk currently being experienced by responding companies, the most common of which were flooding, water shortages, poor water quality, more stringent regulation of water (including discharges into water), and higher water costs.¹⁰⁹ These risks are illustrated by the experiences of the copper-gold Minto mine, operated by the Sherwood Copper Corporation in Yukon, Canada. In 2008 torrential rains forced the company to release 350 000m³ of contaminated water into the Yukon river system, which exceeded the standard of their licence. Disturbingly, the mine owners faced a similar situation in both 2009 and 2010.¹¹⁰

Water impacts are frequently negatively correlated with energy requirements and GHG emissions. For example, in 2013 BHP Billiton reported that its GHG emissions increased by 3.6 million tonnes as a result of the supply disruptions to hydropower at its Mozal aluminium smelter. With torrential rains affecting the hydropower supply, the firm was forced to switch to coal-fired supply.¹¹¹ And in the Atacama desert (the driest place on Earth), firms have responded to acute water scarcity by pumping in and treating raw seawater, which whilst it reduces water stress in the region contributes to increased GHG emissions through the energy utilized in these processes.¹¹²

Human resource-related impacts of climate change, in turn, include the increased risk of heat stress for outdoor and underground workers, the

¹⁰⁶ Ibid 358.

¹⁰⁷ V. Sharma, S. Van der Graaff, B. Loechel & D. Franks *Extractive resource development in a changing climate: Learning the lessons from extreme weather events in Queensland, Australia* (2013) National Climate Change Adaptation Research Facility, Gold Coast, 3.

¹⁰⁸ Pearce *et al.* (note 12 above) 358.

¹⁰⁹ CDP & Eurizon Capital (note 90 above) 9.

¹¹⁰ Pearce *et al.* (note 12 above) 357.

¹¹¹ BHP Billiton (note 13 above).

¹¹² ICMM (note 88 above) 26.

potential of heat stress to exacerbate existing chronic diseases, increased potential for the transmission of vector-borne diseases such as malaria, and temporary disruption to worker availability induced by extreme weather events.¹¹³

Mining supply chains are heavily dependent upon the reliability of transport routes and infrastructure (roads, rail, ports and shipping), all of which are vulnerable to extreme events, changing temperatures, and altered precipitation patterns. Diamond mining in Canada's Northwestern territories, for example, has been negatively impacted by warmer winter temperatures and earlier spring melts that have shortened the operability of the ice roads that are used to transport fuel and supplies to mines. In 2006 an exceptionally warm winter reduced the operating season of the ice road from 70 to 42 days. The Diavik mine owned by Rio Tinto adapted by flying in fuel, at an estimated increased cost of CAD 11.25 million.¹¹⁴

While there is much variability, the scope of climate change-induced impacts on the mining industry is significant. It is of some concern, therefore, that in recent surveys of the perceptions of Canadian professional and operational mining practitioners, both Pearce and Ford found that knowledge of climate change was very low (in Ford's study for instance, half of the practitioners had not even heard of the IPCC reports!), and the industry had benefitted from few climate change knowledge dissemination projects.¹¹⁵ Additionally, limited adaptation planning for climate change appeared to be underway.¹¹⁶

2.3.2 *International policy response*

The ICMM's report on climate adaptation in the mining sector predictably concludes with a set of "process" recommendations to be implemented across a range of existing functions.¹¹⁷ Thus mining companies are advised:

- To engage in awareness, engagement and objective setting (through, for instance, the Private Sector Initiative under the Nairobi Work Programme of the UNFCCC);¹¹⁸
- To undertake a risk and opportunity assessment (an example being Rio Tinto Alcan's reported development of a "climate change sensitivity framework");¹¹⁹
- To integrate climate change into existing risk assessment practices;

¹¹³ Ibid 16.

¹¹⁴ Pearce *et al.* (note 12 above) 355–356.

¹¹⁵ Pearce *et al.* (note 12 above) 363; Ford *et al.* (note 29 above) 412.

¹¹⁶ Pearce *et al.* (note 12 above) 364.

¹¹⁷ ICMM (note 88 above) 40–46. Existing functions within mining companies that are relevant to climate change adaptation include internal risk management policies, procedures and assessment; emergency response planning; asset management; capital and long-term planning; environmental, health and safety programs; biodiversity management; community engagement; and financial and sustainability measurement and reporting.

¹¹⁸ See http://unfccc.int/adaptation/workstreams/nairobi_work_programme/items/6547.php (accessed 17 August 2014).

¹¹⁹ See <http://www.fomin.org/HOME/FOMINblog/Blogs/TabId/628/ArtMID/8837/ArticleID/1617/Default.aspx> (accessed 17 August 2014).

- To undertake adaptation planning (for example, Vale's *Corporate Guidelines on Climate Change and Carbon* states as its first strategic principle "Strategic evaluation of climate change on business ...");
- To implement adaptation actions (including actions to eliminate or avoid risks such as amending engineering design standards, and actions to mitigate against risks, such as developing redundancy in transportation routes);¹²⁰
- To undertake monitoring, evaluation and reporting (for example, Vale and the Espirito Santo State government's environmental monitoring and forecasting tool);¹²¹ and
- To establish partnerships and forms of collaboration.

The approach and ethos underlying this process advocacy, however, is predominantly one of scaling up business-as-usual response to external threats. As the ICMM points out, mining companies have a lot of experience in developing "robust engineering strategies" to cope with threats imposed by harsh external conditions.¹²² This is borne out by Pearce *et al.* who point out that "[i]n many instances the technologies and engineering strategies necessary for adaptation to climate change in the mining sector already exist ...".¹²³ In the 2011 study conducted (by Ford *et al.*, many respondents indicated not knowing whether climate adaptation was taking place, which the authors interpret as possibly being the view of those on the ground who cannot distinguish adaptation measures from maintaining mining operations in the face of day-to-day challenges.¹²⁴

As a supplement to this scaled up business-as-usual approach, however, civil society organizations are advocating mining industries to move rapidly *beyond* their legal obligations,¹²⁵ for example, in their stewardship of water, given that few states at the moment require climate change to be expressly considered in environmental impact assessments for mines.¹²⁶

3. National perspective

3.1 The South African mining sector's contribution to anthropogenic climate forcing

3.1.1 *Quantum and nature of the South African mining industry's GHG emissions*

It is difficult to ascertain the South African mining industry's aggregate scope 1 and 2 GHG emissions. Large, listed mining companies operating in South Africa provide data on their GHG emissions in their annual sustainability or integrated reports, but this information does not appear to be aggregated by the state or the South African Chamber of Mines. The *GHG Inventory for*

¹²⁰ ICMM (note 88 above) 44.

¹²¹ Ibid 45.

¹²² Ibid 4.

¹²³ Pearce *et al.* (note 12 above) 361.

¹²⁴ Ford *et al.* (note 29 above) 411.

¹²⁵ CDP & Eurizon Capital (note 90 above) 15.

¹²⁶ Pearce *et al.* (note 12 above) 362.

South Africa,¹²⁷ which is prepared according to IPCC guidelines, contains information on the mining industry's emissions, but these are folded into broader categories. It is nevertheless clear that the mining industry has contributed to the estimated increase in South Africa's GHG emissions of 24.9 per cent between 2000 and 2010.¹²⁸ The energy sector, which includes energy industries, transport and manufacturing and construction, was by far the greatest contributor to the increase in South Africa's CO₂ emissions. South Africa's energy intensity, as the *GHG Inventory* notes "is high mainly because the economy is dominated by large scale, energy intensive, primary minerals beneficiation industries and mining industries."¹²⁹ The claim is supported by the membership of the Energy Intensive User Group of Southern Africa (EIUG), a lobby group of energy intensive consumers who currently account for approximately 44 per cent of electrical energy consumed in South Africa.¹³⁰ Fifteen of the EIUG's 31 members are mining or metals processing companies.¹³¹ According to data compiled by the Department of Energy in 2009, the mining sector with a total of 1100 consumers, utilizes 15 per cent of South Africa's electricity,¹³² and in a 2007 publication the Chamber of Mines of South Africa maintained that minerals beneficiation alone contributes more than 60 per cent to South Africa's total industrial GHG emissions.¹³³

In addition to reporting on the energy sector (in which mining and mineral and metal production are clearly implicated), the *GHG Inventory* also provides information on emissions trends in the production of cement, limestone and glassware (all falling under the category of "mineral production") and in the metal industry. The latter includes iron and steel, ferroalloys, aluminium, zinc and lead production. From 2000 to 2010, the production of iron and steel, ferroalloys and aluminium was responsible for the greatest proportion of GHG emissions in the sector. During this period the GHG emissions of the iron and steel industry decreased. The emissions arising from ferroalloy and aluminium production decreased during the 2007 – 2009 economic crisis, but then showed signs of increasing once again.¹³⁴ Almost two thirds of the emissions in the production of aluminium arose from PFCs,¹³⁵ which has implications for

¹²⁷ Department of Environmental Affairs *GHG Inventory for South Africa* (August 2014), available at https://www.environment.gov.za/sites/default/files/docs/greenhousegas_inventorysouthafrica.pdf (accessed 23 February 2015). This inventory is for GHG emissions for the years 2000–2010.

¹²⁸ Ibid 13. This percentage excludes the Land sector. If the Land sector is included then CO₂ emissions increased by 29.6 per cent over the same period.

¹²⁹ Ibid 19.

¹³⁰ See <http://www.eiug.org.za/about/membership/> (accessed 25 February 2015).

¹³¹ See <http://www.eiug.org.za/about/membership/> (accessed 25 February 2015).

¹³² Department of Environmental Affairs (note 126 above) 7.

¹³³ Chamber of Mines *Climate Change: Mining and the Clean Development Mechanism* (2007) available at <https://commondatastorage.googleapis.com/comsa/Climate%20Change%20Development%20-%20Mining%20and%20the%20clean%20development%20Mechanism.pdf> (accessed 10 March 2015).

¹³⁴ Department of Environmental Affairs (note 126 above) 68–75.

¹³⁵ Ibid 71.

South Africa's commitments under international laws regulating the eradication of ozone-depleting substances.

Apart from GHG emissions arising from the burning of fossil fuels for electricity and transport (particularly road transport), the mining industry contributes to energy emissions through fugitive emissions; i.e. the intentional and unintentional release of GHGs during the extraction, processing and delivery of fossil fuels to their point of use.¹³⁶ Fugitive emissions from coal mining are significant sources of CO₂ and CH₄ (methane). These emissions increased from 2002 Gg CO₂e in 2000, to 2266 Gg CO₂e in 2010 (an increase of 8.8 per cent).¹³⁷ Important to note, is that the *GHG Inventory* excludes CO₂ and CH₄ emissions from spontaneous combustion of coal seams and abandoned mines, due to unavailability of data and estimation methodologies.¹³⁸ In 2005, however, Lloyd and Cook reported on the emission of methane from underground and surface coal mines in South Africa and found that levels were significantly lower than had been assumed.¹³⁹ In 2013 they reported on another study in which they had sought to estimate CO₂ emissions from a wide range of target areas on dumps arising from coal mining activities. They found that rehabilitation was very effective in reducing emissions to tolerable levels, for example, ranging from emissions of less than 1 kg/m²/pa for even incompletely rehabilitated sites, compared to 100kg/m²/pa for unrehabilitated sites, and 7000kg/m²/pa where combustion was actively taking place.¹⁴⁰

Whilst large, listed mining firms now regularly report on their GHG emissions, and many participate in the Carbon Disclosure Project, it is meaningless to compare their absolute GHG emissions, or even the GHG intensity of their operations, given the differences in their commodities profile, the scope of their operations, and the geographical regions in which they operate. Taking the membership of the EIUG as a starting point, absolute GHG emissions range from Sasol's 70 MtCO₂e per annum and GHG intensity of 3.2tCO₂e per ton production for 2014¹⁴¹ to Lonmin's 1.2 MtCO₂e per annum and GHG intensity of 1.4tCO₂e per PGM ounce.¹⁴² Certain general observations about GHG emissions reporting can, however, be observed from the data provided in their 2013/2014 sustainability reports. Almost all of the EIUG mining company members now report on their scope 1 and 2 emissions, and a number are in the process of determining their scope 3 emissions (Anglo American, African Rainbow Minerals, Exarro). In almost all cases, the greatest proportion of emissions, by far, arises from scope 2 emissions. This means that GHG emissions are closely bound up with energy costs, which should

¹³⁶ Ibid 40.

¹³⁷ Ibid 41.

¹³⁸ Ibid xix.

¹³⁹ P. Lloyd & A. Cook "Methane release from South African coal mines" *Journal of the South African Institute of Mining and Metallurgy* (2005) 105(7), 483–490.

¹⁴⁰ A.P. Cook & P.J.D. Lloyd "The estimation of greenhouse gas emissions from South African surface and abandoned coal mines" (2012) 112(12) *Journal of the South African Institute of Mining and Metallurgy* 1087–1090.

¹⁴¹ Sasol *Sustainable Development Report* (2014), available at <http://www.sasol.co.za/sustainability/reports> (accessed 10 March 2015).

¹⁴² Lonmin *Sustainable Development Report* (2014), available at https://www.lonmin.com/sustainable_development/default.aspx (accessed 10 March 2015).

create a strong incentive for reduction of scope 2 emissions. In some cases, however, firms are reporting an increase in their absolute GHG emissions (African Rainbow Minerals, AngloGold-Ashanti, Glencore). Firms reporting a decrease in absolute GHG emissions included Anglo American, BHP Billiton SA Ltd, Lonmin and Sasol. However, this does not necessarily reflect significant change at an operational level as the GHG emission level, and even the intensity level, can be materially affected by the acquisition or divestiture of particular operations as well as production stoppages, strikes in particular.

3.1.2 The South African mining and metal industry's efforts to mitigate GHG emissions

The South African mining industry has not developed a collective response on climate change. The Chamber of Mines produced an information pack on climate change and carbon finance for the mining industry in 2007, but does not appear to have developed any project around climate change since.¹⁴³ The Chamber and a number of mining companies operating in South Africa are, however, members of the ICMM and one would assume they would be cognisant of the policy developments around climate change, adaptation and carbon financing outlined in the foregoing sections. The EIUG's list of projects focuses largely on energy – security of supply and pricing and tariffs are foregrounded – but the group is also looking at cogeneration and energy efficiency which could offer opportunities for GHG emission reductions.¹⁴⁴

Many large, listed mining firms operating in South Africa identify climate change as a significant regulatory and physical risk. Measures commonly taken to mitigate GHG emissions include policy and strategy development, establishment of energy management information systems, target setting, mainstreaming energy and climate change into appointments and performance management, installation of waste heat recovery systems, and energy switching (solar and biodiesel). Some of the more exciting projects include Sibanye Gold Ltd's installation of energy efficient 45 kW axial ventilation fans in the mine's underground operations, which the company registered as a CDM project earning 7685 CER units. The company has also established a project at its Beatrix mine to recover and utilize methane for electricity generation.¹⁴⁵ In 2015 Sibanye Gold also announced plans to build a R3-billion 150 MW solar power plant to ease its reliance on electricity supply from Eskom.¹⁴⁶

3.1.3 National policy response

¹⁴³ See note 132 above.

¹⁴⁴ See the EIUG's list of projects at <http://www.eiug.org.za/projects/> (accessed 10 March 2015).

¹⁴⁵ Sibanye Gold Ltd *Sustainability Report* (2013) available at <https://www.sibanyegold.co.za/sustainability/sustainability-reporting> (accessed 10 March 2015).

¹⁴⁶ N. Odendaal "Sibanye eyes R3bn, 150 MW solar power station *Mining Weekly* 19 February 2015, available at <http://www.miningweekly.com/login.php?url=/article/sibanye-eyes-r3bn-150-mw-solar-power-station-2015-02-19> (accessed 10 March 2015).

In pursuit of the *National Climate Change Response White Paper's* (*NCCRWP*) overburdened, overarching objective – to build the climate resilience of the country, its economy and people, whilst simultaneously addressing “over-riding national priorities for sustainable development, job creation, improved public and environmental health, poverty eradication, and social security”¹⁴⁷ – one of the *NCCRWP's* strategic priorities is to prioritise mitigation policies, measures and interventions that “significantly contribute” to the “peak, plateau and decline” GHG Emissions Trajectory identified by the study on LTMS and affirmed by our stated emissions reduction targets at the Copenhagen COP.¹⁴⁸ The *NCCRWP* goes on to state that as the (vast) majority of South Africa’s emissions arise from energy supply (electricity and liquid fuels) and use (mining, industry and transport), it is these areas that hold the largest emission reduction potential.¹⁴⁹

The *NCCRWP* specifically states that policy decisions on new infrastructure investments must consider climate change impacts to avoid locking South Africa into emissions-intensive, and increasingly uncompetitive, technologies into the future.¹⁵⁰ New infrastructure investments should include the costly infrastructure necessary to mine or to beneficiate minerals. However, to date the environmental permitting process for mines, mineral beneficiation and the metals industry has not expressly required consideration of climate change impacts. The 2014 Environmental Impact Assessment Regulations under the National Environmental Management Act 107 of 1998,¹⁵¹ which now apply to applications for prospecting and mining rights as well as mine closure, similarly make no mention of climate change.

The *NCCRWP's* response to mitigation, as further elaborated in chapters xxx, was based on defining Desired Emission Reduction Outcomes (DEROs) within 2 years of the policy’s publication. This was to be accompanied by an in-depth assessment of the mitigation potential and best available mitigation options for each sector and sub-sector of the economy. Further, or perhaps as part of the process of defining DEROs, Carbon Budgets for significant GHG emitting sectors would be “drawn up and adopted”. Within three years of the *NCCRWP's* publication, a mechanism and process for translating these Carbon Budgets into company level DERO’s would be implemented. Companies and economic sectors and sub-sectors for whom DEROs had been established would be required to prepare and submit mitigation plans, setting out how they intended complying with the DEROs. A Monitoring and Evaluation System would be established to support analysis of the impact of

¹⁴⁷ Department of Environmental Affairs *White Paper on the National Climate Change Response* Notice 757 *Government Gazette* 34695 of 19 October 2011 (henceforth *NCCRWP*) 14.

¹⁴⁸ As noted in the introduction to this book, the peak, plateau and decline model is based on the idea that our GHG emissions will increase but be 34% below a “business-as-usual” emissions trajectory in 2020, and 42% below a business-as-usual trajectory in 2025. The quantitative counterparts to these figures, as indicated in the *NCCRWP*, are that our GHG emissions per annum would be in the range 398–583 MtCO_{2e} p/a by 2020, and in the range 398–614 MtCO_{2e} for 2025 (see *NCCRWP* 30). As the most recently published *Greenhouse Gas Inventory* shows, however, our aggregate GHG emissions were *already* 579 Mt in 2010.

¹⁴⁹ *NCCRWP* (note 146 above) 29.

¹⁵⁰ *Ibid.*

¹⁵¹ GNR 982–985 *Government Gazette* 38282 of 4 December 2014.

mitigation measures.¹⁵² As a counterpart to these measures, two policy instruments in particular – the National Employment Vulnerability Assessment (NEVA) and Sector Jobs Resilience Plans (SJPs) – would be used to “move employment” from a carbon-intensive to a low-carbon economy.¹⁵³

In a 2014 review of South Africa’s implementation of the NCCRWP, the Electricity Governance Initiative in South Africa notes that it is “common cause” that South Africa has not lived up to the aspirations expressed in the *White Paper*, since most of the two-year deadlines were missed.¹⁵⁴ While South Africa has made progress in establishing a growing information base on climate change response, and some strides in developing policy and institutional capacity, there is little evidence of a resolute government response that matches the scope, scale and severity of climate change risks that are already beginning to manifest.¹⁵⁵ While it is difficult to say to what extent the slow pace of implementation can be ascribed to lack of political will, and to what extent lack of capacity and resources, the author of the review highlights the disadvantages flowing from the “main-streaming” approach that was adopted to implement the *NCCRWP*, and the lack of a strong lead agent in the form of the Department of Environmental Affairs (DEA).¹⁵⁶

Following adoption of the *NCCRWP*, the DEA appointed a Technical Working Group on Mitigation, with representation of business, NGOs, organized labour, and the state. The work of this Technical Working Group was largely focused on an extensive donor-funded research project entitled the Mitigation Potential Analysis (MPA). The MPA aims to consider sectoral opportunities and challenges for mitigation under (amongst others) the themes of energy and industry. A project report, which includes macro-economic modeling and socio-economic analysis, was available at the beginning of 2014, but has not been signed off by Cabinet or published.¹⁵⁷

On 1 July 2014 the DEROs project was launched with the title: “Development of Desired Emission Reduction Outcomes (DEROs) and Mix of Measures and for Sectors and Sub-sectors of the Economy”. The determination of DEROs is arguably the most critical component of implementing the mitigation provisions of the *NCCRWP*. However, as time has passed, the relationship between Carbon Budgets and DEROs has become increasingly opaque. Both terms appear to refer to long-term aspirational outcomes, and there is now uncertainty whether more specific and binding emissions targets will be defined.¹⁵⁸

In addition to these foundational pieces of research, policy and strategy, the government has commissioned work on a Mitigation Technology Plan to

¹⁵² Ibid 28.

¹⁵³ Ibid 36.

¹⁵⁴ Electricity Governance Initiative in South Africa *Report on a Review of Implementation of South Africa’s National Climate Change Response White Paper (NCCRWP)* (2014) [available at ...](#) (accessed 10 March 2015) 9.

¹⁵⁵ Ibid 4.

¹⁵⁶ Ibid 17–18.

¹⁵⁷ Ibid 7.

¹⁵⁸ Ibid 11.

support the transition to a lower-carbon economy, and a study for the National Employment Vulnerability Assessment has been initiated.¹⁵⁹

The mining and metals industries, as significant sub-sectors of the economy, stand to be affected by the MPA and the determination of DEROs. At this stage, however, it is too early to assess the nature, scope and scale of those impacts; whether measures adopted will be binding or non-binding in nature; and whether they will be sufficient to ensure the country remains within the accepted Greenhouse Gas Emissions Trajectory.

3.2 The South African carbon tax

As discussed in chapter xxx the South African government is planning on introducing a carbon tax,¹⁶⁰ the first phase of which will begin running from 1 January 2016. The most current policy statement on the carbon tax, the 2013 *Carbon Tax Policy Paper* proposes a tax rate of ZAR120.00 per tonne of CO₂e (carbon dioxide equivalent) increasing at 10 per cent per annum, to be implemented during the first phase (initially due to run from 1 January 2015 to 31 December 2019).

The *Carbon Tax Policy Paper* proposes that the carbon tax will only cover scope 1 emissions in the tax base.¹⁶¹ As noted in section 3.1.1 above, by far the greatest proportion of mining companies' emissions arise from scope 2 emissions. The primary impact of the carbon tax on the mining sector will thus be increased electricity costs, as it is almost certain that Eskom will pass these costs onto its customers.¹⁶² In the case of scope 2 emissions, the policy proposes introducing complementary measures and incentives such as a proposed energy efficiency savings tax incentive.¹⁶³

In order to facilitate "a relatively smooth transition to a low-carbon economy" the design of the carbon tax proposes tax-free emissions thresholds, reviewable every five years.¹⁶⁴ In addition to this basic tax-free threshold, the policy states that "consideration" will be given to sectors where the potential for emissions reduction is limited by either technical or structural reasons, for

¹⁵⁹ Ibid 21.

¹⁶⁰ In December 2010, the National Treasury published a *Discussion Paper for Public Comment on the Carbon Tax Option*, which outlined the environmental and economic grounds for introducing a carbon tax in South Africa. This was superseded by the *Carbon Tax Policy Paper, Reducing Greenhouse Gas Emissions and Facilitating the Transition to a Green Economy*, published in May 2013 for public comment. The latter proposed the introduction of the carbon tax in phases. The first phase was to run from 1 January 2015 to 31 December 2019, followed by a second phase of another five years, from 2020 to 2025.

¹⁶¹ National Treasury *Carbon Tax Policy Paper: Reducing greenhouse gas emissions and facilitating the transition to a green economy* (May 2013) 13.

¹⁶² Eskom, the national power supplier generates approximately 95% of the electricity used in South Africa and approximately 45% of the electricity used in Africa. It has intimated that it will not be able to absorb the proposed tax and it will be forced to pass on the tax on to consumers in the form of higher tariffs. This will have obvious effects on the operational costs of electricity intensive users, in particular mineral processing operations which have already been negatively affected by Eskom's inability to consistently supply electricity leading to rolling blackouts across the country.

¹⁶³ Ibid.

¹⁶⁴ Ibid.

example in the case of process emissions, and that “graduated relief” will be given to trade-sensitive sectors.¹⁶⁵ The maximum additional allowance for process emissions and trade exposure will be 10 per cent respectively. Sectors likely to benefit from these additional tax-free thresholds include iron and steel, cement, glass and ceramics and fugitive emissions from coal mining.¹⁶⁶ Mining *per se* is not specifically identified as a benefitting sector.

In order to encourage firms to reduce the carbon intensity of their products, however, the *Carbon Tax Policy Paper* also states that the basic tax-free threshold of 60 per cent will be adjusted with reference to either a benchmark emissions intensity for the sector, or one determined with reference to an historical date, in both cases inclusive of both scope 1 and 2 emissions. Adjustments to the 60 per cent threshold would be limited to 5 per cent, either up or down.¹⁶⁷ Determining a benchmark emissions intensity for the mining sector will be very difficult, given the different emissions intensities associated with different commodity profiles, as highlighted in the work of the ICMM discussed above. Instead of determining the benchmark emissions intensity for the mining sector as a whole, it may make better sense to focus on emissions intensities associated with particular mineral commodities.

Additionally, firms may use offsets to reduce their carbon tax liability and in this regard the National Treasury published a *Carbon Offsets Paper* for public comment in April 2014. Noting the number of projects submitted by mining companies in the CDM project pipeline (six projects listed by two mining companies), and given the size of the mining industry in South Africa, the paper estimates scaling up the roll out of these projects by a factor of 10,¹⁶⁸ leading to a potential offset of 5.7 MtCO₂e per year for the sector.¹⁶⁹

The *Carbon Tax Policy Paper* limits the overall maximum tax-free threshold (including the basic amount, adjustments, and offsets) to 90 per cent.¹⁷⁰ At the very least, therefore, mining firms face the prospect of paying the carbon tax on 10 per cent of their scope 1 emissions, and bearing increased electricity costs arising from Eskom’s carbon tax liability.

In the 2014 Budget Speech the Minister of Finance announced that the implementation of the carbon tax would be delayed until 2016. This appears to have followed concerns raised by interested and affected parties about the design of the tax as well as the need to align the tax with the measures proposed by the DEA, in particular the DEROs. This issue as well as other aspects of the carbon tax are discussed in more detail in [chapter xx](#). In the 2015 Budget Speech, the Finance Minister confirmed that the proposed carbon tax would still be implemented in 2016. In the interim a temporary increase in the electricity levy would be imposed (to assist with demand management), along with an increase in the efficiency savings incentive. It

¹⁶⁵ Ibid.

¹⁶⁶ Ibid 14.

¹⁶⁷ Ibid.

¹⁶⁸ National Treasury *Carbon Offsets Paper* (April 2014) 26.

¹⁶⁹ Ibid.

¹⁷⁰ *Carbon Tax Policy Paper* (note 159 above) 14.

was also announced that a Draft Carbon Tax Bill would be published during the latter part of 2015 for public comment. This will hopefully provide greater clarity on the structure and implementation of the proposed carbon tax.

Unsurprisingly these proposals have met with staunch opposition from mining and other carbon intensive industries because of their potential to erode profit margins in a context of rapidly rising electricity costs, weak commodity prices, a sluggish economic growth and widespread labour unrest. The EIUG has suggested that a key issue regarding the tax is its relationship to other explicit and implicit levies paid by the industry, for example the electricity levy.¹⁷¹ New levies, charges and financial outlays are also being proposed. These include the need to make financial provisioning for the rehabilitation of environmental impacts of mining operations in terms of Section 24P of the National Environmental Management Act 107 of 1998 (NEMA) and to “top-up” the financial provision throughout the life of the mine. The Department of Water Affairs and Sanitation is also planning to engage with stakeholders in 2015 regarding a proposed “environmental levy” for remediation activities required to address acid mine drainage, one of the most profound environmental impacts of mining activities in South Africa.¹⁷² The Chamber of Mines also remains opposed to the carbon tax, particularly because of the most recent weakening of commodity prices and the subsequent pressure on mining revenues.¹⁷³

3.3 The South African mining industry, climate change adaptation and environmental impact assessments

As discussed above, the mining industry is not immune to the effects of climate change. Internationally, and through the work of the ICMM, many mining companies are faced with adaptation challenges. These include increased dust emissions; additional pressures on biodiversity; potential structural instability of engineered waste disposal facilities; disruptions in electricity supply (particularly given South Africa’s predominately coal reliant and partially hydropower reliant electricity supply infrastructure); and, most profoundly, impacts on water quantity and water quality. A South African example is the potential impact of a number of proposed (and existing) coal mining projects in the Waterberg region of the Limpopo Province which are ostensibly necessary to supply Eskom’s future coal needs. Interested and affected parties have expressed significant concerns about the impacts of these projects in a water-constrained environment, particularly their acid mine drainage-generating potential.¹⁷⁴ Given that water quantity and quality is likely to be the sector posing the most serious climate change adaptation challenges, the potential for mining activities to exacerbate this impact,

¹⁷¹ See <http://www.moneyweb.co.za/archive/sa-mining-sector-open-to-persuasion-on-carbon-tax/>

¹⁷² This levy was proposed in the 2014 Budget Review and is discussed in <http://www.sabinetlaw.co.za/environmental-affairs-and-water/articles/acid-mine-drainage-levy-cards>.

¹⁷³ <http://www.moneyweb.co.za/in-depth/nene-gives-but-takes-more-economist/>

¹⁷⁴ Department of Environmental Affairs (DEA) *South Africa’s Second National Communication under the United Nations Framework Convention on Climate Change* (2011) (UNFCCC Nat Comm) 7.

particularly on a cumulative basis, needs to be carefully considered in adaptation strategies and reconciliation studies for the relevant catchment (as well as assessments of the Reserve) under the National Water Act 36 of 1998 (NWA). These updated studies, should then play a fundamental role when water use licenses are issued for mining activities in this area.

Such considerations are not only limited to licensing under the NWA. It is imperative that they also inform and underpin a wide array of energy policy development, long term infrastructural planning (in particular decisions relating to siting of mining and energy related infrastructure) and agricultural developments or expansions. This is particularly so in the context of long term energy planning, which in South Africa is integrally reliant on the exploitation of existing coal reserves. This is not only because the burning of fossil fuels is likely to increase GHG emissions, but it is also likely to place an additional and potentially devastating strain on water resources. There are also obvious implications for the water, energy and food nexus, as discussed in the **water chapter xxx**. Decisions relating to mining, particularly projects which are linked to and underpin long term energy trajectories, should not be considered on a case-by-case basis. These should rather be harmonized with the available information on the likely climate change impacts of such projects both on a policy and planning scale, but also on an individual licensing basis.

It is also increasingly likely that mines will need to take into account climate change impacts during the EIA phase of project planning. This is necessary not only to comply with the spirit and object of such assessments in terms of Chapter 5 of NEMA so as to consider all environmental risks and impacts, but also to appropriately internalize costs which are likely to be exacerbated as a result of climate change impacts. It is also necessary so as to take into account unforeseen risks as a result of climate change which may affect the overall viability of the project. While the 2014 EIA Regulations do not mention climate change, as noted above, there is a duty to take into account “cumulative impacts”.¹⁷⁵ Arguably, the need to take consider cumulative impacts is sufficiently broadly framed to require the consideration of climate change impacts, either as a result of that activity itself exacerbating GHG emissions or as a result of it causing an increased vulnerability to the impacts of climate change. Almost all large, listed mining companies operative in South Africa are aware of the need for climate change adaptation, but this area of work appears to lag far behind their efforts to mitigate GHG emissions.

4. Conclusions

The climate relevance of mining is high, and particularly so in a South African context. The mining industry, primarily through its use of electricity is a significant emitter of GHGs, contributing substantially to anthropogenic climate forcing. The South African coal mining industry also consistently feeds the mining-energy nexus by supplying Eskom’s coal-fired power plants. And

¹⁷⁵ Cumulative impacts include “the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities.”

yet, as the preceding discussion has demonstrated, the industry's relationship to climate change is complex. Mining will be key in providing the raw materials necessary to roll out certain green technologies necessary to reduce GHG emissions. And the industry itself is already experiencing the need to adapt to climate change impacts, which have in some cases (the Diavik diamond mine for instance) significantly increased operating costs.

Through the work of the ICMM, there has been important policy development on mitigation, carbon pricing and adaptation. At a national level, firms are operating in a policy and regulatory landscape of which only the outlines have been etched. Even the mooted carbon tax, the most fully-developed of the government's climate change policies, has not yet been operationalized in legislation. South Africa also appears to be lagging behind other jurisdictions in considering the revenue neutrality of the proposed carbon tax (as other environmental levies and taxes appear to be proliferating), whether carbon revenue recycling, will take place, and who the beneficiaries of such recycling might be. Other aspects of the carbon tax policy, such as the adjustments to the 60 per cent tax-free threshold, adjustments for trade-exposed and technologically and structurally sensitive sectors, and carbon offsets, remain opaque. As for the other pillars of the government's climate change mitigation policy – the MPA, determination of DEROs and carbon budgets, and the assessment of national employment vulnerability – both policy detail and the form regulatory intervention will take are lacking. Failure to incorporate climate change considerations into the prior environmental assessment of mining activities in the recently developed 2014 EIA regulations is also a major missed opportunity.

At the moment, therefore, the carbon tax is probably the single biggest regulatory instrument steering the mining industry toward a low-carbon future. While the carbon tax on firms' scope 1 emissions could be whittled down a mere ten per cent of emissions, the threat of increased electricity costs arising from taxation of scope 2 emissions appears to be driving firms to rethink energy efficiency and source of electricity supply.

As the preceding discussion has demonstrated, it is difficult to pin down aggregate GHG emissions data for the mining industry globally and nationally, and difficult to compare the performance of firms based on their published GHG figures. The reporting protocol for GHG Emissions Inventories does not assist in this matter as it defines "sectors" in a broad, cross-cutting manner. As discussed above firms are responding to the call to monitor and report on GHG emissions. In a few cases absolute GHG emissions or emissions intensity has been reduced, but in others the trend is moving in the wrong direction. Some mining companies (for example, Sibanye Gold) are standing out from the herd in terms of technical innovation and creativity, which may over the long term improve their competitiveness.

The mining industry is responding slower to the need for climate change adaptation, both at a global and a national level. In this area there is a need for further policy development, probably initiated by the mining industry itself. Most of all, however, it is apparent that the global mining industry's response to climate change is not helped by the "patchwork" international regulatory

regime that has developed under the auspices of and around the UNFCCC process. Mining firms worry about competitiveness and different national mitigation and carbon-pricing policies further skew the playing field. The articulation of universally binding mitigation obligations and an international price on carbon may go some way toward making mining firms willing to introduce more radical emissions reductions strategies. It is unrealistic, to urge mining firms to accept a reduction in their market share and revenues, when the model of continued expansion of share and profits is what drives investment. Some reform of the investment landscape, both national and international, is therefore also indicated.