

Paradise Lost? The red right hand of green technology

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This article addresses issues of climate and environmental injustice through the lens of electric vehicle (EV) usage. The current market for batteries relies very heavily on Lithium-Ion (Li-Ion) batteries, as they provide 'high efficiency and low cost'.¹ In 2020, BloombergNEF forecast that by 2040, 58% of global passenger vehicles sales would be EVs, with demand for batteries rising commensurately. Between 2010 and 2021, average unit price for EV batteries fell from \$1,200 to \$132 per kWh.²

This article considers the environmental impacts of EVs and assesses the extent to which impacts on local communities are reflected accurately in calculations of the benefits of EV technology. It concludes that whilst the carbon emissions and impact on climate of using EVs is significantly lower than for using petrol or diesel vehicles, the current cost of the technology simply does not reflect the disproportionate impact on the populations living near the extraction sites for the minerals needed in EV batteries.

Key words: Environmental Justice; Climate Justice; Electric Vehicles; Batteries

1 INTRODUCTION

In John Milton's *Paradise Lost*, the 17th Century poet contrasts mineral extraction with environmental destruction. Belial (either a demon or the devil) argues for peace between Heaven and Hell lest the red right hand of God should strike down in bloody vengeance, and further the risks of fiery tempests, whirlwinds, and boiling oceans.³ Mammon, on the other hand, whom one commentator refers to as a 'mining engineer',⁴ says of Hell that '[t]his Desert soile Wants not her hidden lustre, Gemms and Gold; Nor want we skill or Art, from whence to raise Magnificence'⁵ — or, to paraphrase: 'we can extract the mineral wealth from Hell and live well on it'. Whilst Belial's warnings do suggest many of the effects of climate change (record levels of forest and other fires, increasingly extreme storm patterns and warming oceans), Mammon's promises mimic the apparent corporate desire to extract mineral wealth as rapidly as possible, and to Hell with the consequences.

This article explores the age-old contest between those who would tread a more cautious and peaceful path, and those who view the maximisation of revenue as key. It does so in the context of Lithium, Cobalt and Manganese extraction for Lithium Ion (Li-Ion) batteries used to power, *inter alia*, electric vehicles.

¹ J Hong, D Lee, E-R Jeong, & Y Yi, 'Towards the swift prediction of the remaining useful life of lithium-ion batteries with end-to-end deep learning', *Applied Energy*, 278 (2020) 115646 <<https://doi.org/10.1016/j.apenergy.2020.115646>> accessed 26 May 2022.

² BloombergNEF, 'Battery Pack Prices Fall to an Average of \$132/kWh, But Rising Commodity Prices Start to Bite' (Bloomberg NEF, 2021) <<https://about.bnef.com/blog/battery-pack-prices-fall-to-an-average-of-132-kwh-but-rising-commodity-prices-start-to-bite/>> accessed 26 May 2022.

³ John Milton, *Paradise Lost, Book II* (first published 1674, Penguin 2021).

⁴ RC Fox, 'The Character of Mammon in Paradise Lost' *The Review of English Studies*, Volume XIII, Issue 49, 1962, Pages 30–39, <<https://doi.org/10.1093/res/XIII.49.30>> accessed 26 May 2022.

⁵ John Milton, n3.

Man has the fundamental right to freedom, equality and adequate conditions of life, in an environment of a quality that permits a life of dignity and well-being, and he bears a solemn responsibility to protect and improve the environment for present and future generations.⁶

So begins the 1972 Stockholm Declaration and Action Plan of the United Nations Conference on the Human Environment, linking together environmental quality and human rights in a way which may have seemed unusual at the time, but is now a much more mainstream idea. Half a century later, technological and societal developments have meant that the climate is facing an unprecedented emergency. The changes to the climate predicted by the IPCC,⁷ will, according to the principal development agencies, ‘compound’ existing poverty: ‘Its adverse impacts will be most striking in the developing nations because of their geographical and climatic conditions, their high dependence on natural resources, and their limited capacity to adapt to a changing climate’.⁸ In other words, those least able to adapt to climate change will be those who will be most impacted by it.

Climate justice, environmental justice and their respective injustices are closely linked but not the same. In this article it is suggested that attempts to alleviate *climate* injustice by reducing emissions from motor vehicles may in fact be causing *environmental* injustice during the mineral extraction processes.

Environmental Justice has been championed by scholars such as Robert Bullard, who defines it as embracing ‘the principle that all people and communities have a right to equal protection and equal enforcement of environmental laws and regulations’.⁹ Cutter argues that achieving environmental justice requires ‘equal access to a clean environment and equal protection from possible environmental harm irrespective of race, income, class, or other differentiating feature of socio-economic status’.¹⁰ More recently, Banzhaf et al point out that the correlation between ‘pollution, poverty and/or people of color’¹¹ is still the most robust way of conceptualising environmental injustice. This correlation suggests that focus needs to be given to the impacts of particular projects or policies. If the negative impact on some sectors of society (usually the poorest) is disproportionately large, then environmental injustice is present.

Climate justice falls within the wider categorisation of environmental justice. Schlosberg argues that climate change has pushed environmental justice into new areas,¹² and

⁶ Stockholm Declaration and Action Plan for the Human Environment, <http://undocs.org/en/A/CONF.48/14/Rev.1>, Principle 1.

⁷ IPCC, ‘AR6 Climate Change 2022: Impacts, Adaptation and Vulnerability, Intergovernmental Panel on Climate Change Working Group 2’ *Intergovernmental Panel on Climate Change*, (2022) <<https://www.ipcc.ch/report/ar6/wg2/>> accessed 26 May 2022.

⁸ ADB et al, ‘Poverty and Climate Change: Reducing the vulnerability of the poor through adaptation’ (Joint publication of African Development Bank; Asian Development Bank; UK Department for International Development; EU Directorate-General for Development; German Federal Ministry for Economic Cooperation and Development; Netherlands Ministry of Foreign Affairs Development Cooperation; Organization for Economic Cooperation and Development; United Nations Development Programme; United Nations Environment Programme and The World Bank, 2022) <<https://www.oecd.org/env/cc/2502872.pdf>> accessed 26 May 2022, p1.

⁹ R Bullard, ‘About Environmental Justice’ (Robert Bullard, 2019) <<https://drrobertbullard.com/>> accessed 26 May 2022.

¹⁰ S Cutter, Race, class & environmental justice. (1995) *Progress in Human Geography* 19, 1, 111-122 <<https://doi.org/10.1177/030913259501900111>> accessed 26 May 2022, p112.

¹¹ S Banzhaf, L Ma, & C Timmins, ‘Environmental Justice: The Economics of Race, Place, and Pollution’ (2019) *Journal of Economic Perspectives*, 33(1) 185–208, 190 <<https://doi.org/10.1257/jep.33.1.185>> accessed 26 May 2022.

¹² D Schlosberg, ‘Theorising environmental justice: the expanding sphere of a Discourse’ (2013) *Environmental Politics*, 22 (1), 37–55 38 <<http://dx.doi.org/10.1080/09644016.2013.755387>> accessed 26 May 2022.

that the Bali Principles of Climate Justice were ‘[a]dopted using the “Environmental Justice Principles” developed at the 1991 People of Color Environmental Justice Leadership Summit as a blueprint’.¹³ The specific point at which climate justice differs from environmental justice is debated, however. Aliozi suggests that climate justice is predicated on the move away from simply focusing on the environmental impacts of climate change towards incorporating acknowledgment of, and action to combat, the social and political impacts.¹⁴ These social and political impacts will be felt most strongly in the Global South¹⁵ and in the ‘South within the North’ — the more deprived areas of otherwise wealthy countries.¹⁶ In other words, there is a clear correlation between detrimental impact, poverty and/or people of colour, to paraphrase Banhaf et al.¹⁷

The links between both environmental and climate justice on the one hand and human rights on the other are also fairly clear, even if the formal incorporation of the concepts within legal frameworks is limited. By way of example, the European Convention on Human Rights (ECHR)¹⁸ and cases brought before its Court (ECtHR) such as *Öneryıldız*¹⁹ and *Brincat*²⁰ do not specifically mention ‘environmental justice’ even though clear links can be drawn. In *Öneryıldız*, people were allowed to build their dwelling close to a domestic refuse site and were killed when a build-up of methane gas exploded. The ECtHR found that this was a violation of Articles 2 (right to life) and 13 (right to a domestic remedy) of the ECHR and Article 1 of Protocol No 1 (right to peaceful enjoyment of possessions)²¹ as the state had failed in its duty to take adequate steps to protect its citizens. In *Brincat*, the applicants were made seriously unwell, and in one case died, as a result of exposure to asbestos in their workplace. The ECtHR held that there had been a breach of Articles 2 (right to life) and 8 (respect to private and family life) as the state had failed to put in place the required measures to protect them from mesothelioma.²² In both these cases, the approach of government was to allow activities to take place which created the benefits of cheaper waste disposal and asbestos treatment. The cost was felt more heavily by those living closest to the sites in question while the benefit was enjoyed more fully by those who were at a distance. The as-yet-undecided case of *Di Caprio v Italy*²³ which revolves around a higher risk of cancers in the ‘Tierra del Fuochi’ area of Campagna as a result of illegal toxic waste disposal is another example of this phenomenon.

In September 2021, the Social Affairs Committee of the Parliamentary Assembly of the Council of Europe (PACE) proposed what they called an ‘ambitious new legal framework’ by presenting the draft of an additional protocol to the ECHR which would cover ‘the right to a safe, clean, healthy and sustainable environment’.²⁴ Similar proposals were rejected in 2009, so it is unclear how successful the new proposal will be.

¹³ Bali Principles of Climate Justice, 2002, <<https://www.ejnet.org/ej/bali.pdf>> accessed 26 May 2022, p2.

¹⁴ A Aliozi, ‘Climate Justice: Human Rights and Animal Rights’ (2020) Resolution Journal, Vol 1 <https://www.jerseylawcommission.org/the-resolution-journal> accessed 26 May 2022.

¹⁵ Ibid.

¹⁶ Bali Principles of Climate Justice, 2002, Preamble.

¹⁷ S Banzhaf, L Ma, & C Timmins, n11.

¹⁸ European Convention on Human Rights, <https://www.echr.coe.int/documents/convention_eng.pdf> accessed 26 May 2022.

¹⁹ *Öneryıldız v. Turkey* [2004] ECHR 657.

²⁰ *Brincat v Malta* [2014] ECHR 900.

²¹ *Öneryıldız v. Turkey* [2004] ECHR 657, Para 165.

²² *Brincat v Malta* [2014] ECHR 900, para 117.

²³ *Di Caprio & Ors v Italy*, (no 38742/14).

²⁴ PACE, ‘PACE committee proposes draft of a new protocol to the European Convention on Human Rights on the right to a healthy environment’ (*Parliamentary Assembly to the Council of Europe*, 2021) <<https://pace.coe.int/en/news/8419/pace-committee-proposes-draft-of-a-new-protocol-to-the-european-convention-on-human-rights-on-the-right-to-a-healthy-environment>> accessed 26 May 2022.

Like the ECHR, the Universal Declaration on Human Rights (UDHR)²⁵ does not specifically mention either environmental justice or climate justice or protect the right to a healthy environment. Article 25(1) comes close, saying that ‘Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services...’. The Office of the High Commissioner for Human Rights (OHCHR) argues that:

if you deliberately dump toxic waste in someone's community or disproportionately exploit their natural resources without adequate consultation and compensation, clearly you are abusing their rights. As our recognition of environmental degradation has grown so has our understanding that changes in the environment can have a significant impact on our ability to enjoy our human rights. In no other area is it so clear that the actions of nations, communities, businesses and individuals can so dramatically affect the rights of others — damaging the environment can damage the rights of people, near and far, to a secure and healthy life.²⁶

The OHCHR is therefore very clear about the linkages between environmental degradation (whether related to air, ground or water) and environmental (and climate) injustices, despite not using the words. This is a promising direction of travel, despite very little associated action in the intervening years.

The present article uses EV batteries, whose number is growing rapidly, as a lens through which to examine environmental and climate justice. What will be demonstrated is that while the reduction in motor vehicles powered by internal combustion engines, and resulting diminution of the impacts of climate change, are undoubtedly beneficial, and indeed may meet many of the criteria for climate justice, the extraction of minerals for EV batteries causes its own environmental injustices.

Most current estimates put the total number of vehicles on the road across the world at between 1.2bn and 1.4bn,²⁷ although all acknowledge the difficulties in ascertaining exact figures. The vast majority of these vehicles are powered by internal combustion engines, either petrol or diesel. As has been well-established for many years, the combustion process releases a range of harmful pollutants. Some of these are directly harmful to health (oxides of nitrogen, particulate matter) and others are acknowledged causes of climate change (oxides of carbon). The US Environmental Protection Agency estimates that ‘the average vehicle over a year of driving has tailpipe CO₂ emissions of about [...] 4.7 metric tons’.²⁸ Assuming the estimates of number of vehicles and average vehicle emissions are accurate, that would mean that passenger vehicles emit around 6bn tons of carbon, or around 14 per cent of the global total.²⁹

Two useful examples of the links between vehicle-related air pollution and

²⁵ Universal Declaration of Human Rights, <<https://www.un.org/en/about-us/universal-declaration-of-human-rights>> accessed 26 May 2022.

²⁶ OHCHR, ‘Stories on Human Rights: by Filmmakers, Artists and Writers’ (*Office of the High Commissioner for Human Rights*, 2008) <https://www.ohchr.org/EN/UDHR/Documents/60UDHR/Stories_on_Human_Right_PressKit_en.pdf> accessed 26 May 2022, p10.

²⁷ See for example Hedges, ‘Market Research: How many cars are there in the world in 2021?’ (*Hedges & Company*, 2021) <<https://hedgescompany.com/blog/2021/06/how-many-cars-are-there-in-the-world/>> accessed 26 May 2022; Wards, ‘Industry News: Connected Cars Must Gain Crucial Human Ability’ (*Wards Automotive*, 2019) <<https://www.wardsauto.com/industry-voices/connected-cars-must-gain-crucial-human-ability>> accessed on 26 May 2022.

²⁸ US-EPA, *EPA-420-F-14-040 Greenhouse Gas Emissions from a Typical Passenger Vehicle* (US Environmental Protection Agency Office of Transportation and Air Quality, 2020), p2.

²⁹ IPCC, ‘AR5 Climate Change 2014: Mitigation of Climate Change, *Intergovernmental Panel on Climate Change Working Group 3*, 2014) <<https://www.ipcc.ch/report/ar5/wg3/>> accessed on 26 May 2022.

environmental injustice come from India and the UK. Garg³⁰ concluded that those living in low-income groups in Delhi faced a 64 per cent higher risk of death and a 68 per cent higher risk of developing asthma from air pollution than those in high income groups. In the UK, a very useful meta-study was published by Natural England in 2019, which found that levels of inequality in the UK fell as air quality improved, ‘but deprived areas have the slowest rate of air quality improvement, and most cases where air quality deteriorates’.³¹ Focusing on areas with over 40µg/m³ of NO₂ annually, the study demonstrates a much greater drop from 2001 to 2011 amongst people living in Q1 areas (least deprived) compared to those living in Q5 areas (most deprived). The studies from India and UK, as well as several others from around the world,³² clearly demonstrate that poor air quality is considerably more of a problem in lower income areas in the same country (the ‘South within the North’ covered in the Bali Principles). Poor air quality therefore meets Banzhaf et al’s ‘robust’ criteria for environmental injustice,³³ as the negative impacts are borne more heavily by those in low-income areas.

Moving away from the internal combustion engine as a way of powering vehicles will clearly have significant environmental justice and emission reduction gains. Greenhouse gases, and the impact of the climate change that results from them ‘are disproportionately felt by small island states, women, youth, coastal peoples, local communities, indigenous peoples, fisherfolk, poor people and the elderly’.³⁴ Any overall reduction in carbon emissions will thus be a step in the right direction.

The first ‘proper’ internal combustion engine was developed in the 1850s by Barsanti and Matteucci (though the patent went to Nicolaus Otto),³⁵ whereas fuel cells were invented in the late 1830s.³⁶ What are today considered alternative methods for powering vehicles have thus been around for longer than the internal combustion engine.

Thomas³⁷ used US Department of Energy figures to calculate that internal combustion engines typically use around 13 per cent of the energy in fuel to power the vehicle, and the rest is lost in noise, heat, ‘engine and driveline inefficiencies or used to power accessories’.³⁸ One of the leading alternatives to the internal combustion engine is battery power. Miller et

³⁰ A Garg, ‘Pro-equity Effects of Ancillary Benefits of Climate Change Policies: A Case Study of Human Health Impacts of Outdoor Air Pollution in New Delhi’ (2011), *World Development*, 39 (6) 1002-1025, <<https://doi.org/10.1016/j.worlddev.2010.01.003>> accessed on 26 May 2022.

³¹ Natural England, ‘The Messy Challenge of Environmental Justice in the UK: Evolution, status and prospects: Natural England Commissioned Report NECR273’ (*Natural England*, 2019) <<http://publications.naturalengland.org.uk/file/5425667586129920>> accessed on 26 May 2022, p6.

³² See, for example N Kravitz-Wirtz, S Teixeira, A Hajat, B Woo & K Crowder, ‘Early-Life Air Pollution Exposure, Neighborhood Poverty, and Childhood Asthma in the United States, 1990–2014’ (2018) *International Journal of Environmental Research and Public Health*; 15 (6) 1114. <<https://doi.org/ijerph15061114>> accessed on 26 May 2022; M Kristiansson, K Sörman, C Tekwe & A Calderón-Garcidueñas, ‘Urban air pollution, poverty, violence and health – Neurological and immunological aspects as mediating factors’ (2015) *Environmental Research*, Vol 140, Pages 511-513, <<https://doi.org/10.1016/j.envres.2015.05.013>> accessed on 26 May 2022.

³³ S Banzhaf, L Ma & C Timmins, n11

³⁴ Bali Principles of Climate Justice, 2002, Preamble.

³⁵ J Kunze & U Stimming, ‘Electrochemical Versus Heat-Engine Energy Technology: A Tribute to Wilhelm Ostwald’s Visionary Statements’ (2009) *Angewandte Chemie (International ed.)* 48 (49), <<https://doi.org/10.1002/anie.200903603>> accessed 26 May 2022.

³⁶ JM Andújar & F Segura, ‘Fuel cells: History and updating. A walk along two centuries’, (2009) *Renewable and Sustainable Energy Reviews*, 13 (9) <<https://doi.org/10.1016/j.rser.2009.03.015>> accessed 26 May 2022.

³⁷ J Thomas, ‘Drive Cycle Powertrain Efficiencies and Trends Derived from EPA Vehicle Dynamometer Results’ (2014) *SAE International Journal of Passenger Cars – Mechanical Systems*. 7(4):1374-1384, <<https://doi.org/10.4271/2014-01-2562>> accessed 26 May 2022.

³⁸ US Department of Energy, ‘Where the Energy Goes: Gasoline Vehicles’, (*US Department of Energy Office of Energy Efficiency and Renewable Energy*, no date) <<https://www.fueleconomy.gov/feg/atv.shtml>> accessed 26 May 2022.

al³⁹ calculate that EVs convert between 77 per cent and 100 per cent of the electrical energy to power the vehicle — at least six times greater than internal combustion engines. No wonder then that BloombergNEF forecast that EV's share of global passenger vehicles sales will rise from 4 per cent in 2019 to 58 per cent by 2040.⁴⁰

The current battery market relies very heavily on Lithium-Ion (Li-Ion) batteries, as they provide 'high efficiency and low cost'.⁴¹ Li-Ion batteries were first put to commercial use by the electronics giant Sony in 1991⁴² and as well as their use in EVs are widely used in portable electronic devices such as mobile phones. Although the focus of this article is on their use in EVs, the conclusions will apply equally to all their uses. Regardless of their use, Li-ion batteries require four elements — a cathode, anode, electrolyte and a separator.⁴³ The cathode is most commonly lithium cobalt oxide (LiCoO₂), but may also be lithium manganese oxide (LiMn₂O₄) or lithium nickel cobalt oxide (LiNiCoO₂) and the anode is most commonly graphite baked on to copper foil.⁴⁴ The three most common elements used in the cathode therefore are lithium, cobalt, manganese, and the remainder of this present article focuses on the environmental justice and human rights implications of the extraction of these minerals.

All the minerals discussed are mined, in one form or another, and then processed. Highlighting the relationship between extraction and human rights violations, Whitmore⁴⁵ quotes the West Papuan environmentalist John Rumbiak on the relationship between extractive industries in general and the rights of Indigenous communities:

To put an end to these dynamics of destruction and violence, the international community — particularly international investors — must, first and foremost, recognise indigenous communities' basic rights to chart their own development paths, to manage their own resources, to pursue their traditional livelihoods and cultures, and to say 'no' to multinational operations on their lands. The failure to respect communities' basic right to 'just say no' exists at the heart of the nexus of human rights violations, environmental degradation and conflict.⁴⁶

It is against this backdrop that the present discussion will take place. For each mineral, the discussion will be offered in three sections. Firstly, a brief explanation of the extraction process will be given, covering location, methods, scale and efficiency. Secondly, the environmental and social impacts of the extraction stage will be considered. Finally, the relationship between the environmental and societal impacts and both the universal and relevant regional human rights standards will be assessed.

³⁹ M Miller, A Holmes, B Conlon, & P Savagian, 'The GM "Voltec" 4ET50 Multi-Mode Electric Transaxle' (2011), SAE International Journal of Engines 4(1):1102-1114, 2011, <<https://doi.org/10.4271/2011-01-0887>> accessed 26 May 2022.

⁴⁰ BloombergNEF, 'Electric Vehicle Outlook 2020: Executive Summary' (BloombergNEF, 2020), <<https://bnf.turtl.co/story/evo-2020/page/1>> accessed 26 May 2022.

⁴¹ J Hong, D Lee, E-R Jeong, & Y Yi, n1

⁴² B Scrosati, J Hassoun, & Y-K Sun, Y-K, 'Lithium-Ion batteries: A look to the future' (2021) Energy Environ. Sci., Vol4, 3287-3295, <<https://doi.org/10.1039/C1EE01388B>> accessed 26 May 2022

⁴³ Samsung SDI, 'Technology: The Four Components of a Li-ion Battery' (Samsung SDI, 2016), <<https://www.samsungsdi.com/column/technology/detail/55272.html>> accessed 26 May 2022

⁴⁴ CEI, 'Lithium-Ion Battery' (University of Washington Clean Energy Institute, 2020) <<https://www.cei.washington.edu/education/science-of-solar/battery-technology/>> accessed 26 May 2022; K Rajagopalan, D Rajan & MH Weatherspoon, 'The effect of pulse charging on commercial lithium nickel cobalt oxide (NMC) cathode lithium-ion batteries', (2020) Journal of Power Sources, v479 229085, <<https://doi.org/10.1016/j.jpowsour.2020.229085>> accessed 26 May 2022; Targray, 'Anode Materials: High-performance anode materials for lithium-ion battery manufacturing' (Targray, 2022) <<https://www.targray.com/li-ion-battery/anode-materials>> accessed 26 May 2022.

⁴⁵ A Whitmore, 'The emperor's new clothes: Sustainable mining?' (2006) Journal of Cleaner Production, 14 (3) 309-314, <<https://doi.org/10.1016/j.jclepro.2004.10.005>> accessed 26 May 2022.

⁴⁶ Ibid.

2 LITHIUM: FLAMINGOES, MICROCYSTINS AND THE ATACAMEÑOS

Lithium is a soft, white, highly reactive metal. Because of its nature, which causes a violent reaction when exposed to water, it does not occur in its pure form unprocessed, and must be extracted, either from brine, or from rock.

2a Chilean Lithium

Chile has the largest reserves of lithium in the world, at just over 9 million tons.⁴⁷ Its current production of 26,000 tons annually lags far behind Australia, for example, which produces 55,000 tons annually.⁴⁸ Chilean lithium mining is focused on the *Salar de Atacama*, a massive salt flat in the Atacama Desert, one of the driest places on earth. The water requirements for Chilean lithium mining are huge, as the lithium is dissolved in the brine of the *Salar*. Gutiérrez et al⁴⁹ calculated the rate of water use at 17,000 litres per second, and Katawala⁵⁰ says that 500,000 gallons (2.2 million litres) of water is needed to produce 1 ton of lithium. Some estimates put the water use for lithium as two thirds of the region's entire water budget.⁵¹

To the East of the *Salar* is the Los Flamencos Nature Reserve, home to the Andean Flamingo (*Phoenicoparrus andinus*), listed as 'vulnerable' on the IUCN's Red List of threatened species.⁵² Gutiérrez et al⁵³ argue that the extraction for lithium is threatening the flamingo, and this finding is backed up by IUCN which lists mining and quarrying among the known threats to the species.⁵⁴ Wanger reports that reductions in flamingo numbers in similar habitats elsewhere have led to a rise in microcystin (a toxin produced by cyanobacteria)⁵⁵ which is a liver toxin and possible carcinogen,⁵⁶ and can be fatal to humans. Since lithium extraction in the *Salar* is known to be reducing flamingo numbers, this rise in cyanobacteria and microcystin appears inevitable. Though the area close to the Nature Reserve is sparsely populated,⁵⁷ there are Indigenous Atacameño communities which have shifted over time from living mainly as subsistence farmers and transhumant pastoralists⁵⁸ to living as wage labourers in the mining industries.⁵⁹ These communities do not generally have access to drinking water

⁴⁷ USGS, 'Mineral Commodity Summaries: Lithium', (*US Geological Survey*, 2022) <<https://pubs.usgs.gov/periodicals/mcs2022/mcs2022-lithium.pdf>> accessed 26 May 2022, p22.

⁴⁸ Ibid.

⁴⁹ JS Gutiérrez, JG Navedo, & A Soriano-Redondo, 'Chilean Atacama site imperilled by lithium mining' (2018) *Nature* 557 (7706): 492. <<https://doi.org/10.1038/d41586-018-05233-7>> accessed 26 May 2022.

⁵⁰ A Katwala, 'The spiralling environmental cost of our lithium battery addiction' (2018) *Wired*, <<https://www.wired.co.uk/article/lithium-batteries-environment-impact>> accessed 26 May 2022.

⁵¹ UNCTAD, *Commodities at a Glance, No. 13: Special issue on strategic battery raw materials UNCTAD/DITC/COM/2019/5* (United Nations Conference on Trade and Development, 2019), p57.

⁵² BirdLife International, 'Phoenicoparrus andinus' (*The IUCN Red List of Threatened Species* 2020) <<https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T22697387A182422217.en>> accessed 26 May 2022.

⁵³ JS Gutiérrez, JG Navedo, & A Soriano-Redondo, 'Chilean Atacama site imperilled by lithium mining' (2018) *Nature* 557 (7706): 492. <<https://doi.org/10.1038/d41586-018-05233-7>> accessed 26 May 2022.

⁵⁴ BirdLife International, n52.

⁵⁵ TC Wanger, 'The Lithium future—resources, recycling, and the environment' (2011) *Conservation Letters*, <<https://doi.org/10.1111/j.1755-263X.2011.00166.x>> accessed 26 May 2022, p205.

⁵⁶ US-EPA NARS, 'Indicators: Algal Toxins (microcystin)', (*US Environmental Protection Agency National Aquatic Resource Surveys*, 2020) <<https://www.epa.gov/national-aquatic-resource-surveys/indicators-algal-toxins-microcystin>> accessed 26 May 2022.

⁵⁷ AT Bull, BA Andrews, C Dorador, & M Goodfellow, 'Introducing the Atacama Desert' (2018), *Antonie van Leeuwenhoek* 111:1269–1272,1270 <<https://doi.org/10.1007/s10482-018-1100-2>> accessed 26 May 2022.

⁵⁸ S Babidge, 'Contested value and an ethics of resources: Water, mining and indigenous people in the Atacama Desert, Chile' (2015) *The Australian Journal of Anthropology*, 27 (1) 84-103 89.

⁵⁹ C Fernández, 'Nutrition Transition and Health Outcomes Among Indigenous Populations of Chile' (2020), *Curr Dev Nutr* 4, p3.

systems, and so carbonated drinks with added sugar have replaced water consumption for many.⁶⁰ In addition to the health risks posed by toxins and by consuming high-sugar drinks instead of water, human health is also damaged by prolonged exposure to lithium. Agusdinata et al demonstrate that lack of water has led to ‘forced migration of populations from villages and the abandonment of ancestral settlements’.⁶¹ Lithium extraction in the Atacama is therefore having ecological impacts on IUCN Red-Listed species, direct and indirect health impacts on the Atacameños populations, and societal impacts as ancestral ways of life and settlements are abandoned.

Despite the impacts of lithium extraction, it is very big business, with Chile’s exports hitting close to US\$1bn in 2021.⁶² The US-based multinational Albemarle Corporation (the world’s largest producer of lithium) and the Chile-based multinational *Sociedad Química y Minera* (SQM, the world’s second largest producer of lithium) operate three huge extraction sites on the *Salar*. Both companies lease the sites from the *Corporación de Fomento de la Producción de Chile* (Corfo) which is a government corporation. In 2014, according to the US Department of Justice, SQM paid US\$630k to a Chilean politician who ‘had influence over the Chilean government’s plans for mining in Chile, an issue of central importance to SQM’s business’.⁶³

SQM was blocked from expanding its extraction operations by the First Environmental Court in Antofagasta in 2019 in response to a petition brought by the Indigenous Advisory Council of Atacameño People.⁶⁴ The court held that the proposals did not take full account of a precautionary approach to water extraction in the *Salar*. Corfo itself is currently being criticised by Albemarle for failure to release a long-awaited report into the environmental effects of the *Salar*’s lithium mining.⁶⁵ The report should have been released in August 2020 but was still awaited in May 2022.

All of this suggests that the Chilean lithium industry is not giving due heed to issues of environmental justice, and furthermore that the Chilean State is not pushing them to do so. The country did, however, ratify the 1969 American Convention on Human Rights (ACHR, aka the Pact of San José)⁶⁶ in 1990, although it has not to date ratified the 1988 Protocol of San Salvador which protects a range of social, economic and cultural rights.⁶⁷ However, as with the UDHR and ECHR, there is nothing specifically in the ACHR to provide for a right to a healthy environment. One possible route is to follow the trail left by the ECtHR and to link the state of the environment to the right to life (ACHR, Art 4) or to the right to ‘the use and enjoyment’ of property (Art 21(1)). This approach would enable groups such as the Atacameños to use the human rights route to protect their ancestral homelands from the

⁶⁰ Ibid., p9.

⁶¹ DB Agusdinata, W Liu, H Eakin, & H Romero, ‘Socio-environmental impacts of lithium mineral extraction: towards a research agenda’ (2018) *Environmental Research Letters* 13 (12) 3001 <<https://doi.org/10.1088/1748-9326/aae9b1>> accessed 26 May 2022.

⁶² Statista, ‘Lithium exports from Chile from 2012 to 2021’ (*Statista*, 2022) <<https://www.statista.com/statistics/1122893/chile-value-lithium-exports>> accessed 26 May 2022.

⁶³ US v Sociedad Química y Minera de Chile (“SQM”) Case 1:17-cr-00013-TSC.

⁶⁴ A Laing, ‘Chilean lithium miner SQM dealt blow by environmental court ruling’ (*Reuters*, 2019) <<https://www.reuters.com/article/us-chile-sqm/chilean-lithium-miner-sqm-dealt-blow-by-environmental-court-ruling-idUKKBN1YV05T?edition-redirect=uk>> accessed 26 May 2022.

⁶⁵ D Sherwood, ‘Lithium giant Albemarle slams Chile over 'unjust' withholding of Atacama study’ (*Reuters*, 2021) <<https://www.reuters.com/article/us-chile-lithium-albemarle-exclusive-idUSKBN2AW2AB>> accessed 26 May 2022.

⁶⁶ American Convention on Human Rights (the Pact of San José) (Jose), <https://www.oas.org/dil/access_to_information_American_Convention_on_Human_Rights.pdf> accessed 26 May 2022.

⁶⁷ OAS, ‘Multilateral Treaties: American Convention on Human Rights "Pact of San Jose, Costa Rica" (B-32)’ (Organization of American States, 2021) <http://www.oas.org/dil/treaties_B-32_American_Convention_on_Human_Rights_sign.htm> accessed 26 May 2022.

impact of lithium extraction. To date, however this has not happened before the Inter-American Court of Human Rights.⁶⁸

2b Australian Lithium

In Australia, lithium is mined in rock form, so the environmental and societal issues are different from those in Chile. The largest mine is the open-pit Greenbushes mine, in the Southern tip of Western Australia. Greenbushes is owned by the Australian company Talison Lithium Pty, although that company is jointly owned by the Albemarle Corporation and the Chinese Tianqi Lithium Corporation (which also owns a significant stake in SQM in Chile).⁶⁹

In 2019, the Environmental Protection Authority of Western Australia granted permission to Talison to expand its mining operations in Greenbushes.⁷⁰ One of the EPA's environmental objectives in assessing the viability of a proposal is 'to protect social surroundings from significant harm',⁷¹ which is a sign that perhaps greater focus is being placed on local communities in Australia than in Chile. This is not always the case, however: Green, Sullivan and Nolan⁷² pointed out that 'Aboriginal Australians are... disproportionately impacted by [mining] industries due to mining occurring on or near their lands, by the imbalance of power relationships, social and legal disadvantage, and poverty'.⁷³ In the case of Greenbushes, the 'proponent's consultants undertook heritage surveys in 2015 and 2016. The survey work did not identify any sites of significance as defined under section 5 of the Aboriginal Heritage Act 1972 (AH Act)'.⁷⁴ There are, of course, well-rehearsed arguments about the objectivity of these types of assessments being carried out by those who would benefit from the development,⁷⁵ but those are for discussion elsewhere. In this case, Talison's consultants discussed the proposals with the South-West Aboriginal Land and Sea Council, and concluded that the proposals would not affect any new sites of concern under the 1972 Act.⁷⁶ Talison consulted with government agencies and stakeholders prior to its submission to the EPA, and the EPA concluded that this consultation was appropriate.⁷⁷ The records

⁶⁸ CORTEIDH, 'Sentencias', (*Corte Interamericana de Derechos Humanos*, 2022) <https://www.corteidh.or.cr/casos_sentencias.cfm> accessed 26 May 2022.

⁶⁹ Tianqi, 'Our Business: Resources', (*Tianqi*, 2022) <<http://en.tianqilithium.com/>>.

⁷⁰ EPA, 'Report 1635: Report and recommendations of the Environmental Protection Authority on the Greenbushes Lithium Mine Expansion by Talison Lithium Australia Pty Ltd' (*Environmental Protection Authority of the Government of Western Australia*, 2019a) <https://www.epa.wa.gov.au/sites/default/files/EPA_Report/EPA%20Report%20-%20Greenbushes%20Lithium%20Mine%20Expansion.pdf> accessed 26 May 2022.

⁷¹ *Ibid.*, p23.

⁷² D Green, M Sullivan & K Nolan, 'Environmental injustice in resource-rich Aboriginal Australia' in R Holifield, J Chakraborty, & G Walker (eds) *The Routledge Handbook of Environmental Justice* (Routledge 2017).

⁷³ *Ibid.*, p515.

⁷⁴ EPA, n72, p23.

⁷⁵ See, for example S Beder 'Bias and Credibility in Environmental Impact Assessment' (1993) *Chain Reaction*, 68, pp28-30; E Mostert, 'Subjective Environmental Impact Assessment: causes, problems, solutions' (1996) *Impact Assessment*, 14:2, 191-213, <<https://doi.org/10.1080/07349165.1996.9725896>> accessed 26 May 2022; A Enríquez-de-Salamanca, 'Stakeholders' manipulation of Environmental Impact Assessment', *Environmental Impact Assessment Review* (2018) v68, Pages 10-18 <<https://doi.org/10.1016/j.eiar.2017.10.003>> accessed 26 May 2022.

⁷⁶ EPA, 'Report and recommendations of the Environmental Protection Authority on the Greenbushes Lithium Mine Expansion by Talison Lithium Australia Pty Ltd: Appendix H – Aboriginal Heritage Survey (Brad Goode and Associates 2018)' (*Environmental Protection Authority of the Government of Western Australia*, 2019b) <http://www.epa.wa.gov.au/sites/default/files/PER_documentation2/Appendix%20H%20-%20Aboriginal%20Heritage%20Report.pdf> accessed 26 May 2022.

⁷⁷ *Ibid.*, p10.

submitted by Talison⁷⁸ show that a total of 32 different consultation meetings were held between February 2017 and April 2018, with a range of different groups. The majority of the meetings, however, were with government departments (9 meetings), and a community group based in the town of Greenbushes called 'Grow Greenbushes' (10 meetings). The EPA also considered as part of its process the principle of intergenerational equity, and concluded that 'the proponent has taken measures to avoid and minimise impacts and this (together with the recommended conditions) will ensure the quality of terrestrial environment is maintained for future generations'.⁷⁹

On balance, it is clear that despite low numbers of Indigenous people in the region, Talison has made reasonable steps to engage with them, and with the other local communities. This level of engagement and consideration of future generations seems to fit within some of the Bali Principles, particularly Principle 3 '...the rights of indigenous peoples and affected communities to represent and speak for themselves' and more tenuously Principle 26 '...ensuring the health of the natural world for present and future generations'.

It is worth noting that the three closest towns to the Greenbushes site (Greenbushes, Balingup and Bridgetown) have several things in common. They are all small (with a combined population of under 4,000);⁸⁰ their inhabitants earn on average around 75 per cent of the average Australian earnings;⁸¹ and they have a much lower proportion of degree-level education than the remainder of Australia (3-4% compared to 16%).⁸² Whilst this disparity doesn't necessarily translate to the 'South in the North' concept, it does mean these areas are among the least wealthy in the country and, as we have seen, these are the areas which tend to suffer environmental injustice more frequently.

The health impacts too are different when extracting lithium from ore rather than from brine. The water requirements are far lower, and although there is significant need for land, the impacts of this can be offset relatively easily. The impact of the Greenbushes extraction site on local communities is mainly caused by airborne pollutants and dust, which the World Health Organization (WHO) calls 'one of the greatest environmental risks to health'.⁸³ Particulate Matter with a diameter of less than 10 microns is known as PM₁₀. The WHO has set a guideline limit for 24-hour mean levels of PM₁₀ at 45µg/m³,⁸⁴ and argues that achieving this level should be the target of all nations. Talison's figures for 2013-18⁸⁵ show that this level was breached five times, but Talison is confident that the spikes in PM₁₀ emissions were caused by external factors.⁸⁶ Talison's licence, granted by the Western Australian Environmental Protection Agency (WEPA), set a limit of 90µg/m³, or twice the WHO guide limit.⁸⁷ This is interesting, as it suggests that WEPA air quality standards have not

⁷⁸ DAWE, 'Attachment 3 – Talison Greenbushes Lithium Mine Expansion Stakeholder Consultation Record' (*Australian Government Department of Agriculture Water and the Environment*, 2019)

<<http://epbnotices.environment.gov.au/entity/annotation/e3056463-e554-e811-886f-005056ba00a8/a71d58ad-4cba-48b6-8dab-f3091fc31cd5?t=1647475200329>> accessed 26 May 2022.

⁷⁹ EPA, n78, p11.

⁸⁰ ABS, 'Australia 2016 Census All persons QuickStats' (*Australian Bureau of Statistics*, 2020)

<<https://www.abs.gov.au/census/find-census-data/quickstats/2016/0>> accessed 26 May 2022.

⁸¹ Ibid.

⁸² Ibid.

⁸³ WHO, 'Ambient (outdoor) air pollution' (*World Health Organization*, 2020) <[https://www.who.int/news-room/fact-sheets/detail/ambient-\(outdoor\)-air-quality-and-health](https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health)> accessed 26 May 2022.

⁸⁴ Ibid.

⁸⁵ EPA, 'Report and recommendations of the Environmental Protection Authority on the Greenbushes Lithium Mine Expansion by Talison Lithium Australia Pty Ltd: Appendix G - Talison Greenbushes Dust Impact Assessment (GHD)' (*Environmental Protection Authority of the Government of Western Australia*, 2019c)

<http://www.epa.wa.gov.au/sites/default/files/Referral_Documentation/Appendix%20G%20-%20Talison%20Greenbushes%20Expansion%20Dust%20Impact%20Assessment.pdf> accessed 26 May 2022.

⁸⁶ Ibid., p13.

⁸⁷ Ibid., p10.

kept pace with WHO standards, and furthermore that even full compliance with WEPA standards may not avoid the creation of environmental injustices.

Other pollutants are caused by site traffic, which, with the expansion of the mine, is predicted to rise to a potential 200 ‘road trains’ per day. Ironically, as battery technology improves, this method of transport could eventually use electric vehicles. Currently, however, the fleet is diesel powered, and the Australian Transport Department calculates that a ‘Double B Double’ Road Train on a relatively straight road with a slight incline will use 166 litres of fuel per 100 kilometres travelled (1.4mpg)⁸⁸

Overall, the lithium industry in Australia, whilst not necessarily embracing all the principles of environmental justice, does seem to be further along the road than the Chilean equivalent, and thus the negative impact on local communities is comparatively less damaging.

In terms of laws that protect the environment, because of the Federal nature of Australia, the Australian Constitution does not ‘explicitly provide the Commonwealth Parliament with power to make laws for the environment’.⁸⁹ What Parliament can do, however, is use indirect powers (such as those relating to the country’s international obligations) to legislate.⁹⁰ The key piece of federal environmental legislation in Australia is the Environment Protection and Biodiversity Conservation Act 1999, which makes no mention of environmental rights in s3 (Objects of Act). At a state level, Western Australia has passed the Environmental Protection Act 1986, which the Environmental Defenders Office says is in ‘urgent need of reform’ as it ‘does not provide clear avenues for the community to seek climate justice’.⁹¹ Although the EDO was writing prior to the amendments to the Environmental Protection Act incorporated in the Environmental Protection Amendment Act 2020, none of these provisions, which come into force in stages over 2021 and 2022, address their concerns.

If there is little avenue for environmental justice in Federal or State environmental legislation, perhaps there might be a constitutional avenue. The Australian Human Rights Commission points out that there are:

five explicit individual rights in the Constitution. These are the right to vote (Section 41), protection against acquisition of property on unjust terms (Section 51 (xxxii)), the right to a trial by jury (Section 80), freedom of religion (Section 116) and prohibition of discrimination on the basis of State of residency (Section 117).⁹²

Pointon and Bell-James⁹³ point out that ‘Australia remains one of only 15 countries without the right to a healthy environment enshrined in our federal laws or constitution’.⁹⁴ At State level, Western Australia has no single piece of human rights legislation. Proposals were

⁸⁸ ATAP, ‘Detailed fuel consumption coefficients (uninterrupted flow)’ (*Australian Transport (Assessment and Planning)*, 2022), <<https://www.atap.gov.au/parameter-values/road-transport/appendix-e-detailed-fuel-consumption-coefficients-uninterrupted-flow>> accessed 26 May 2022.

⁸⁹ S Power, ‘Environmental Law Review’ (2015) Parliament of Australia, Library of Parliament Briefing Book, <https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/BriefingBook46p/EnvironmentalLaw> accessed 26 May 2022.

⁹⁰ Ibid.

⁹¹ EDO, Review of the Environmental Protection Act 1986 (WA), (Environmental Defenders Office, 2020) <<https://www.edo.org.au/2020/01/08/review-of-ep-act-1986-wa/>> accessed 26 May 2022.

⁹² AHRC, ‘How are human rights protected in Australian law?’ (*Australian Human Rights Commission*, 2022), <<https://humanrights.gov.au/our-work/rights-and-freedoms/how-are-human-rights-protected-australian-law>> accessed 26 May 2022.

⁹³ R Pointon, & J Bell-James, ‘The Right to a healthy environment in Australia’ (2019) Griffith Journal of Law and Human Dignity, 7 (2) <<https://griffithlawjournal.org/index.php/gilhd/article/view/1185>> accessed 26 May 2022.

⁹⁴ Ibid.

introduced in 2007⁹⁵ but nothing was enacted. By 2021, Queensland, Victoria and the Australian Capital Territory had enacted state-level human rights laws, but these were still absent in the remaining states and territories.⁹⁶

In Australia, then, there is no direct route available to use human rights provisions to ensure a healthy environment. As with Chile, there is a possible, indirect, route using the approach tried by the ECtHR and interpreting Federal and State provisions broadly enough to protect environmental quality. However, unlike the case of Chile, the Australian provisions are very limited, and such an action has never successfully been undertaken.

In summary, the extraction of lithium, whether it is from the brine of the *Salar* or the rocks of Western Australia brings with it a considerable environmental burden. In Chile, this takes the form of the displacement of Indigenous people, damage to watercourses and threats to vulnerable wildlife. These are clear examples of environmental injustices. In Australia, though the situation is markedly different, it is still those in the poorest quartile who live closest to the lithium mines and bear the brunt of any environmental degradation which is an inevitable consequence of opencast mining, without reaping the financial reward.

3 COBALT: THE DRC, CHILD LABOUR AND ZAMBIA

Cobalt, like lithium, is a grey to silver metal which does not occur naturally in its pure form and must be mined and processed from different ores. The largest sources of cobalt are the Democratic Republic of the Congo (DRC) and Zambia. Like lithium, cobalt is concentrated in a few large deposits and in many smaller deposits. Farjana et al concluded in 2019 that the process of cobalt mining releases radioactive waste, due to the gamma ray properties of the mineral,⁹⁷ and identify consumption of electricity and metal particles emitted by blasting as being the largest contributors to environmental emissions.⁹⁸

The Mukondo Mine at the southern tip of the DRC, close to the border with Zambia, is possibly the largest deposit of cobalt in the world, and the mining rights are controlled by the London-based multinational, Eurasian Natural Resources Corporation PLC (ENRC). ENRC, like SQM, has faced allegations of fraud and corruption and the Serious Fraud Office has been investigating the company for ‘allegations of fraud, bribery and corruption around the acquisition of substantial mineral assets’ since 2013.⁹⁹ This was several years before the company bought the Central African Mining and Exploration Company which had controlled the Mukondo Mine. It should be noted that unlike SQM, which admitted wrongdoing (*UV v SQM*), ENRC strongly refutes the accusations and in 2021 launched a counteraction against the SFO.¹⁰⁰

Whilst ENRC are the clear market leader in DRC, up to one fifth of cobalt is produced in artisan (small scale) mines (ASM), which may or may not work together to form larger groups. Many of the ASM are suspected of using illegal child labour for extraction, and

⁹⁵ AHRC, ‘Submission - Proposed WA Human Rights Act (2007)’ (*Australian Human Rights Commission*, 2007) <<https://humanrights.gov.au/our-work/legal/submission-proposed-wa-human-rights-act-2007>> accessed 26 May 2022.

⁹⁶ A Xamon, ‘WA Charter of Rights would protect the freedoms we hold dear’ *Western Australia Today* (Perth, 10 February 2021).

⁹⁷ SH Farjana, N Huda, & MA Parvez Mahmud, ‘Life cycle assessment of cobalt extraction process’ (2019) *Journal of Sustainable Mining*, 18(3), 150-161 150 <<https://doi.org/10.1016/j.jsm.2019.03.002>> accessed 26 May 2022.

⁹⁸ Ibid.

⁹⁹ SFO, ‘Our Cases: ENRC Ltd’ (*Serious Fraud Office*, 2022) <<https://www.sfo.gov.uk/cases/enrc/>> accessed 26 May 2022.

¹⁰⁰ K Beioley, ‘Lawyer Neil Gerrard denies ‘rape mode’ comment in ENRC trial’ *Financial Times*, (London, 30 June 2021).

the International Labor Organisation (ILO) reports that ‘children, some as young as seven years of age, work in life-threatening conditions, subject to violence, extortion and intimidation’.¹⁰¹ Whilst there is nothing specific in the Bali Declaration about child labour, it is restricted under Article 32(1) of the UN Convention on the Rights of the Child¹⁰² and under two ILO Conventions.¹⁰³ The DRC has been a member of the ILO since 1960, and has ratified both ILO Conventions, and has also ratified the UN Convention on the Rights of the Child. Any child labour which occurs in the country is therefore a clear violation of DRC’s international obligations.

A Fair Cobalt Alliance (FCA) was formed in 2019 to keep children out of mines in DRC and to help them into education.¹⁰⁴ To date, the FCA has many members from car manufacturers and battery producers, to mining companies,¹⁰⁵ and although it will take time for the FCA to achieve its aims, it is a good first step. ASM Production has recently come under the auspices of a new *Entreprise Générale du Cobalt* (Cobalt Enterprise Company), a state-owned corporation which was established in 2019. EGC ‘is responsible for purchasing all domestically produced ASM cobalt ore, prior to processing and/or transformation and marketing’,¹⁰⁶ and attempts to ensure ‘cobalt has been brought to market in a responsible manner’.¹⁰⁷ In addition, the government of the DRC regularly attempts to ban the export of unprocessed cobalt, possibly in an attempt to trigger a rise in in-country processing.¹⁰⁸

The situation in DRC has been complicated in the past because it is ‘a country weakened by violent ethnic conflict, Ebola, and high levels of corruption’.¹⁰⁹ During the Second Congo War (1998-2003) the United Nations Security Council submitted its final report,¹¹⁰ which found numerous examples of the systematic exploitation of cobalt and other mineral wealth of the DRC by forces from outside DRC, and that the ‘looting that was previously conducted by the armies themselves has been replaced with organized systems of embezzlement, tax fraud, extortion, the use of stock options as kickbacks and diversion of State funds conducted by groups that closely resemble criminal organizations’.¹¹¹ Indeed,

¹⁰¹ ILO, ‘Child Labour in Mining and Global Supply Chains’ (*International Labor Organization Child Labor Platform*, 2019) <https://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---ilo-manila/documents/publication/wcms_720743.pdf> accessed 26 May 2022, p2.

¹⁰² UN Convention on the Rights of the Child, Article 32(1) “States Parties recognize the right of the child to be protected from economic exploitation and from performing any work that is likely to be hazardous or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral or social development.”

¹⁰³ ILO Minimum age Convention 1973 (No 138) and ILO Worst Forms of Child Labour Convention, 1999 (No. 182).

¹⁰⁴ Impact Facility, ‘Fair Cobalt Alliance / L’Alliance du Cobalt Equitable’ (*Impact Facility*, 2021), <<https://www.theimpactfacility.com/commodities/cobalt/fair-cobalt-alliance/>> accessed 26 May 2022.

¹⁰⁵ Ibid.

¹⁰⁶ EGC, ‘Official Launch of *Entreprise Générale du Cobalt* in the Democratic Republic of the Congo’ (EGC, 2021) <<https://www.egcobalt-rdc.com/official-launch-of-entreprise-generale-du-cobalt-in-the-democratic-republic-of-the-congo/>> accessed 26 May 2022.

¹⁰⁷ Ibid.

¹⁰⁸ J Bedder, ‘Cobalt, copper: DRC bans export of copper and cobalt concentrates (again)’ (*Roskill*, 2021) <<https://roskill.com/news/cobalt-copper-drc-bans-export-of-copper-and-cobalt-concentrates-again/>> accessed 26 May 2022.

¹⁰⁹ D Baumann-Pauly, ‘Why Cobalt Mining in the DRC Needs Urgent Attention’ (*Council on Foreign Relations*, 2020) <<https://www.cfr.org/blog/why-cobalt-mining-drc-needs-urgent-attention>> accessed 26 May 2022.

¹¹⁰ UNSC, ‘Final Report of the Panel of Experts on the Illegal Exploitation of Natural Resources and Other Forms of Wealth of the Democratic Republic of the Congo S/2002/1146’ (UN Security Council, 2002).

¹¹¹ Ibid., p6.

Sidorova and Lyubenova¹¹² go further and argue that the exploitation of DRC's resources was not a simple result of conflict but that much of the conflict itself comprised 'artificially created chaos by various interested power parties for expansion, profit, and hope for further profit'.¹¹³ Although the war is now over, there is an ongoing insurgency by the Lord's Resistance Army under Joseph Kony which despite periodic claims that it has been defeated,¹¹⁴ continues to affect the security and stability of the country. Kony is currently subject to a US\$5m bounty offer from the US Department of Justice.¹¹⁵ The NGO Transparency International's Corruption Perceptions Index (CPI) ranks DRC as one of the ten most corrupt countries in the world,¹¹⁶ and the UNSC report concluded that 'years of lawlessness and a Government incapable of protecting its citizens have allowed the armed groups to loot and plunder the country's resources with impunity'.¹¹⁷

In Zambia, Cobalt is mined in the North of the country, close to the border with DRC. Whilst there do not seem to be issues around child labour in Zambian mines, Kakiya et al¹¹⁸ showed that Cobalt levels in soil samples taken near to mines was 15 times higher than the level deemed safe by the EU.¹¹⁹ They concluded that 'the concentrations of cobalt in all the mango fruits fall above the safety limit'¹²⁰ and recommended 'that consumption and sale of fruits obtained from these areas should be discouraged to reduce health hazards for the consumers'.¹²¹ Not only, therefore, is the process of cobalt mining causing health problems for those in the vicinity, it is also going to have knock-on economic issues because of the lost opportunities for mango sales

In early 2021, the Zambian government announced¹²² that it was bringing one of the largest mining operations under state control. Mopani Copper Mines Ltd, which was largely owned by two Swiss and Canadian Corporations, and operates one of the largest mines in Africa, will now be owned by the state. It was a longstanding policy goal of President Lungu to secure export revenue as well as tax revenue for Zambia from its considerable mineral

¹¹² G Sidorova, & E Lyubenova, 'Contemporary Wars in Africa or 21st Century Competition for Power' (2020) *Journal of Asian and African Studies*, 56(6):1318-1328 <<https://doi.org/10.1177/0021909620965609>> accessed 26 May 2022.

¹¹³ Ibid.

¹¹⁴ S Matti, 'In Pursuit of the Lord's Resistance Army: How to Deter Illegal Resource Extraction by Ugandan Forces' (2012) *Africa Today*, 59(1) 26-41.

¹¹⁵ U Zeya, 'Remarks to the Assembly of States Parties to the Rome Statute', Uzra Zeya, US Department of State Under Secretary for Civilian Security, Democracy, and Human Rights, <<https://www.state.gov/remarks-by-under-secretary-zeya-to-the-assembly-of-states-parties-to-the-rome-statute/>> accessed 26 May 2022.

¹¹⁶ TI, 'Corruption Perceptions Index 2020' (*Transparency International*, 2021) <<https://www.transparency.org/en/cpi/2020/index/nzl>> accessed 26 May 2022.

¹¹⁷ UNSC, 'Final Report of the Panel of Experts on the Illegal Exploitation of Natural Resources and Other Forms of Wealth of the Democratic Republic of the Congo S/2002/1146' (UN Security Council, 2002), p28.

¹¹⁸ P Kakiya, SM Siachoono, C Kalinda, & JM Kwenye, 'An Investigation of Concentrations of Copper, Cobalt and Cadmium Minerals in Soils and Mango Fruits Growing on Konkola Copper Mine Tailings Dam in Chingola, Zambia' (2017) *Archives of Science*, 1:103, <<https://www.omicsonline.org/open-access/an-investigation-of-concentrations-of-copper-cobalt-and-cadmium-minerals-insoils-and-mango-fruits-growing-on-konkola-copper-mine-t.pdf>> accessed 26 May 2020.

¹¹⁹ Ibid., p3.

¹²⁰ P Kakiya, SM Siachoono, C Kalinda, & JM Kwenye, 'An Investigation of Concentrations of Copper, Cobalt and Cadmium Minerals in Soils and Mango Fruits Growing on Konkola Copper Mine Tailings Dam in Chingola, Zambia' (2017) *Archives of Science*, 1:103, <<https://www.omicsonline.org/open-access/an-investigation-of-concentrations-of-copper-cobalt-and-cadmium-minerals-insoils-and-mango-fruits-growing-on-konkola-copper-mine-t.pdf>> accessed 26 May 2020, p3.

¹²¹ Ibid.

¹²² NAZ, 'Ministerial Statement by the Minister of Mines and Minerals Development' (*National Assembly of Zambia*, 2021) <<https://www.parliament.gov.zm/node/8769>> accessed 26 May 2022.

wealth,¹²³ and the acquisition of Mopani fits well with this strategy. It is not known whether the August 2021 elections, which saw President Lungu defeated and replaced by President Hichilema will result in a change to this policy.

In terms of environmental justice in the cobalt mining industries in DRC and Zambia, the regional human rights charter is the Banjul [African] Charter on Human and Peoples' Rights (ACHPR).¹²⁴ This gives citizens 'the right to a generally satisfactory environment favourable to their development' (Article 24). Both the DRC and Zambia are signatories to the Charter, but neither has complied with their Art 62 obligation to report every two years on 'the legislative or other measures taken, with a view to giving effect to the rights and freedoms recognized and guaranteed by the Charter'.¹²⁵ The DRC has not reported since 2015, and Zambia has not reported since 2004, and has the dubious honour of being the state with the largest number of overdue reports.¹²⁶ Both states are also signatories to various other international and regional measures which serve to protect issues of environmental justice, yet the corruption in each country is seemingly endemic. The instability resulting from corruption has meant that the countries' mineral wealth is extracted largely for the benefit of foreign-owned corporations and populations, and largely at the cost of local communities. And, once again, using the words of Banzhaf et al,¹²⁷ there is a clear correlation between poverty and detrimental environmental impact.

4 MANGANESE: STEEL VERSUS BATTERIES

Manganese is most commonly used in the production of steel and the increase in its use for battery technology means that there is increasing competition for the finite stocks of the mineral. The US needs 500kt per year to feed its steel industry, for example¹²⁸ all of which is imported. China, by far and away the world's biggest steelmaker, produces around 11mt of manganese a year and imports a further 30mt a year.¹²⁹ In 2019, Statista estimated the global reserves of manganese at 810mt¹³⁰, which suggests that these will be exhausted in under 20 years. The largest exporter of Manganese ore 'containing 47% or more manganese' is Gabon, on the West African coast.¹³¹ In 2015, Gabon opened its first manganese processing plant, which is fuelled by hydroelectric power from a nearby dam.¹³² Industrial exports from

¹²³ G Mushingie, 'Nationalizing Zambia's copper mines' (*DeutscheWelle*, 2021) <<https://www.dw.com/en/nationalizing-zambias-copper-mines/a-56843152>> accessed 26 May 2022.

¹²⁴ ACHPR, 'African Charter on Human and Peoples' Rights' (*African Commission on Human and Peoples' Rights*, 2022a) <<https://www.achpr.org/legalinstruments/detail?id=49>> accessed 26 May 2022.

¹²⁵ ACHPR, 'Status of State Reporting' (*African Commission on Human and Peoples' Rights*, 2022b) <<https://www.achpr.org/statepartiestotheafricancharter>> accessed 26 May 2022

¹²⁶ Ibid.

¹²⁷ S Banzhaf, L Ma, & C Timmins, n11.

¹²⁸ Palisade, 'Manganese – the third electric vehicle metal no one is talking about' (*Palisade Research*, 2007) ><https://www.mining.com/web/manganese-the-third-electric-vehicle-metal-no-one-is-talking-about-it-heres-how-to-take-advantage/>> accessed 26 May 2022.

¹²⁹ J Davies, & A Lv, 'China's manganese ore imports in H1 surge by 28% on growing demand' (*MetalBulletin*, 2019) <<https://www.metalbulletin.com/Article/3887644/Chinas-manganese-ore-imports-in-H1-surge-by-28-on-growing-demand.html>> accessed 26 May 2022.

¹³⁰ Statista, 'Reserves of manganese worldwide from 2005 to 2020' (*Statista*, 2021) <<https://www.statista.com/statistics/247609/world-manganese-reserves/>> accessed 26 May 2022.

¹³¹ USGS, 'Mineral Industry Surveys: Manganese in June 2021' (*UN Geological Survey*, 2021) <<https://prd-wret.s3.us-west-2.amazonaws.com/assets/palladium/production/atoms/files/mis-202106-manga.pdf>> accessed 26 May 2022.

¹³² C Kotze, 'Gabon engages in the local processing of manganese' (*Mining Review Africa*, 2015), <<https://www.miningreview.com/top-stories/gabon-engages-in-the-local-processing-of-manganese/>> accessed 26 May 2022.

the plant started three years later.¹³³ The establishment of the plant initiated the move to replace the previous practice of artisanal mining (ASM), which had been the norm for many decades.¹³⁴ The plant is operated by COMILOG (Compagnie Minérale d'Ogouée), a vast manganese mining and processing company based in Gabon, which is itself a subsidiary of the French Eramet company, which turned over around €3.5bn in 2020.¹³⁵ Eramet mines manganese in the southwest of Gabon, in a large open cast mine close to the town of Moanda, and also operates the School of Mines and Metallurgy in the town. This educational project demonstrates at least an alignment with the Bali Principles (principle 25),¹³⁶ insofar as the School provides local people with an opportunity to learn about, and become more engaged with the mining industry. However, Fisher et al¹³⁷ argue that while ASM for Manganese creates many positive opportunities for miners, 'the related bureaucratic regulation can also entail a significant cost in terms of time and taxes for mining communities'.¹³⁸ This reality suggests that there are economies of scale in this regard for ASM miners to band together into groups, as happens on occasion in the DRC with ASM cobalt miners.

Manganese mining has elsewhere been linked to a range of damage to the development of children, including skeletal deformities, impaired motor skills, cognitive disorders, and disrupted metabolic processes.¹³⁹ Other reports link manganese inhalation to neurological illnesses,¹⁴⁰ and to increased alcohol consumption¹⁴¹ and demonstrate that these problems do not abate after exposure to manganese has stopped.¹⁴²

Gabon, like the DRC and Zambia, is a signatory to the Banjul Charter. A further commonality is that Gabon is also behind with its mandatory reporting, having not submitted a report since 2012.¹⁴³ There have been limited successes for environmental justice campaigns in Gabon in the past, however, with the cessation of uranium mining by Comuf (*La Compagnie des mines d'uranium de Franceville*, owned by French mining conglomerate Orano Group through

¹³³ KH Ndukong, 'Gabon - Industrial Manganese Exports Expected' (*All Africa*, 2018), <<https://allafrica.com/stories/201802060497.html>> accessed 26 May 2022.

¹³⁴ R Fisher, H Ling, R Natonis, S Hobgen, NR Kaho, W Mudita, J Markus, W Bunga & W Nampa, 'Artisanal and small-scale mining and rural livelihood diversification: The case of manganese extraction in West Timor, Indonesia' (2019) *The Extractive Industries and Society*, 6 (1) 229-240, <<https://doi.org/10.1016/j.exis.2018.08.004>> accessed 26 May 2022.

¹³⁵ Eramet, 'Financial Figures' (*Eramet*, 2022) <<https://www.eramet.com/en/investors/financial-figures>> accessed 26 May 2022.

¹³⁶ Bali Principle 25 "the education of present and future generations, emphasizes climate, energy, social and environmental issues, while basing itself on real life experiences and an appreciation of diverse cultural perspectives."

¹³⁷ R Fisher, H Ling, R Natonis, S Hobgen, NR Kaho, W Mudita, J Markus, W Bunga & W Nampa, n134

¹³⁸ *Ibid.*, p239.

¹³⁹ YD Duka, SI Ilchenko, MM Kharytonov & TL Vasylyeva, 'Impact of open manganese mines on the health of children dwelling in the surrounding area' (2011) *Emerging Health Threats Journal*, Vol 4, <<https://doi.org/10.3402/ehj.v4i0.7110>> accessed 26 May 2022.

¹⁴⁰ HA Roels, P Ghyselen, JP Buchet, E Ceulemans & RR Lauwerys, 'Assessment of the permissible exposure level to manganese in workers exposed to manganese dioxide dust' (1992) *British Journal of Industrial Medicine*, 49, 25-34, <<https://doi.org/10.1136/oem.49.1.25>> accessed 26 May 2022.

¹⁴¹ M Bouchard, D Mergler, M Baldwin, MP Sassine, R Bowler & B MacGibbon, 'Blood Manganese and Alcohol Consumption Interact on Mood States Among Manganese Alloy Production Workers' (2003) *Neurotoxicology*, 24, 641-7, <[https://doi.org/10.1016/S0161-813X\(03\)00028-7](https://doi.org/10.1016/S0161-813X(03)00028-7)> accessed 26 May 2022.

¹⁴² R Lucchini, P Apostoli, C Perrone, D Placidi, E Albinì, P Migliorati, D Mergler, MP Sassine, S Palmi & L Alessio, 'Long-term exposure to "low levels" of manganese oxides and neurofunctional changes in ferroalloy workers' (1999) *Neurotoxicology*, 20, 287-297, <<https://pubmed.ncbi.nlm.nih.gov/10385891/>> accessed 26 May 2022.

¹⁴³ ACHPR, n126.

its subsidiary Areva) at Mounana in 1999.¹⁴⁴ Health complications linked to the mining process continue, however,¹⁴⁵ and Areva announced that ‘in 2008, uranium prospecting activities resumed and are continuing with the AREVA Gabon subsidiary’.¹⁴⁶ Accordingly, any ‘successes’ in preventing extraction are modest.

In sum, we have seen that there are clear examples of environmental injustices in the case of all three minerals. This is true whether the extraction takes place in a wealthy country (Australia’s GDP per capita is the 20th highest in the world¹⁴⁷) or a poor country (the DRC’s GDP per capita is the 8th lowest in the world¹⁴⁸), or in a country with significant issues with corruption (DRC is the 10th most corrupt country, while Australia is the 11th least corrupt country¹⁴⁹). The driver for environmental injustice seems to be the failure of states and international instruments to do much more than pay lip service to attempts to prevent it. Despite the OHCHR arguing fairly unequivocally that ‘changes in the environment can have a significant impact on our ability to enjoy our human rights’,¹⁵⁰ the ECHR and UDHR offer no direct path for victims to follow. The Pact of San José and the Banjul Charter both have provisions which appear to protect the rights of Indigenous populations from environmental degradation, but yet again, there is a marked lack of cases to demonstrate an appetite or ability to enforce those rights.

5 EXCLUSIONS

This article has intentionally omitted a detailed focus on the mineral processing stage of battery production, or on the shipping of materials to sites where they are assembled into complete batteries. However, in brief, the five largest manufacturers of Li-ion batteries in 2021 were Tesla (USA, although *gigafactory 1* is a joint venture with Panasonic); Panasonic (Japan); LG Chem (South Korea); CATL (China); and BYL (China).¹⁵¹ This geographic distribution means that lithium is transported from Chile and Australia to Southeast Asia, as is Cobalt from central Africa and Manganese from Africa, South America and Australia. This transportation is usually by ship, an industry which the International Maritime Organisation (IMO) says is responsible for 2.89% of anthropogenic carbon emissions, a rise on the figures from the previous IMO study in 2011.¹⁵²

The manufacturing of pieces for batteries is significantly less polluting than it was in the past, but it is significant that the main manufacturers are operating in countries with

¹⁴⁴ B Özkaynak, B Rodriguez-Labajos, & CI Aydin, ‘Towards environmental justice success in mining resistances: An empirical investigation’ (EJOLT Report No 14, 2015) <http://www.ejolt.org/wordpress/wp-content/uploads/2015/04/EJOLT_14_Towards-EJ-success-mining-low.pdf> accessed 26 May 2022.

¹⁴⁵ G Hecht, ‘An elemental force: Uranium production in Africa, and what it means to be nuclear’ (2012) Bulletin of the Atomic Scientists, 68(2):22-33 <<https://doi.org/10.1177/0096340212440352>> accessed 26 May 2022.

¹⁴⁶ Areva, ‘Responsible Development report 2016 on Areva’s Mining Activities’ (*Areva Mines*, 2016) <https://www.orano.group/docs/default-source/orano-doc/expertises/producteur-uranium/rapport-de-responsabilite%20-%20societal/archives-rse-en/rcr_2016_en.pdf?sfvrsn=c168f4a6_6> accessed 26 May 2022, p12.

¹⁴⁷ World Bank, ‘GDP per Capita (US\$)’ (*World Bank*, 2021) <https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?most_recent_value_desc=true> accessed 26 May 2022.

¹⁴⁸ Ibid.

¹⁴⁹ TI, , n118.

¹⁵⁰ OHCHR, n26, p10.

¹⁵¹ Grepow, ‘Top Lithium Battery Manufacturers in the World 2021’ (*Shenzhen Grepow Battery Co. Ltd*, 2021) <<https://www.grepow.com/blog/top-lithium-battery-manufacturers-in-the-world/>> accessed 26 May 2022.

¹⁵² IMO, ‘4th IMO Greenhouse Gas Study: Executive Summary’ (*International Maritime Organisation*, 2021) <<https://www.imo.org/en/MediaCentre/Pages/WhatsNew-1596.aspx>> accessed 26 May 2022.

generally low levels of renewable energy, again exacerbating the environmental impact of the battery industry:

- Japan – 17% with a target of 22-24% by 2030;¹⁵³
- South Korea – 15% with a target of 40% by 2034;¹⁵⁴
- USA – 11% with no Federal targets;¹⁵⁵
- China – 10% with a target of 26% by 2030 and 60% by 2050.¹⁵⁶

These completed batteries are then shipped, either as standalone products; power units for EVs; or as completed EVs to markets in Europe, America and the wider world. All of these stages warrant further investigation to assess their environmental justice implications.

6 RECOMMENDATIONS

There are two main approaches to improving environmental justice in relation to Li-ion batteries, one economic, the other rights-based, although a hybrid approach might be the most effective.

Economically, Principle 15 of the Bali Declaration says that ‘Climate Justice affirms the need for solutions to climate change that do not externalize costs to the environment and communities, and are in line with the principles of a just transition’. In 2015, the European Environmental Agency (EEA) identified that the issue of internalising external costs had already been on the ‘agenda of European transport and environment policy’¹⁵⁷ for more than a decade, and that related EU Commission policy papers appeared in 1995, 1998, 2001¹⁵⁸ and, most recently, June 2019.¹⁵⁹ Furthermore, within the EU, there is a duty under the 2009 Clean Vehicle Directive¹⁶⁰ for all public bodies to take into account the energy and environmental impacts of all road transport vehicles over their whole lifetime. This duty, however, does not specifically extend to reducing the environmental impact of vehicle components, and of course only applies to EU member states. Bali Principle 15 also calls for ‘...the need for solutions to climate change that do not externalize costs to the environment and communities...’.

¹⁵³ Japan Times, ‘Editorial: Bump up the target for increasing renewable energy’ Japan Times (*Tokyo*, 17 August 2020).

¹⁵⁴ J Bairstow, ‘South Korea to shift to 40% clean energy share by 2034’ (Energy Live News, 2020) <<https://www.energylivenews.com/2020/05/18/south-korea-to-shift-to-40-clean-energy-share-by-2034/>> accessed 26 May 2022.

¹⁵⁵ CfSS, ‘US Renewable Energy Factsheet’ (*University of Michigan Center for Sustainable Systems*, 2020) <<https://css.umich.edu/factsheets/us-renewable-energy-factsheet>> accessed 26 May 2022.

¹⁵⁶ X Jin Yang, H Hu, T Tan & L Li, ‘China’s renewable energy goals by 2050’ (2016) *Environmental Development*, v20 Pages 83-90, <<https://doi.org/10.1016/j.envdev.2016.10.001>. The authors do, however, express their confidence that this target date will be met earlier> accessed 26 May 2022.

¹⁵⁷ EEA, ‘Internalisation of External Costs: Overview of all non-fuel related charges and internalisation policies for EEA countries’ (*European Environment Agency*, 2015) <<https://www.eea.europa.eu/data-and-maps/indicators/internalisation-of-external-costs-1>> accessed 26 May 2022.

¹⁵⁸ Ibid.

¹⁵⁹ EC, ‘Sustainable Transport: Internalisation of transport external costs’ (*European Commission*, 2019) <https://ec.europa.eu/transport/themes/sustainable/internalisation-transport-external-costs_en> accessed 26 May 2022.

¹⁶⁰ Directive 2009/33/EC of the European Parliament and of the Council on the promotion of clean road transport vehicles <http://data.europa.eu/eli/dir/2009/33/oj>.

By making the market reflect the true environmental and societal cost of Li-ion batteries, allowance can be made for several as-yet-excluded elements:

- Fair wages and a fair share of profit for those in the extraction, processing, manufacturing and transportation stages (Bali principle 14);
- Assessing the environmental, health and social impacts to local communities of each stage (Bali principles, 8, 14, 17).

The degree of reliance on raw minerals for battery production can also be reduced by investing in a more circular economy. Recycling specialists forecast that by 2030, 3.5 million tons of batteries will reach the end of their life, a seven-fold increase on 2020.¹⁶¹ At the moment these batteries are stored, as there is insufficient capacity to recycle them. Inevitably, some will reach the illicit waste market, and contribute to the myriad of environmental and social problems that accompany that market.¹⁶² Toto argues that to recycle just 15 per cent of lithium and 43 per cent of cobalt would require global recycling capacity to treble.¹⁶³ This will itself require development and construction projects which will likely contribute to GHG emissions and other pollution, and consideration also needs to be given to the impact on non-G20 states which currently provide the raw materials. Ironically, whilst reducing the global impact of Li-ion batteries, moves towards a circular economy will remove a significant income stream from the countries currently providing the raw minerals — close to US\$1bn for Chile's lithium exports,¹⁶⁴ US\$55bn for DRC's cobalt exports¹⁶⁵ or US\$1.28bn for Gabon's manganese exports,¹⁶⁶ for example, and this will need to be carefully managed to avoid yet more injustice.

Additionally, Whitmore makes a strong argument that 'attempts by the mining industry to green-wash itself as a new, improved, sustainable industry simply will not wash',¹⁶⁷ as the land of local communities 'is still being taken from them without ... their free, prior and informed consent, and they are suffering the same ill effects on their ways of life, health and environment'.¹⁶⁸ Some responses, such as the blocking by the First Environmental Court in Antofagasta of SQM's expansion plans for their lithium extraction facility, suggest this might be changing slightly, as the action was brought by the Indigenous Advisory Council of Atacameño People.¹⁶⁹ However, even if the emperor is no longer naked, as Whitmore suggests, he is wearing something ephemeral which 'scarcely keeps him warm'.¹⁷⁰

¹⁶¹ DeA Toto, 'IHS Markit: Lithium-ion battery recycling industry poised for substantial growth' (Recycling Today, 2020) <https://news.ihsmarkit.com/prviewer/release_only/slug/2020-12-09-battery-recycling-industry-poised-for-substantial-growth> accessed 26 May 2022.

¹⁶² See, for example, BIG, 'Illegal waste trade: what's driving this multi-billion-dollar transnational crime and what could stop it?' (*Basel Institute on Governance*, 2021) <<https://baselgovernance.org/news/illegal-waste-trade-whats-driving-multi-billion-dollar-transnational-crime-and-what-could-stop/>> accessed 26 May 2022.

¹⁶³ DeA Toto, n161.

¹⁶⁴ Statista 'Lithium exports from Chile from 2012 to 2021', Statista, 2021) <<https://www.statista.com/statistics/1122893/chile-value-lithium-exports-1>> accessed 26 May 2022.

¹⁶⁵ EITI, 'Democratic Republic of the Congo: Overview' (*Extractive Industries Transparency Initiative*, 2021a) <https://eiti.org/es/implementing_country/5> accessed 26 May 2022.

¹⁶⁶ OEC, 'Manganese Ore in Gabon' (*Observatory of Economic Complexity*, 2020) <<https://oec.world/en/profile/bilateral-product/manganese-ore/reporter/>> accessed 26 May 2022.

¹⁶⁷ A Whitmore, n45, p313.

¹⁶⁸ A Whitmore, n45, p309.

¹⁶⁹ A Laing, 'Chilean lithium miner SQM dealt blow by environmental court ruling' (*Reuters*, 2019) <<https://www.reuters.com/article/us-chile-sqm/chilean-lithium-miner-sqm-dealt-blow-by-environmental-court-ruling-idUKKBN1YV05T?edition-redirect=uk>> accessed 26 May 2022.

¹⁷⁰ Shakespeare, 1606, *King Lear*, Act 2, Sc 4.

Acuña¹⁷¹ suggests that a reconceptualization of the political landscape is needed, replacing the view of Indigenous peoples as ethnic minorities with a move to thinking about Indigenous nations, with territorial rights. This, he argues ‘interprets opposition to extractive activities as a want to preserve cultures and the environment, not a move underpinned by economic or political formal participation’.¹⁷² This conceptualisation could make the commission of environmental injustices harder to ignore.

7 CONCLUSIONS

As methods of powering vehicles, Li-ion batteries are not alone in causing environmental injustices — indeed, they likely cause fewer problems in this regard than do petrol and diesel. However, all of the minerals used in EV Li-ion batteries, and thus the industry as a whole, does exhibit clear signs of environmental injustice. The areas, companies, governments and people reaping the most benefit in terms of reduced emissions do not clearly overlap with those suffering the worst impacts of the extractive processes.

Greener technologies, moreover, should not simply be the ‘least-worst’ option available, and EV manufacturers should not be allowed to rely on the fact that EVs are less directly polluting than vehicles with internal combustion engines. With effort, and willpower, by industry, consumers and governments, the impacts of the supply chain industries can be recognised and rectified. Rather than simply focusing on the final product, and conveniently bypassing the immense effort expended to produce it, there is a clear need to internalise all the external costs. The additional cost to the end consumer can then be passed on to the affected communities throughout the supply chain and, in some way, compensate them for the environmental injustices of the past (Bali Principle 9).

To bolster an economic- or cost-based solution, there is a rights-based solution which warrants investigation.

One of the simplest ways to improve environmental injustice is to give affected communities access to the knowledge about environmental and climate-related issues which might affect them. Members of the European Commission for Europe, as well as those with consultative status, could sign the UNECE Århus/Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters.¹⁷³ This treaty gives citizens the right to access environmental information pertinent to their area and, while not without its flaws, it can be regarded as playing a fundamental role in harmonising relations between humans and the environment¹⁷⁴ and making ‘a valuable contribution in establishing good environmental governance’.¹⁷⁵ The preamble to the Convention recognises that protection of a suitable environment is essential to ‘human wellbeing and to basic human rights’ and further that ‘to be able to assert this right and observe this duty, citizens must have access to information, be entitled to participate in decision-making and have access to justice in environmental matters, and acknowledging in this regard that citizens may need assistance in order to exercise their rights’.

¹⁷¹ RM Acuña, ‘The politics of extractive governance: Indigenous peoples and socio-environmental conflicts’ (2014) *The Extractive Industries and Society*, vol. 2, pp. 85-92. <<https://dx.doi.org/10.1016/j.exis.2014.11.007>> accessed 26 May 2022.

¹⁷² *Ibid.*, p91.

¹⁷³ UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Århus / Aarhus Convention) <https://unece.org/environment-policy/public-participation/aarhus-convention/text>.

¹⁷⁴ A Egorov, A Sadvokassov, V Shestak & R Yerezhepyzy, *Implementing the Aarhus Convention*, (2021) *European Energy and Environmental Law Review*, 30 (4) 127.

¹⁷⁵ M Počuča, M Mladenov & P Mirković, *The analysis of the Aarhus convention in the context of good environmental governance* (2018) *Ekonomika poljoprivrede*, 65 (4), pp. 1615-1625, <<https://doi.org/10.5937/ekoPolj1804615P>> accessed 26 May 2022.

Naturally, given their position outside Europe, none of the states that have formed the focus of this article (Australia, Chile, DRC, Gabon and Zambia), are members of the ECE, and so none has signed up to the Aarhus Convention. There exists no overarching international equivalent treaty, and only one regional mechanism, so it is down to most of the individual nation states to pass their own regulations.

The regional mechanism relevant to Chile is the Escazú Agreement,¹⁷⁶ which came into force in 2021. The agreement has similar provisions to Aarhus, but Chile has yet to sign the document. Barritt suggests that ‘that procedural rights are not enough if the social-political context makes it difficult for those rights to be exercised’¹⁷⁷ and that the Escazú Agreement goes further in this regard than Aarhus.

In terms of access to information, Australia does have a searchable environmental information database ‘Find Environmental Data’, run by the Department for Agriculture and Water Resources which allows members of the public to search for specific issues, or to browse more generally.¹⁷⁸ Chile operates the SINCA (*Sistema de Información Nacional de Calidad del Aire* – National Information System on Air Quality) database, which is searchable and also has specific Historic Information sections for the different regions of Chile.¹⁷⁹ None of the DRC, Gabon or Zambia report any form of searchable environmental database available to the public. Whilst online access to environmental data is a laudable step and those countries which offer such a service are going some way to empowering their citizens, once again there are inherent injustices within this. In Australia, over 80 per cent of people have access to the Internet, in Chile the figure is around 70 per cent, whereas the equivalent figures in Zambia, Gabon and the DRC are all below 20 per cent (Zambia 17 per cent, Gabon 10 per cent and the DRC 3 per cent).¹⁸⁰ The right to access environmental information needs to extend to the access element, and is not satisfied simply by environmental information being available online.

There is some suggestion that the environmental responsiveness of extractive industries may be getting slightly better. Overland et al suggest that ‘the increase in mineral-related voluntary sustainability initiatives, including Fairtrade Gold, the Aluminium Stewardship Initiative, the Fair Cobalt Alliance, and IRMA, suggest that sustainable sourcing of minerals is becoming increasingly important’.¹⁸¹ To these can be added the Extractive Industries Transparency Initiative (EITI) as a self-proclaimed ‘global standard for the good governance of oil, gas and mineral resources’.¹⁸² These are small steps in the right direction, however.

To minimise the impact of the climate emergency and avoid its catastrophic outcomes, global society needs to move away from fossil fuels and embrace truly green technology practices as quickly as possible. Green technology that solves some injustices by

¹⁷⁶ The Regional Agreement on Access to Information, Public Participation and Justice in Environmental Matters in Latin America and the Caribbean (Escazú Agreement), <https://www.cepal.org/en/escazuagreement>.

¹⁷⁷ E Barritt, Global values, transnational expression: from Aarhus to Escazú, in V Heyvaert, & L-A Duvic-Paoli (eds.) *Research Handbook on Transnational Environmental Law* (Cheltenham: Edward Elgar, 2020).

¹⁷⁸ DAWR, Find Environmental Data, Department of Agriculture and Water Resources (Government of Australia, 2021) <<http://www.environment.gov.au/fed/catalog/search/search.page>> accessed 26 May 2022.

¹⁷⁹ SINCA, 2021, Sistema de Información Nacional de Calidad del Aire, <<https://sinca.mma.gob.cl/index.php/>> accessed 26 May 2022.

¹⁸⁰ M Roser, H Ritchie & E Ortiz-Ospina, E. ‘Internet’ (*Our World in Data*, 2015) <<https://ourworldindata.org/internet>> accessed 26 May 2022.

¹⁸¹ I Overland, A Bourmistrov, B Dale, S Irlbacher-Fox, J Juraev, E Podgaiskii, F Stammler, S Tsani, R Vakulchuk & EC Wilson, ‘The Arctic Environmental Responsibility Index: A method to rank heterogeneous extractive industry companies for governance purposes’ (2021) *Business Strategy and the Environment*, 30 (4) 1623-1643 <<https://doi.org/10.1002/bse.2698>> accessed 26 May 2022, p1632.

¹⁸² EITI, ‘Who we are’ (The Extractive Industries Transparency Initiative, 2021b) <<https://eiti.org/>> accessed 26 May 2022.

causing others — by merely replacing one issue with a different one — should not be considered a viable option.

As has been demonstrated above, small steps in the right direction are being taken, but the journey towards justice is a long one. Like Belial, the players in the EV market need to find a way to make peace with the communities adversely affected by the production and processing of Li-ion batteries, and to entrench a meaningful commitment to environmental justice.