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Article

The Post-Covid Future of the Environmental Crisis Industry and its Implications for Green Criminology and Zemiology

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Abstract

Smith and Brisman (2021) have argued that our social and cultural orientation toward environmental crises is influenced by the existence of an 'Environmental Crisis Industry' (ECI hereafter) that favours environmental 'solutions' that are palatable to state corporate interests and the global consumer classes ahead of systemic change. This article, however, argues that the ECI is evolving in the context of political-economic and geopolitical changes that have emerged as a result of the Covid-19 pandemic, and is becoming increasingly focused on renewable energy and the shoring up supply and control over the minerals and natural resources crucial to the energy transition. These, however, are not without their own harms. While green criminology has spent a great deal of time considering the harms and consequences of failing to seriously tackle climate change, it has scarcely considered the potential harms that could emerge if the ECI decided to seriously pursue zero-carbon targets. As the ECI gets more serious, this article considers these potential harms and the implications this has for criminologists and zemiologists interested in climate change and environmental harm.

Introduction

We write this article amid events that put beyond doubt any question that we are experiencing environmental crises on several fronts. Unprecedented wildfires in Siberia, calamitous floods in Germany and Belgium, and 'heat domes' ravaging the Canadian coastline dominate the environmental news. Despite unequivocal evidence from climate scientists and endless award-winning television documentaries and celebrity endorsements, little meaningful change appears to have occurred over the last several decades, and for many environmentalists we are still hurtling toward environmental disaster.

Smith and Brisman (2021) have argued that our social and cultural orientation toward environmental crises is influenced by the existence of an 'Environmental Crisis Industry' (ECI hereafter) that favours environmental 'solutions' that are palatable to state corporate interests and the global consumer classes ahead of systemic change. The ECI is loosely defined as a 'convoluted and chaotic assemblage of media, government, and corporate interests that epitomizes a neoliberal apparatus comprising political actors, corporations and organizations, aided and abetted by charities and career academics that, in combination, close the loop on the creation and absolution of the anxiety of inaction in relation to environmental crisis (ibid. 3). Narratives are generated around environmental issues by a range of actors by providing imagery, infographics, and soundbites to create new forms of eco-anxiety that have the capacity to negatively impact our lives. The very same actors then offer up a series of responses to these crises that promise to lead us from the brink of extinction and bring an end to our anxiety. In truth, such responses target the low-hanging fruit of climate change and environmental harm. Typically, the solutions endorsed by the ECI revolve around green consumerism and small-scale community activism; easy wins of government legislation around plastic use; and a 'technosalvation' that assures us that new technologies will be developed to counter or reverse environmental harms.

Rendered complicit by the connections made between our consumer habits and the devastation on our screens, we vow to shop more ethically and consider buying an electric vehicle or a bamboo toothbrush. We applaud governmental decisions to tax plastic bags and relish the opportunity to mitigate the harm of our travel through carbon offset schemes. These environmentally sympathetic decisions accrue admiration from friends, colleagues and online followers, providing us with a sense of identity and assuaging our guilt and anxiety by assuring us that we are making a difference and are on the right side of history.

In reality, engagement with the ECI has done little to impact the underpinning dynamics of global capitalism or climate change. Neoliberal political economy and consumer culture has remained broadly unaffected, while engagement with green consumer markets legitimates some of the worst aspects of consumerism rather than threatening them. The Covid-19 pandemic has exposed the gross insufficiency of the measures put forward by the ECI. Lockdown measures around the world brought commercial flights to a grinding halt. With stay-at-home orders and large numbers working from home, the number of car journeys reduced dramatically. Carbon

emissions from commercial airlines declined from 905 million tonnes in 2019 to 495 million tonnes 2020, a single year decrease of 45.3% (IATA, 2021). Outside of the Covid-19 pandemic, such measures would be among the most drastic and authoritarian environmental policies imaginable. Yet this still only amounted to an 8% reduction in global carbon emissions (IEA, 2020). While this is the largest annual reduction of carbon emissions on record, it is only just above the annual 7.6% reduction that the United Nations Environment Programme (2019) believes is required over the next decade to stay below the 1.5°C global temperature increase. The reason for this being that some of the usual targets of the ECI, such as air and car travel, are not among the biggest emitters. The electricity required to work from home, power our various electronic devices, and store our data generates just as much CO2, if not more. 'Even unprecedented and draconian lockdowns with a third of the world population confined to their homes came nowhere near to being a viable decarbonization strategy' (Schwab and Malleret, 2020: 141).

However, we cannot assume that the environmental crisis industry will, by default, continue in limiting itself to individualised feel-good solutions that assuage our anxiety and guilt while remaining entirely ineffective. The Covid-19 outbreak has opened a number of fissures in the current social and economic fabric and has exposed the fragility of our commitment to meaningful levels of behavioural change. Campaigns and legislation to reduce our use of plastic were rapidly jettisoned as supermarkets once again embraced plastic packaging and erected miles of PVC screens in bars and retail stores, while many of us who might previously have eschewed a plastic disposable coffee cup filled our shopping trolleys with throwaway PPE. Simultaneously, there appears to be a concerted shift toward technosalvation with increased public investment and government intervention in green infrastructure, renewable energy and, perhaps most importantly, a concerted effort to claw back control over the most crucial minerals for a 'green' energy transition. As we intend to show, the ECI's targets are becoming loftier. The push to substantially increase the share of renewable energy and take meaningful steps toward a 'green' energy transition is real, and the political-economic and geopolitical transformations surrounding these targets make them more achievable (and market friendly) than they have been previously.

Whether or not these measures are *sufficient* is an entirely different argument. But they are significant. Consequently, we should avoid an infantile postmodern cynicism in which our analytical efforts are limited to a default tendency to dismiss all policy changes as meaningless rhetoric. Even if these developments are ultimately insufficient in the battle against climate change, they nevertheless raise important questions which require analytical adaptability from green criminologists and zemiologists.

In the first part of this article we will outline the reasoning behind our contentions above by examining how the Covid-19 pandemic has set in motion political-economic changes, accelerated pre-existing trends, and sharpened certain geopolitical tensions in ways that have significant consequences for the environmental crisis industry. First, we examine how the pandemic has prompted many sovereign currency issuing nation-states to abandon many of the

central tenets of neoliberalism, particularly those regarding fiscal and monetary policy (Fazi, 2020; Hochuli et. al, 2021; Jäger, and Zamora, 2021). While it is still early days, there are signs to suggest that this shift away from neoliberal economic orthodoxy is not a mere emergency measure but will be selectively sustained as governments across the world attempt to fumble their way out of the pandemic. Relatedly, as the global economy attempts to recover from the pandemic, many of capitalism's political and economic elites have suggested that the time has come for a 'Great Reset' of the global economy that will usher in a Fourth Industrial Revolution geared around digital technology, green industries, deglobalisation and the shortening of supply chains (Schwab, 2016; 2018; Schwab and Malleret, 2020). Numerous heads of state and governments are openly advocating a 'green industrial revolution' as being central to the challenge of 'building back better' from the economic shock of the Covid-19 pandemic. The term 'energy transition' is now being openly used in shareholder reports and mass media interviews by politicians and corporate energy giants. Furthermore, the pandemic revealed the fragility of the elongated, just-in-time supply chains that have been a feature of globalist neoliberalism and have left deindustrialised Western states in highly precarious positions, particularly when it comes to essential goods and resources.

This latter point is particularly pertinent as we turn our attention to the importance of a range of metals and rare earth elements (REEs) for the energy transition, the fight against climate change, and the evolving ECI. In addition to being vital to military defence technologies and the electronics industry, REEs are also essential components for solar panels, wind turbines, and batteries to store energy and power things such as electric vehicles (EVs) (Abraham, 2015; Pitron, 2020). Consequently, the success of the energy transition and the so-called 'fourth industrial revolution' largely hinges upon the establishment of stable supply chains for these vital resources. However, China has established an overwhelmingly dominant position in this market in recent decades, holding a near monopoly over the extraction, processing, and exportation of these natural resources. This dominant position significantly enhances China's geopolitical influence, with concerns around their ability to effectively hold the global supply of REEs hostage as a new geopolitical trump card bringing significant uncertainty and potential volatility to the ECI and other markets reliant on REEs (MacDonald, 2021). Given the significant financial expense and legal and environmental complexities in establishing a foothold in the market for REEs – and returning to the shift away from neoliberal economic policy – we explore how Western governments such as the UK and US are leveraging monetary and fiscal policy to invest public funds in green infrastructure and green technology industries in order to 'address shortfalls in the provision of private finance to make projects happen that would otherwise not have had the necessary support' (HM Treasury, 2021: 4).

In the second part of this article, we consider the implications of these developments for green criminology. A somewhat neglected but undeniable reality is that mining is an essential pre-requisite for the drive to achieve net zero carbon emissions and a 'green energy transition' (Abraham, 2015; Hund et. al, 2020; IEA, 2021a; Pitron, 2020; World Bank Group, 2017). Significant reductions in carbon emissions and the shift toward these 'greener' forms of energy

therefore necessitate not just the continuation of mining, but a substantial *increase* in the mining of these metals, minerals and REEs in order to meet demand. But mining is an inherently dirty business irrespective of what is being extracted, and the mining, processing, and refinement of REEs in particular is extremely energy-intensive, pollutive, and destructive to the natural environment and local populations in ways that are distributed unevenly along existing lines of global inequality (Pitron, 2020). This basic and seemingly unavoidable contradiction – that combatting climate change and achieving 'green' societies and energy infrastructures is necessarily built upon mining, environmental destruction, and pollution – poses some difficult political, ethical, and policy conundrums for those who critically study environmental harm and climate change.

Where and *who* is mining and processing these vital resources for the energy transition are also crucial questions for a variety of environmental and human rights reasons that are of significant interest to green criminology and zemiology. The major players in the mining of REEs have extremely dubious track records when it comes to human and workers' rights, and the geographic areas in which REEs are found in high enough concentrations to be mined profitably tend to be in South America, Africa, China, and other parts of Asia where global inequalities and forms of exploitation can be exacerbated and intensified and environmental regulations have historically been lax, poorly enforced, or both. In all of these locations, illegal mining operations also make up a significant proportion of the global supply of REEs, complicating matters further in ways that should be of central importance to green criminology (Lee and Wen, 2018). Furthermore, as the ECI becomes increasingly entangled with geopolitics (Harasim, 2020; Pitron, 2020), green criminology must also broaden its gaze to consider the harms, violence, and corruption that emerges from such resource wars, geopolitical jockeying, and industrial change.

Therefore, while green criminology has invested a lot of time and energy analysing the harms that will occur through failing to tackle the climate crisis; now it seems that green criminologists must also take into consideration the potential harms involved in actively *combatting* climate change. Who and what is harmed in the process, what is the severity of these harms, what new inequalities will be created in the process, and how can they be avoided? Expressions of outrage and dismay over the failure of political and business elites to take climate change seriously and laying blame at the door of neoliberalism is no longer sufficient for a truly critical green criminology, if it ever was in the first place. The emerging picture that we paint in this article is far more complex and will require green criminology to adjust and adapt its analytical lens in accordance with events unfolding in reality.

The End of the End of History

For our purposes in this article, one of the most significant outcomes of the Covid-19 pandemic was that it revealed the fundamental falsity of many central pillars of neoliberal political and economic thought (Fazi, 2020). The first and most significant pillars to fall were the interlinked ideas that there is 1) a scarcity of money; 2) that taxes fund public spending; and 3) that removing the alleged independence of central banks to control the supply of money and subordinating

monetary policy (i.e. how much money is in the economy and issued by the central bank) to fiscal policy (i.e. government spending) would lead to runaway hyper-inflation that would be reminiscent of Weimar Republic Germany in the 1920s. For decades these pillars of neoliberal economic policy have justified reduced public expenditure, the privatisation of public services, and brutal austerity cuts. To depoliticise austerity it was frequently reasserted by politicians and economic commentators that these measures were not ideological choices. While they were unpleasant and unfortunate, they were a necessary and unavoidable factual reality of the economic and fiscal position in which we found ourselves. Utilising the notion that taxes pay for public spending through the use of the now commonplace term "taxpayers' money", successive governments operated according to the household budget analogy (Mitchell and Fazi, 2017). Governments could not spend more than they had coming in through tax revenue, and therefore had to 'balance the budget' either through reducing public spending or raising taxes. Every instance of progressive or redistributive government spending was met with the same question: *'How are you going to pay for it?'* Even the most allegedly 'radical' political manifestos in British political history, such as that put forward by the Corbyn-led Labour Party, adhered to the 'fiscal credibility' rule that any government spending must be balanced by a hike in taxes (BBC, 2016).

Proponents of Modern Monetary Theory (MMT) have been attempting to challenge this narrative for some time and cut through these ideological falsehoods to provide a more accurate description of how modern monetary systems actually work[i] (Kelton 2015; 2020; Mitchell and Fazi, 2017; Mitchell and Wray, 2016; and Tcherneva, 2020; Winlow and Hall, 2019). Their basic argument is that for many countries there is no scarcity of money. Nations such as the United States, United Kingdom, Australia, Japan, and many others are *sovereign currency issuers*. In simple terms, this means that these nations' central banks – such as the Bank of England in the UK or the Federal Reserve in the United States – hold a monopoly on the legal power to issue and create their nation's currency, and because of this power any nation that issues its own currency can never 'run out' of that currency. On the contrary, it has an infinite supply of its own currency. Whenever a government wants to spend the central bank simply issues the currency to enable it to do so, adding numbers to a balance account. Taxes, therefore, do not fund public spending and governments do not have to wait to 'raise money' in taxes before they can spend. If central banks 'create' currency by issuing more of it, then taxation simply 'destroys' money and removes it from the economy; and one of the key purposes of taxation, among other things, is to create *demand* for currency.

This is logical when one thinks about things a little closer. Given that central banks hold a monopoly on the legal creation of their currency, they have to first issue currency before individuals can use it to pay their taxes. Theoretically, therefore, a government can buy anything it wants that is for sale in that currency, and is limited only by the availability of land, materials, labour, and knowledge – in essence the productive capacity of its economy. It is only when a government exceeds this 'internal speed limit' of its economy at which inflation becomes a problem. But MMT proponents argue that what successive governments have done is to erroneously treat currency *issuing* governments like currency *users* – individuals, households,

business and so on – who do not have this power to create money and have to work, save, or borrow in order to find money to spend. Because sovereign currency issuers can issue the currency and never have the problem of 'finding' money, they do not (and should not) behave like currency users.

The response of governments from all over the world to the Covid-19 pandemic effectively vindicated the arguments of MMT. After decades of declaring that 'there is no money', that taxes fund public spending, and that the state has no source of money other than taxpayers' money, governments across the world all of a sudden had vast sums of money at their disposal to spend on a variety of measures to fight the challenges posed by the coronavirus pandemic; and they had this money at their disposal at precisely the moment when tax revenue was shrinking at unprecedented rates. As of May 2021, the British government spent £64 billion on the furlough scheme to cover the wages of workers whose jobs were affected by lockdown restrictions. In total, between April 2020 and April 2021, the British government spent £299 billion, the highest figure since records began in 1946. The United States similarly spent in excess of $4.5 trillion dollars in response to the pandemic, and other governments around the world have engaged in prolonged periods of significant spending, while inflation has remained low[ii], sitting at only 0.7% in the UK as of February 2021. As the executive chairman and co-founder of the World Economic Forum, Klaus Schwab, has written:

> Measures that would have seemed inconceivable prior to the pandemic may well become standard around the world as governments try to prevent the economic recession from turning into a catastrophic depression [...] All these changes are altering the rules of the economic and monetary policy "game". The artificial barrier that makes monetary and fiscal authorities independent from each other has now been dismantled, with central bankers becoming subservient to elected politicians. It is now conceivable that, in the future, government will try to wield its influences over central banks to finance major public projects, such as an infrastructure or green investment fund. (Schwab and Malleret, 2020: 67)[iii]

We have been here before, of course. In 2007/8, governments leveraged the power of central banks in an emergency fashion to provide government bailouts to over-exposed banks in the global financial crisis. But Schwab and Malleret's prediction that big government spending will be a continued feature of fiscal and monetary policy, rather than a mere emergency measure, appears to be correct. Shortly after taking office, US President Joe Biden announced a $1.9 trillion stimulus package. While the furlough schemes were effectively a trial of a universal basic income (UBI), Germany has explicitly trialled a UBI, and one is being discussed in Wales. Under this proposed trial, each adult would receive £11,106 per annum and each child would receive £6,264 per annum which would be paid to their parent or guardian.

Along more environmental lines, the British government launched the UK Infrastructure Bank (UKIB) in June 2021 with an initial financial capacity of £22 billion that is projected to rise significantly in the years to follow. The UKIB's explicitly stated objective is to help tackle

climate change and achieve net zero targets by 2050 and a number of other ambitious targets that have been set by the British government along the way. In April 2021, the British government made a legally binding[iv] commitment to reduce carbon emissions by 78% by 2035 compared to 1990 levels (equivalent to a 60% reduction on today's levels); a world-leading target that is actually in keeping with the Climate Change Committee's recommendations for the sixth carbon budget. During the pandemic, they also announced that a ban on the sale of petrol and diesel cars would come into effect in 2030 – ten years earlier than the original ban which was set to take effect in 2040 – a law which would require the automotive industry to significantly accelerate electric vehicle production in the coming years. The UKIB intends to contribute to meeting these goals by allocating £12 billion for cornerstone investment, loans, and equity for green infrastructure projects, in addition to offering up to £10 billion in guarantees for high-risk projects in an effort to try and 'crowd-in' private finance and kick-start new sectors in green technology and infrastructure[v]. Underpinning the rationale behind the UKIB is a recognition that while "much of [UK] infrastructure is financed, built, operated and maintained by the private sector…the private sector cannot always shoulder the burden alone" (HM Treasury, 2021: 2). While there are "significant pools of private finance" to invest in green infrastructure projects, "there can be a mismatch between market appetite and the risk profile of projects" (ibid, 8). Infrastructure projects are notoriously susceptible to market failure and under-investment due to the long-term nature of such projects and the complexities involved. On its own, the private sector simply won't take the risks at a meaningful scale. The purpose of the UKIB, therefore, is to "address shortfalls in the provision of private finance to make projects happen that would otherwise not have had the necessary support" and, "[a]cting as a cornerstone investor, it will leverage private sector finance into underdeveloped or challenging markets" (ibid, 4).

Similarly in the US, the federally funded International Development Finance Corporation (DFC) has invested $25 million in the UK-based mining investment firm TechMet (Sanderson, 2020), who invest in mining projects for metals and rare earth elements that are key to the energy transition and now count the US government as its biggest investor. The US have also awarded $30.4 million to Australia's Lynas Rare Earths Ltd. – the largest rare earths mining and processing company outside of China – to build a Texas-based facility for the processing of rare earth elements that are indispensable resources for the transition toward low-carbon or 'renewable' energy sources. This state of affairs is almost a reversal of traditional neoliberal public-private partnerships – such as private finance initiatives (PFI) in the UK – where private companies handled the initial costs of a project to alleviate government spending, and then leased the project to the government in return for a profitable repayment at a later date. Through subordinating monetary to fiscal policy, governments (via central banks) now appear to be taking on the role of financiers – a friendly bank manager for the Environmental Crisis Industry.

Such actions are consistent with calls from numerous political and economic elites to take the opportunity provided by the Covid-19 pandemic to institute a 'Great Reset' of the global economy, and usher in a fourth industrial revolution that centres around a 'green industrial revolution'. Klaus Schwab, the founder and executive chairman of the World Economic Forum

(WEF), has openly denounced 'neoliberalist ideology' by name as thoroughly inadequate for addressing our current crisis and has talked of the necessity to radically 'reimagine capitalism' to respond to both Covid-19 and climate change (Schwab, 2020). For such a figure to publicly write such words was almost unthinkable not long ago, and he has advocated aggressive interventionist economic policy from nation states, central banks, and the likes of the International Monetary Fund (IMF) to set capitalism in this new direction. For someone of the 'Davos Set' to advocate such ideas so publicly and talk of pulling key policy and public finance levers to induce such change is not something to be casually and cynically overlooked.

A key aspect of the so-called 'Great Reset' – which has been misunderstood and misrepresented as a Covid-19 conspiracy theory[vi] – has been advocacy for deglobalisation and shortening supply chains for key goods, materials, and resources. Long and intricate supply chains have been a feature of globalist neoliberalism, providing access to the cheapest sources of labour, loose regulations, and optimising cost and efficiency to provide low prices whilst maintaining high profits. The Covid-19 pandemic exposed the fragility of long globalised supply chains and the vulnerability of deindustrialised nations that are heavily reliant on foreign nations for key resources. Surveying the emerging post-pandemic landscape, Schwab and Malleret are quite emphatic in their verdict that greater economic protectionism and shortened and more resilient supply chains will be a feature in the future:

> The pandemic has placed the last nail in the coffin of the principle that companies should optimise supply chains based on individual component costs and depending on a single supply source for critical minerals. In the post-pandemic era, it is "end-to-end value optimisation", an idea that includes both resilience and efficiency alongside cost, that will prevail…"just-in-case" will eventually replace "just-in-time".
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> […] Simplification is therefore the antidote, which should in turn generate more resilience…companies dependent upon complex just-in-time supply chains can no longer take it for granted that tariff commitments enshrined by the WTO will protect them from a sudden surge in protectionism somewhere. As a result, they will be forced to prepare accordingly by reducing or localizing their supply chains (Schwab and Malleret, 2020: 180-181)

This call for deglobalisation and greater economic protectionism is undoubtedly being reflected in the environmental crisis industry. There has been a concerted effort to ramp up domestic manufacturing and reshore certain industries in order to establish secure supply chains for resources that are vital to the energy transition and the electric vehicles market, in addition to military defence and electronic goods. Some examples of this trend have already been listed above, but there are numerous additional examples worthy of mention. Just recently, the British government invested £100 million in the construction of a Nissan factory in Sunderland dedicated to the manufacturing of electric car batteries. Pensana Ltd., a company who mine and source rare earth elements for magnets that are crucial for wind turbines and electric vehicles, have recently commenced construction of a rare earths separation facility at Saltend Chemicals

Plant, located at a freeport on Humberside. This facility will process a range of REEs, including neodymium and praseodymium – two of the most important REEs for magnets in wind turbines – that it will source from the new Longonjo mine in Angola, which is set to be the first major rare earths mine in over a decade. However, the Saltend freeport facility will also, according to Pensana's announcement, serve as an 'attractive alternative to mining houses who may otherwise be limited to selling their products to China [for processing], having designed the facility to be easily adapted to cater for a range of rare earth feedstocks'[vii]. In 2020 in Cornwall, UK, a project publicly funded by UKRI's InnovateUK, discovered 'globally significant' levels of lithium– a crucial metal for energy storage batteries – and in January 2021 announced the first domestic production of battery-grade lithium carbonate from UK sources (BBC, 2020; Wardell Armstrong, 2021). The United States are also trying to revive rare earth mining, of which they were a global leader up until the 1980s when China began to exercise global dominance (Abraham, 2015), with MP Materials resuming operations at the Mountain Pass mine in California (Reuters, 2021).

The list of examples could go on for quite some time and have been limited for the purposes of space. But it is no coincidence that all of the examples listed above refer to securing the supply chain for rare earth elements and other key metals or industries reliant upon such resources (such as EVs). As the energy transition and market for electric vehicles gather pace, demand for such resources is expected to spike rapidly. The International Energy Association (IEA, 2021a) has estimated that reaching the goals of the Paris Climate Agreement would require a quadrupling of mineral requirements by 2040, with demand for Lithium being 40 times higher than present-day demand; demand for Cobalt being between 20-25 times higher; and demand for rare earth elements being seven times higher than present-day demand[viii]. There are significant concerns that a sharp increase in demand would overwhelm current levels of supply (Ballinger et. al, 2020).

These concerns are amplified by the fact that at present, there is a high geographic concentration of the mining and processing of many of these minerals, with global supply for certain minerals overwhelmingly reliant on one nation, and in some cases even one mine (Abraham, 2015). In 2020, the Democratic Republic of the Congo (DRC) were responsible for 67.8% of global cobalt production, while China was responsible for 58% of global production of REEs (US Geological Survey, 2021). When it comes to the processing of REEs, China holds an even more dominant position, responsible for the separation and refining of 90% of REEs (IEA, 2021a). China has a history of using its REE hegemony quite aggressively as a leveraging chip in international trade agreements, geopolitical relations, and international conflicts (Alves Dias et. al, 2020). To provide just one example, in response to an incident regarding a long-running territorial dispute with Japan, China imposed an informal ban on the export of rare earth elements to Japan in September 2010. All thirty-two of Chinese REE suppliers stopped trading on the same day, refusing to fill Japanese companies' orders for REEs which are a vital resource for Japan's high-tech economy. As a consequence, prices for REEs spiked as much as 2000% over the following eighteen months, revealing the volatility of a market that is so heavily

reliant on one nation for resources (Abraham, 2015). In recent years, China have also implemented production and export quotas in an effort to drive up prices (Lee and Wen, 2018).

This is now a key and openly admitted concern for Western nations – particularly amidst growing tensions between China and US – prompting US President Biden to make an executive order for a 100-day review of critical supply chains with a particular emphasis on metals and minerals crucial for combatting climate change and clean energy transitions (The White House, 2021). The review heavily recommended 'onshoring', 'nearshoring', or 'friendshoring' critical supply chains, and 'pursuing measures such as loans and other financial incentives to encourage domestic manufacturing as well as efforts to work with like-minded allies and partners abroad' (ibid). As these metals and minerals become a new geopolitical trump card, it is quite clear that the environmental crisis industry will become intimately entangled with geopolitical battles (Pitron, 2020), creating its own dangers and forms of violence that have been a feature of geopolitical battles over other global resources. As the likes of Abraham (2015) and Kiggins (2015) have argued, the age of metals and rare earth elements is not just imminent but has already arrived.

Big government spending, large deficits, deglobalisation and economic protectionism. These are all significant departures from neoliberal orthodoxy. As numerous commentators have observed, neoliberalism has always relied upon strong government despite frequent mischaracterisations that neoliberalism is about weak government and a retraction of state power (Davies, 2017; Harvey, 2005). But as Slobodian (2018) points out, neoliberalism has required strong states and supranational organisations to achieve the separation of *imperium* – the realm of bounded territorial nation-states and their sovereign power – and *dominium* – the realm of property, money, resources and so on. The purpose of the neoliberal state was to ensure that the latter was as autonomous from the former as possible, protecting private property, free markets, free trade and preventing the supposedly dark and backwards forces of economic sovereignty and protectionism. Therefore, whatever it is we are witnessing it is not the neoliberalism we have known for the past several decades. Nor does this form of monetary, fiscal, and economic policy interventionism constitute a shift toward state capitalism or progressive socialism, either. The measures taken remain highly individualistic and pro-business, with Jäger and Zamora (2020; 2021) borrowing from Sloman (2019) to describe this as the emergence of a cash 'transfer state'.

Aspects of neoliberal thought will undoubtedly remain, and big government spending will be highly selective, with certain areas likely to remain severely under-funded. There has also been recent pushback within the Conservative Party in the UK over enhanced public expenditure on green infrastructure, with certain MPs and Ministers reverting to neoliberal discourse over fiscal policy by expressing concern that working class communities will have to 'foot the bill' of such spending (Malnick and Gatten, 2021)[ix]. It remains to be seen whether or not this constitutes a legitimate attempt to put the MMT genie back in the bottle, or whether this is just standard political theatre to try and diminish the extent of the U-turn on fiscal and monetary policy that has taken place over the past 18 months. Overall, there is not a great deal of ideological coherence to be detected. This much is evidenced by big government spending and pushes for the

deglobalisation of supply chains co-existing alongside the use of freeports, which have traditionally reeked of neoliberal free-market ideology. Such freeports are extra-legal economic zones that, while sitting within a nation's borders, legally exist outside its borders in terms of taxes, and in other nations have seen relaxed workers' rights and environmental regulations which raise crucial questions for green criminology interested in green industry taking place in these freeports. This smorgasbord of policies is indicative of a post-neoliberal interregnum (Streeck, 2016) as governments stumble out of the Covid-19 pandemic, described by Hochuli et. al (2021) as 'the end of the end of history' which began in earnest in 2016 and has been confirmed in 2020-21 through the coronavirus pandemic. It is roughly analogous to what Wainwright and Mann (2018) have previously described as 'Climate Leviathan', one of the four potential political responses to climate change they envisage. Under Climate Leviathan, 'capitalism is treated not as a question but as the solution to climate change' (ibid. 31), viewing the energy transition as an economic opportunity for climate profiteering, and draws upon concentrated political power, economic sovereignty, and novel state financial tools to initiate market change.

The issue of climate change is one lathered in an array of powerful emotions, drives, and affective states. Fear, guilt, anxiety, lack, self-loathing, narcissism, enjoyment, desire, ambition, hope, and loss. Historically, this has been the libidinal engine room of the environmental crisis industry. It is the same libidinal engine room as consumerism, of which the ECI has been an offshoot (Hall et. al, 2008; McGowan, 2013; 2016). But as we have attempted to demonstrate in this section, the engine room of the ECI is transforming, becoming oriented more around metals, rare earth elements, mining, supply chains, central banks, economic sovereignty, energy transitions, and geopolitical competition. The question for green criminologists and zemiologists is the harms and dangers that emerge from the ECI moving beyond the long-hanging fruit of 'ethical consumerism'. What new harms will it generate or relocate? What existing inequalities will be deepened and what new ones will be created? Who is going to be affected? And lastly, how does green criminology and zemiology respond to this?

The Dirty Underbelly of the 'Green' Energy Transition

'[A]ll green technology begins prosaically as a gash in the Earth's crust. This new demand on the planet replaces our dependence on oil with an addiction to rare metals' (Pitron, 2020: 45). This is the warning of journalist Guillame Pitron in his book *The Rare Metals War*. While it is fair to say that green criminology overall has shared Pitron's justifiable anti-mining position (see for example Bedford et. al, 2020; Carrington et. al, 2011; McClanahan, 2020; Davies et. al, 2019; White, 2013), it is an undeniable truth recognised by academics, political leaders, supranational organisations, and the energy industry alike that an increase in mining is integral to tackling climate change, achieving net zero and eventually moving toward zero carbon emissions (Abraham, 2015; Alves Dias et. al, 2020; Hund et. al, 2020; IEA, 2021a; The White House, 2021; World Bank Group, 2017). We have already alluded to the reasons for this above, with a discussion of the importance of certain rare earth elements to wind energy technologies and other metals such as lithium and cobalt to batteries and energy storage. But there are many

others. Silicon, cadmium, gallium, germanium, indium, selenium, tellurium, and nickel are all vital for the photovoltaic cells (PV) in solar panels. In 2020 renewable energy made up 29% of global electricity generation and is set to increase by another 8% in 2021, the largest year-on-year increase since the 1970s (IEA, 2021b). Given that solar PV and wind are set to make up two-thirds of renewable energy use, significant reductions in carbon emissions requires a substantial *increase* in the mining of these minerals.

Here we are only referring to the more exotic specialty minerals, whose almost magical properties have significantly advanced renewable energy technologies. But these technologies also rely on huge quantities of base metals such as iron, copper, and aluminium. Vidal et. al (2013: 895) observed that as of 2013, demand for base metals was increasing by 5% annually, and that increasing the contribution of renewable energy to 25,000 terra-watt hours (TWh) by 2050 would require metal production in the next forty years to match the cumulative production of metals throughout the entire history of humanity. It should be noted that the International Renewable Energy Agency (IRENA, 2019) project that to meet global climate goals, the share of renewables would have to rise to 86% by 2050, amounting to roughly 47,000 TWh compared to the 7,000 TWh in 2019. All of this raises a number of issues for green criminology and zemiology.

For starters, as green criminologists have been at pains to stress, mining is an inherently dirty and destructive business irrespective of what is being extracted, and it is particularly the case for rare earth elements. While abundant, their concentration in the earth's crust is extremely minute, requiring a painstaking process of refinement to separate rare earths from the rock or the soil which usually relies on two methods, both of which use a number of chemical processes. One method is to remove the topsoil and move it to a 'leaching pond' where a wide range of chemicals, such as sulphuric and nitric acid, are used to separate the rare earths. Another method involves drilling into the ground and inserting pipes and hoses which pump chemicals in to flush out the earth. The mixture is pumped into leaching ponds for separation just as they are through topsoil removal. The toxic and hazardous chemicals used in both of these processes can cause erosion, overflow, leach into groundwater and create air pollution (Langkau and Erdmann, 2018; Lee and Wen, 2018).

In China, the major supplier of rare earths globally, pollution levels from rare earth mining are high. At Baotou, Inner Mongolia, the site of one of the largest rare earth mines in the world, lies the Weikuang Dam, an artificial lake where black toxic effluent from rare earth mining and separation processes is disposed. Lacking a proper lining, the contents of the Weikuang Dam seep into the groundwater, and occasionally pollute the Yellow River which lies just 10 kilometres away (China Water Risk, 2016). Other leaching ponds have been known to overflow during heavy rain periods. Nearby local populations have felt the effects, with some communities being dubbed as 'cancer villages' due to the high levels of cancer and other physical ailments caused by pollution from the REEs industry (Maughan, 2015; Pitron, 2020). Crops and livestock die in these conditions, with many residents being relocated. Rare earth deposits often contain radioactive elements such as uranium and thorium as well, adding radioactive waste into the list of pollutants from rare earth mining and processing (Zhu et. al, 2015). In Malaysia, a new

rare earths plant run by Lynas was given the go-ahead by government despite significant opposition from local residents over fears around a disproportionate number of birth defects and leukaemia cases in the town of Bukit Merah, the site of another rare earth refinement facility (Looi, 2018).

None of this is to mention the fact that, at present, many of the facilities that are producing essential components for renewable energy technologies are carbon intensive. The mines themselves have a serious impact on the natural landscape and local eco-systems and they also use extraordinary quantities of water. To process one ton of rare earths requires 200 cubic metres of water (or 200,000 litres). Moreover, the most significant global deposits of the vital minerals for the energy transition are typically found in some of the more impoverished parts of Africa, South America, and Asia. It has become customary to speak of the 'slow violence' or 'systemic violence' of climate change (Nixon, 2011), which has generated harm, displacement and exploitation of the world's environmental poor as global powers have sought control over fossil fuels and other natural resources (Briggs, 2020). But there is equally a 'slow violence' to the energy transition, one that is once again being borne by the rural populations and working class of the far east and the global south along existing and predictable patterns of global inequality. Quite simply, the fact that combatting climate change is necessarily built on mining, environmental destruction and pollution is a fundamental and urgent tension for green criminology, one that has yet to be addressed in the criminological and zemiological literature. Notions of 'eco-justice' (White, 2013) need to be extended to cover issues of workers' rights for those operating within these parts of the green industry's supply chain; particularly as efforts to reshore the processing of these minerals in Western nations is, in some cases, taking place in freeports (such as the plant in the Humber freeport) that historically have had relaxed environmental regulations and workers' rights and have been an express concern of parliamentary committees[x].

A related question for green criminology is how renewable are renewable energies? We think of wind and solar energy as 'renewable' energy sources because we cannot 'run out' of wind or sunshine to generate power. However, the name is misleading. The technologies that convert these renewable energy sources into power rely on natural resources which are not renewable whatsoever. Like most natural resources, they exist in finite quantities in the earth's crust. The initial scaling up of renewable energy sources will make a significant dent in current global reserves, and as wind turbines and solar panels require replacing as they come to the end of their lifespan (between 20-25 years and 25-40 years respectively, depending on the quality), materials will have to be recycled or new materials will have to be extracted. Currently, recycling of REEs is extremely low, verging on non-existent (US Geological Survey, 2021: 132). This is largely due to the fact that they are not used in their pure form in green technologies, with manufacturers preferring alloys which combine the properties of various elements, making the recycling of rare earths time-consuming, costly, and energy intensive.

It is difficult to provide any reasonable estimates of when we are likely to reach a critical juncture with regards to depleting mineral reserves for green technologies, given that the quantity

of known reserves changes as we discover new significant reserves of various minerals, thereby altering the reserves to production ratio and the reserves depletion rate. However, Jowitt et. al (2020) have argued that while some estimates that suggest certain metals reserves will be exhausted within the next 50 years are misguided, there are nevertheless a number of economic, environmental, socio-political, and governance factors that place the supply of a number of metals and minerals at risk, potentially contributing to future resource conflicts. Over a decade ago, Parenti (2011) wrote of the small-scale inter-tribal resource wars and skirmishes being fought in parts of East Africa, witnessing neighbouring tribes kill one another over water, patches of fertile land, and cattle raids for livestock, all of which are dwindling as a result of climate change. As we alluded to earlier, resource conflicts in the future are likely to be far bigger and more nakedly geopolitical in nature, fought between nations rather than tribes. Wainwright and Mann (2018: 151) have written that this is 'one of the most worrisome aspects' of their analysis:

> If the principal change wrought by climate change is the adaptation of the political, the greatest source of uncertainty in its adaptation lies in the complex geopolitical relations between the United States and China. We could see a world war between two spheres of influence, leading to a collapse in the world system, or the consolidation of Climate Leviathan through collaboration between the United States and China, or a US-centric Leviathan (ibid.)

Lastly, a more traditional criminological issue in this area is that of illegal mining and illegal employment practices. Returning to REEs for a moment, small scale illegal mining operations and artisanal rare earth mining remain a significant issue in China, despite efforts from the Chinese government to crack down on such operations. According to Wübekke (2015), this can be traced back to the 1980s, when the Chinese government welcomed small private miners and weak regulation to try and ramp up extraction and establish their hegemonic position in the global market. However, Lee and Wen (2018) estimate that in 2010, illegal miners still contributed around 40,000 tonnes of rare earth elements to global supply, rising to approximately 45,000 tonnes in 2016, with much of this being sold overseas due to the imposition of production and export quotas in China. Naturally, illegal mining operations are typically among the most environmentally hazardous as well (Langkau and Erdmann, 2018). As global demand rises and the Chinese government continues with production and export quotas in order to drive up prices and slow resource depletion, it is not unreasonable to speculate that there are opportunities for these illegally mined resources to make their way into the global supply chains. Shifting our attention to cobalt, a key component in lithium-ion batteries, there are already well-documented concerns around artisanal mining and the use of child labour in the Democratic Republic of the Congo (DRC). The majority of the world's supply of cobalt comes from the DRC, and Amnesty International's (2016) report showed that 20% of this comes from artisanal mines in which approximately 40,000 children labour for long hours in hazardous conditions for miniscule pay, often exposed to violence, sexual exploitation and drug abuse. The report details how the cobalt mined by these children is making it into the supply chain for some of the world's largest electronics and automotive companies. Understanding the dynamics of the

illicit market for metals, rare earth elements, and other minerals crucial for the energy transition, how these illicit minerals make it into the supply chain, and the role of organised crime groups, corporations, and corruption is a potentially rich field of empirical and theoretical study for green criminology (Zabyelina and van Uhm, 2020).

Dupuy (2014) observes that sacrifice always entails an original violence which, put in service of the Good, is transformed into the Good itself. The innocent child or animal is sacrificed before the Gods in a sacred ritual in order to stave off their wrath or further disaster, and thereby becomes sacralised. We should be aware of the potential emergence of a 'sacrificial environmentalism', in which a zero-carbon fetishism trumps 'lesser' social and environmental harms to communities and eco-systems, which come to be seen as unfortunate but necessary forms of collateral damage that are to be systematically disavowed from collective consciousness. It appears that the energy transition and global climate security will be built on extracting wealth from globally poorer nations and exploiting both their natural resources and working class in potentially harmful ways. Will these be the sacrificial children of the energy transition and the fight against climate change? As we have attempted to demonstrate in this article, there is already a geopolitical race underway for control over the resources for the energy transition which could be construed as a form of 'green imperialism'; and green imperialism could well beget the proliferation of sacrificial environmentalism or *vice versa*. This creates serious tensions for the political left and their atomised advocacy for various causes and marginalised groups. Will it be sustainable to champion environmentalism and the energy transition while also claiming that black lives matter? Similarly, is it possible to champion the pursuit of carbon neutral policies while advocating for the health of ocean environments, given the destructive impact of deep-sea mining for minerals crucial to the energy transition? The ramifications are numerous, and we are certain that we have not considered all of them here. The purpose of this article, therefore, has been to urge green criminologists and zemiologists to take the baton and start asking these important questions that have previously been absent from the literature.

Closing Remarks[xi]

The prevailing assumption among many leading thinkers and commentators on climate change seems to have been that capitalism is fundamentally incapable of tackling climate change (see, for example, Klein, 2014; Monbiot, 2016; 2019). With good reason, such thinkers have argued that the market simply would not abandon its short-termism and drive to accumulation of its own volition; and that the only way to resolve the deadlock between capitalism and climate change would be through the formation of organic global climate justice movements – such as Naomi Klein's (2014) aspirational vision of 'Blockadia' – that would 'overturn fossil fuels and capitalist political economy in the name of a new relationship to community and the environment' (Wainwright and Mann, 2018). The Covid-19 pandemic, however, was something that few people saw coming (see Malm, 2020 for an exception). Even fewer people could predict how long it would last, how it would affect the global economy, and how governments would respond; and absolutely nobody was going to factor a global pandemic into their analyses. But in the wake of this pandemic and the various processes we have explored in this article, we can no

longer dismiss with incredulity the idea that capitalism and capitalist nation-states are willing to and potentially capable of seriously addressing climate change. Even prior to the pandemic, respected anti-capitalist commentators did not rule out the possibility that capitalism could address carbon emissions and climate change (Parenti, 2011; Wainwright and Mann, 2018).

Let us be clear. We are not for one moment acting as capitalist apologists, cheerleading the market as our climate saviour, or suggesting that a 'Great Reset' or 'fourth industrial revolution' will be benign and that capitalists, corporations, and governments will have all of a sudden transformed into environmentalist humanitarians. Capitalists and professional politicians are first and foremost pragmatists and any changes that occur will undoubtedly remain driven by the profit motive, with the resultant ineffectiveness, cronyism and corruption that characterised parts of the UK response to the coronavirus. Nor are we suggesting that the changes being made are sufficient or happening fast enough, or that fossil fuels are being outright abandoned by political and economic elites. We are simply arguing that the political-economic and geopolitical shifts we are witnessing is making the energy transition a far more profitable, attractive, and realistic possibility than it has ever been previously in late-capitalism.

While much stands to be lost by global elites in the fight against climate change, there is also plenty to be gained. The environmental crisis is an existential one. Wainwright and Mann (2018) correctly characterise the looming environmental crisis as a Leviathan. It is the return of a monstrous and absolute authority in the proper sense of the term, ready to exert its force over us and expose our frailties in the face of its indiscriminate power. Our origin myths and legends are littered with stories of heroes who triumphed over beasts that threatened the security of the tribe or the village—Perseus over the Gorgon, Theseus over the Minotaur, St. George over the Dragon, David over Goliath (Ehrenreich, 1997). In more recent times, political and military leaders who defeated mortal enemies have been elevated to the status of Hero. They are physically and culturally etched into eternity with statues, monuments, and celebratory Hollywood biopics. Scientists who have provided cures or medical solutions to fatal diseases are canonised as academic departments, awards and fellowships bear their names. These individuals do not experience the symbolic death that awaits most of us after a few generations, fading from the collective memory (Becker, 1973). Their names echo throughout history. For those who promise us salvation from climate change, who tell us that we can cheat death and tame the threat of climate catastrophe, similar prestige and accolades await—not to mention unimaginable wealth.

The likes of Jeff Bezos, Bill Gates, Steve Jobs, and Mark Zuckerberg amassed unprecedented wealth as a result of the third industrial revolution in the digital economy—leaving a number of zemiological questions in their wake that are currently dominating academic journals, news media, and mainstream culture alike. Under the right political and economic conditions, there is significant wealth and power to be accumulated in seriously tackling the climate crisis; and there is growing evidence that is compelling enough to suggest that political and economic elites are serious about creating the conditions to incentivise entrepreneurs and businesses to set about the task. Whether capitalism and its elites are capable of doing so in a

humane way that does not cause other environmental issues is an entirely different question, one that it is up to green criminology to answer.

Therefore, in considering the energy transition, we need to ask: who and what is harmed in the process, what is the severity of these harms, what new inequalities will be created in the process, what new forms of entrepreneurial and organised crime and violence will emerge, and how can they be avoided and policed? Does it still make sense to couch our critiques exclusively in terms of 'neoliberalism', given the substantial departures from neoliberal orthodoxy being displayed by nations the world over? More abstractly, it suggests that we must begin to ask ourselves the question: at what human, social, and environmental price are we willing to allow capitalism to halt the climate crisis? Will most of the general populace care much about the fate of faraway nations and communities who are rich in the minerals key to the energy transition, and are therefore the most likely victims of such harms and crimes? Will they care much about *who* is addressing the crisis and what new global inequalities it is creating? Or will they gladly disavow such harms if it means avoiding the worst effects of climate change and having the self-satisfaction of living in net zero cities with environmentally sustainable lifestyles, feeling like we have cheated death, outflanked the monster of climate change and saved the habitability of our planet? How do we rank order the environmental harms that emerge from the energy transition? Climate change and reducing carbon emissions is just one of many important environmental issues, and as we have attempted to demonstrate in this article, renewable energy is not necessarily as environmentally friendly as it first appears. What ethical, moral philosophical tools do we have at our disposal to answer these questions and are they equipped for the task (Raymen, 2019)? Can we avoid becoming crude consequentialists on these matters? Or will we continue as we have done for centuries and exteriorise this original violence by putting it in service of a larger good, thereby transforming this violence into the Good itself (see Dupuy, 2014; Ellis et. al, this volume; Hirschman, 1977; Raymen, 2021)? These, we argue, must become increasingly central questions for green criminology and zemiology. Questions which could become the great ethical conundrums of our time.

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Endnotes

[i] In addition to the texts cited here, this video animation also provides a useful visual overview (https://www.youtube.com/watch?v=TDL4c8fMODk&t=53s).

[ii] Inflation can also be considered too low, with economists typically viewing 2% as an ideal level of inflation (Kelton, 2020). Therefore, concerns around large government deficits driving dangerous levels of inflation are often overstated. As Mitchell and Fazi (2017) observe, Japan has long maintained large government deficits without causing high levels of inflation.

[iii] It should be noted that this is not without concern for political and economic elites such as Schwab. On the following page to the quote cited above, he discusses his political concerns around MMT in a way that is typical of the anti-democratic tendencies of liberal globalists who have always been hostile to popular opinion (see Slobodian, 2018; Zevin, 2019). Schwab and Malleret (2020: 68) write: 'The idea [of MMT] is appealing and realizable, but it contains a major issue of social expectations and political control: once citizens realize that money can be found on a 'magic money tree", elected politicians will be under fierce and relentless public pressure to create more and more'.

[iv] The Climate Change Act 2008 included the provision of legally binding carbon budgets, a statutory cap on greenhouse gas emissions. The UK met the first and second carbon budgets, is

currently in the process of meeting the targets of the third carbon budget, but is not on track to meet the 4th or 5th carbon budgets. The sixth carbon budget was the first to be set in line with net zero targets. While these carbon budgets are legally-binding, it is unclear how the seemingly inevitable transgression of these carbon budgets will be enforced.

[v] Szwarc et. al (2021) of the London School of Economics Grantham Research Institute on Climate Change and the Environment have also written about the potential of the UKIB. https://www.lse.ac.uk/granthaminstitute/news/the-new-uk-infrastructure-bank-can-drive-the-just-transition-heres-how/

[vi] There have been individuals and groups who believe that the Covid-19 pandemic is not real and has been orchestrated or exaggerated in order to initiate the 'Great Reset'. For others, any mention of the Great Reset is viewed as a far-right conspiracy theory dog whistle. Neither position is valid. The former is fanciful conspiracy theorising, imagining some hidden power pulling the strings at a global level. The latter is to dismiss the fact that elites of the political and economic mainstream have made strong public calls for a Great Reset of the global economy, and that political and economic elites have frequently sought to take advantage of unexpected crises to pursue their own goals and ends (see Klein, 2007; Mirowski, 2013). For us, the Covid-19 pandemic has exposed the fragility of neoliberal capitalism and disrupted its normal functioning to such an extent that there is now a unique opportunity for a significant political-economic shift to pursue some of the goals of the Great Reset and the so-called 'fourth industrial revolution'. This is precisely the language that Klaus Schwab and Thierry Malleret (2020) have used in their book *Covid-19: The Great Reset*.

[vii] See the following link for the details of the full announcement https://pensana.co.uk/wp-content/uploads/2021/07/FINAL-Pensana-Company-Update-05.07.21.pdf

[viii] While this is the lowest increase projected, it needs to be put into perspective. The properties of REEs have almost magical qualities which make them indispensable for green energy technologies. However, they are used in extremely small quantities, and while they are abundant in the earth's crust, they are seldom found in high enough concentrations to be mined viably, and even where they are the separation and refinement process is time-consuming and resource intensive. Global production of all 17 REEs in 2020 amounted to only 240,000 metric tonnes, roughly 15,000 times less than total iron production (Pitron, 2020). Therefore, seven times increase in supply to meet growing demand is an extremely tall order.

[ix] The political cartoon accompanying this article actually sarcastically invokes the typical neoliberal discourse around fiscal policy. It depicts Boris Johnson as a hippie-like figure, covered in placards demanding environmental action, while a stern-looking Rishi Sunak – Chancellor of the Exchequer – is sat in front of a bank vault asking Johnson sardonically, 'And how do you propose to pay for all this, young man?'

[x] See for example, the written submission from the Wildlife and Countryside link to a parliamentary committee on freeports in 2020 https://committees.parliament.uk/writtenevidence/5465/pdf/

[xi] We are cognisant of the fact that this paper has not discussed nuclear power, and that to some readers this is a significant omission. According to the IAEA, it is the energy source for approximately 10% of global electricity and one third of global low-carbon electricity, making it the second largest low-carbon energy source for electricity production. Environmental activists, politicians and commentators have objected to nuclear power because it still produces greenhouse gases, produces long-lived radioactive waste, and there remains risks of nuclear meltdown, the consequences of which are catastrophic. However, there has been significant progress made around nuclear *fusion* reactors. These are substantially different from traditional

nuclear fission reactors as they utilise opposite atomic processes. Nuclear fusion does not produce carbon emissions, its radioactive waste is not long-lived, it is an abundant and replenishable source of power, and perhaps most significantly there is zero chance of reactor meltdown and explosion. Within the past year, scientists have proven that nuclear fusion reactor designs are theoretically capable of working and producing net energy gain, in which more energy is produced than consumed (Creely et. al, 2020); and in the last few months they have also been successful in producing this net energy gain, albeit in small quantities (Turrell, 2021). These are substantial leaps forward that have surprised even the scientific community, and some estimate that nuclear fusion reactors can start providing electricity to the grid by the end of this decade. Nevertheless, nuclear energy is not discussed here for two reasons. Firstly, there remain questions of its viability. Secondly, public funding institutions such as the UKIB have vowed that public money will not be given to nuclear energy projects. Thirdly, discussion of nuclear fusion was beyond the scope of this paper, in that it diverged from the primary argument which considers the *immediate* future direction of the ECI and its potential human and environmental consequences.