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Research article

A coal elimination treaty 2030: Fast tracking climate change mitigation, global health and security

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ABSTRACT

This article sets out the case for an international treaty to phase out the mining and burning of coal—a Coal Elimination Treaty, or CET—by 2030, as a way of addressing multiple weaknesses in the global climate change regime and as a medium-term success towards arresting average global heating at 1.5°C before 2050. Given the growing risk that the Paris agreement will fail to trigger rapid emissions reduction, we propose the CET as a global "supply-side" mechanism, and as a way of empowering climate-vulnerable and high-ambition states. We make an integrated environmental, public health and security case for a CET, specify its design principles, and propose three negotiation pathways, including a normative model inspired by the 2017 Treaty on the Prohibition of Nuclear Weapons; one that would progressively stigmatize, prohibit and eliminate coal so as to prevent a dire and unmanageable climatic future.

1. Introduction

At Paris in November 2015, the international society of states adopted a historic agreement to prevent dangerous anthropogenic climate change that is failing to do so. Indeed, the decision published adopting the Agreement acknowledges 'with concern…the significant gap between the aggregate effect of Parties' mitigation pledges in terms of global annual emissions of greenhouse gases by 2020 and aggregate emission pathways consistent with holding the increase in the global average temperature to well below 2°C' (United Nations, 2016). Even as its signing came with great hopes, the agreement has been criticized as a form of 'dangerous incrementalism' that merely 'repackages rules that have already proven inadequate to reduce emissions and improve resilience' (Allan, 2019: 4). This is the irony of humanity's global attempt to address climate change and global ecological degradation more broadly, which scholars have credibly described as 'institutionalizing unsustainability' and 'failing the planet' (Stevenson, 2012; Burke et al., 2016). As one major mechanism to arrest this trend, this article advocates the global adoption of a treaty to prohibit and phase out the mining and burning of coal by 2030, as a medium-term success towards reducing global greenhouse emissions to net-zero before 2050 or earlier.

Even if met, states' Paris commitments would only restrict global heating to 3°C and current emissions trends are tracking towards as much as 4–5°C this century (Fawcett et al., 2015: 1168–1169; IPCC, 2018: 11; Global Carbon Project, 2018).[1] The gap between global intent and effort has been underlined by the publication of the 2018 special report of the Intergovernmental Panel on Climate Change (IPCC) on the impacts of global warming of 1.5°C above preindustrial levels, which states that global greenhouse emissions will need to be reduced 45 per cent as soon as 2030 and brought to net zero by 2050 (Watts, 2018a; IPCC, 2018: 12). Concerned by the additional heating potential of other gases such as methane and nitrous oxide, plus feedbacks from permafrost and cryosphere melting, some scientists are suggesting net zero needs to be achieved by as early as 2040–45 (Steffen, 2020; Steffen et al., 2018; Watts, 2018b). The weakness of the Paris Agreement's non-specific and non-binding model was further underlined at the

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[1] The IPCC's baseline scenarios i.e. "without additional efforts to constrain emissions" (RCP6.0–8.5 in the 5th Assessment Report of 2014) indicate a mean increase of 4°C, while the 2018 assessment by the Global Carbon Project considers that a baseline scenario would cause warming of between 3 and 5.1°C by 2100.

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United Nations' 2019 Climate Action Summit, which contributed greatly to global awareness but attracted no new commitments by the world's major emitters. 70 countries—representing just 36 per cent of the UN's membership and 6.8 per cent of global emissions—have pledged to increase their NDC's in 2020. In contrast to Secretary-General Guterres' call for states to eliminate fossil fuel subsidies, commit to net zero by 2050 and place a moratorium on all new coal projects, states and fossil fuel corporations continue to plan and subsidize new projects (Beuret, 2019; McDonald, 2019; Farand and Sauer, 2019; Irfan, 2019).

Efforts to strengthen and embed the Paris Agreement and ratchet up national commitments must be continued, but they are likely to fail to trigger the coordinated emissions reductions necessary to arrest dangerous anthropogenic climate change at 1.5°C this century. With the enormous collateral harms caused by deforestation and the burning of coal, oil and gas in mind, the Paris approach should be complemented by international cooperation to attack major greenhouse emissions sources and sectors directly—especially electricity generation, cement, steel, transport, agriculture and deforestation. As the authors of an influential 'roadmap' for rapid decarbonization explain, 'all sectors (e.g. agriculture, construction, finance, manufacturing, transport) need comparable transformation pathways' (Rockström et al., 2017). In other words, the failure of the Paris Agreement to create consensus on coordinated efforts to reduce emissions should not signal a pessimistic future where all action remains impossible, but rather give clues as to how to approach international deadlock more successfully. Complex problems where there are no single solutions—or wicked problems—need to be tackled differently, because traditional responses cannot resolve them. Their wickedness stems not from their complexity, but rather from having multicausal origins that leave policy makers with no single path to solve the issues such problems raise (Rittel and Webber, 1973). One proposal, treaty, agreement, or policy will not be sufficient to address the global issue of carbon emissions from fossil fuels; multisector and multilevel level action must be undertaken immediately to have a chance to arrest average global heating at 1.5°C.

Economists have begun to argue that climate policies which seek to reduce demand for fossil fuels—such as carbon prices—should be supplemented by "supply-side" policies that restrict production and use (Green and Denniss, 2018; Sinn, 2008, 2012; Lazarus et al., 2015). As one contribution to such a direct approach, we propose the adoption of a new international treaty—a Coal Elimination Treaty, or CET—as a powerful means to rapidly and dramatically reduce energy emissions from the electricity production sector, to contribute to climate change mitigation, and to improve global human health and security. We argue that the treaty should provide for the complete phasing out and prohibition of coal's mining, sale and burning by 2030, because the IPCC has stated that a pathway to arrest global heating at 1.5°C must begin with a 45 per cent reduction in global emissions by 2030 (IPCC, 2018: 12). Given the complexity involved in addressing emissions from transport, land use and industry, and the relative simplicity of greening electricity and steel production (Newell and Simms, 2019: 6–7), phasing out coal by 2030 promises a medium-term cooperative success on the path to net zero global greenhouse emissions before 2050.

Whilst a CET could also be a broad model for subsequent global agreements on oil and gas emissions, and deforestation, the toxic effects of coal burning and the growing trend of disinvestment from coal suggest that the coal emissions sector is a ripe one for early success. South Pacific countries are considering a Pacific climate treaty (Wewerinke, 2016) that includes a moratorium on new coal projects; a "Powering Past Coal Alliance" of 91 governments and businesses formed after the COP23 meeting in 2017 has committed to phasing out unabated coal by 2050; and 350.org has recorded some $11 trillion of committed divestment from fossil fuels by 1055 different institutions globally (PPCA, 2017, 2019; Tyler-Davies, 2019; Jewell et al., 2019; Blondeel et al., 2020). A global agreement could benefit industry transition by providing investment certainty, preventing carbon leakage, stimulating state support for new investment in renewables, and freeing global climate funds for affected workers in the developing world.

Our proposal aims to support the overall intent of the United Nations Framework Convention on Climate Change (UNFCCC) but also find a way around two key problems in its architecture. Firstly, the UNFCCC's soft law model is gradualist, non-binding and lacks accountability (Park and Kramarz, 2019; Allan, 2019; Stevenson and Dryzek, 2014; Stevenson, 2012). While this was helpful in cutting through the political impasse experienced at Copenhagen, it may doom the agreement as a global vehicle for emissions reduction. Near universal participation is less meaningful when it does not prompt the needed results. Secondly, the UNFCCC's failure to agree its voting rules means that one or a few states can cripple effective progress. This has fueled a disabling power politics in the regime, disempowering climate-vulnerable and high-ambition states (many of which are in Africa, the Pacific and other parts of the global South) at the expense of states dominated by fossil-fuel interests. Two of our proposed models, which draw inspiration from the Treaty on the Prohibition of Nuclear Weapons (TPNW), step around this power politics by empowering climate-vulnerable states to lead, setting an achievable threshold for adoption, and placing normative pressure on others to join. This will also provide a natural means for states to stagger their accession; states who join the treaty can also include their coal reduction achievements in their nationally determined contributions under the Paris Agreement, thus supporting its goals.

The case for the CET is a compelling one: coal burning is a major historical and future contributor to climate change; the source of a global public health crisis; and a significant contributor to global insecurity. In this article we review the threats that coal poses to human health and security and outline the treaty models and negotiation pathways that might provide the most effective design and adoption route. We are aware of resistance to change from key states and fossil fuel interests, but we consider this an additional argument *for* rather than against such a treaty, given the devastating climatic impact that planned coal investment will have. A 2016 Climate Analytics study[2] estimated that when coal-fired power plants in operation, under construction or planned are added together, they will produce an emissions overshoot of the 1.5°C guardrail of astonishing magnitude—317% of the Paris budget (Rocha et al., 2016: 3, 8–14). With some climate models estimating that the remaining carbon budget to keep global heating below 1.5°C will be used up within 18 months, and the IPCC estimating less than seven years, urgency is an especially salient concern now (Hausfather, 2018, Hausfather, 2018; Sackett, 2019).

Our proposal joins others that advocate new treaty concepts to strengthen the global climate regime: the Pacific Climate Treaty, a previous call for a coal non-proliferation treaty, and a highly developed model for a Fossil Fuel Non-Proliferation Treaty (FF-NPT) (Wewerinke, 2016; Christoff and Eckersley, 2013; Newell and Simms, 2019). Fergus Green has also proposed sub-treaty

[2] The study estimated that, globally, there are 7992 coal power plants in operation or under construction, and another 1082 planned. Using a relatively conservative reductions scenario (1.5°C with overshoot) they calculated that, to 2050, the cumulative emissions from current capacity will be 214% of the Paris carbon budget. When planned and announced plants are added, the total is 317% of the Paris budget (Rocha et al., 2016: 3, 8–14).

mechanisms such as “fossil fuel free zones” and analyzed the trend towards “fossil fuel bans” within national jurisdictions (Green, 2018a, 2018b). We consider all these proposals to be important and worth pursuing, and Newell and Simms (2019: 2) rightly point out that in addition to a coal agreement ‘a more general FF-NPT is needed, since the majority of remaining oil and gas reserves must also remain in the ground.’ The FF-NPT might also provide the template for an even more comprehensive post-2050 Greenhouse Emissions Convention (analogous to the way in which a Nuclear Weapons Convention would provide the means to police and secure a nuclear weapon-free world). Our CET proposal, however, is more modest and urgent.

A CET would leave the problem of oil and gas unaddressed—not to mention other major emissions sectors—but by being focused on a single emissions source it has the virtue of simplicity and greater short-term viability. It is specifically designed to achieve short-term success in a sector accounting for 40 per cent of global emissions, knowing that the structural challenges around other emissions sectors are comparatively greater. It is not proposed as a strict model for all emissions, although we would assert the virtues of binding and sequenced reductions based on strong lines of reporting and accountability. Unlike the Pacific and FF-NPT proposals, the CET has a firm phase-out date ensuring certain benefits from the resulting emissions reductions.

We also avoid adopting the FF-NPT's model of sequenced phase outs between fuel reserves and countries as unnecessarily complex and likely to cripple negotiations, because of the risk that countries will be unable to agree on burden-sharing principles, however elegantly framed by scholars. Likewise, principles such as Common But Differentiated Responsibilities (CBDR) are already deeply contested both across and within North and South, given, for example, the profound clash of interests between industrializing BRICS in the global South and climate-vulnerable states in Africa and the Pacific (Alam and Razzaque, 2015: 617–20). We do however note the FF-NPT authors' view that ‘given the carbon intensity of coal, its diminishing financial viability and its substitutability in most cases, it might be an appropriate focus for the first wave of negotiations’ (Newell and Simms, 2019: 7). At the same time, we acknowledge that climate justice questions remain important and keep an open mind on the applicability of the CBDR principle. We propose ways of addressing justice criteria and discuss our concerns about the uncertain effects of applying the CBDR principle in this context in section 3.1 below (Atapattu and Gonzalez, 2015).

2. The case for the treaty: the fourfold threat of coal

There is a simple one-word climate mitigation case for a coal elimination treaty: urgency. Coal is responsible for 81 per cent of the CO_2 added to the Earth's atmosphere since 1870, and comprises some 40 per cent of global CO_2 emissions annually; current emissions trends will cause 4°C of global heating by 2100 and will see the remaining carbon budget to hold heating at 1.5°C used up within seven years; and the IPCC is stating that to hold global heating to 1.5°C global greenhouse emissions must be reduced 45% by 2030 and to net zero by 2050 (Global Carbon Project, 2014, 2016; 2019; IPCC, 2018). Furthermore, CarbonBrief analysis of the 2050 net zero pathway projects coal needing to fall by at least four-fifths this decade (Evans, 2020).

If that is not persuasive enough, coal forms a fourfold threat to planetary life based on its contribution to climate change, its devastating effect on global health, its enormous damage to ecosystems, and its role as a driver of climate-related insecurity from fire, drought, cyclones, and conflict. Our argument about coal's contribution to climate insecurity here does not consider future impacts; we simply note that the Earth has exceeded 1°C of average global heating and that dangerous climate change is already underway.

In 2019–2020 Australia was devastated by intense forest fires that burned an area the size of Syria, killed 33 people and destroyed over a billion animals, vast areas of habitat and hundreds of millions in ecosystem services. It was suffering severe drought following a decade of record temperatures, culminating in average mean maximum temperatures of 2.09°C above the 1961–1990 average in 2019—Australia's warmest year on record, bringing the conditions expected of a two-degree world (Burke, 2020; BOM, 2020; Glasser, 2020). In addition to increased intensity and speed of fire, climate science affirms that oceans are warming, and cyclones will become more powerful and intense (IPCC, 2014). 2013's Super Typhoon Haiyan/Yolanda, the most intense northern hemisphere storm then measured, killed 6300 people in the Philippines and caused over US$2 billion in damage; 2016's Cyclone Winston, the strongest storm recorded in the southern hemisphere, killed 44 and caused $1.4 billion in damage in Fiji; and 2019's Hurricane Dorian, the strongest Atlantic hurricane to make landfall, destroyed much of the Bahamas, killing at least 63 and causing $8.3 billion in damage. These storms exceeded the Saffir-Simpson Category 5 by magnitudes with winds over 280 km/h, powerful enough to devastate entire cities with mortality and destruction analogous to that caused by sustained conventional bombing or the use of a nuclear weapon (Vidal and Carrington, 2013; GDFL, 2019; Masters, 2019). Within two months in 2019 two powerful cyclones, Idai and Kenneth, also devastated Mozambique, Malawi and Zimbabwe, causing nearly $900 million in damage, destroying crops, and killing 1000 and displacing 87,000 people. Cyclone Kenneth was a Category 4 storm that was the most intense to have ever made landfall in Africa (OCHA, 2019).

Climate change is also a ‘threat multiplier’, feeding into other complex causal chains for conflict and instability. Existing heating has been implicated as one of multiple triggers for brutal conflicts in Syria and the Sudan, which have killed and wounded hundreds of thousands and spurred millions more to move (Werrell and Femia, 2014; Mazo, 2010). In those conflicts alone, climate change has thus contributed to a toxic stew of more conventional international security crises: war crimes and crimes against humanity, chemical weapons use, civil war, and geopolitical tensions. Analysts now point out that we have lost the background security provided by the climatic stability of the Holocene (Harrington and Shearing, 2017).

The mining and burning of coal also cause grave damage to ecosystems and human health. There have been over 100,000 coal mine accidents in the US since 1900, and rates of ischemic heart disease and coal workers pneumoconiosis (‘black lung disease’) remain high. The latter has killed over 200,000 US mineworkers since the nineteenth century and 2700 worldwide in 2016 (We-Haas, 2017; Goodell, 2006, xx; Department of Labor, n.d.; Landon et al., 2011; McCabe, 2010; GBD, 2013 Mortality and Causes of Death Collaborators, 2015; GBD, 2016 Disease and Injury Incidence and Prevalence Collaborators, 2017). Mountaintop mining, especially common in the eastern United States, destroys the headwaters of riverine ecosystems and aquatic biodiversity, causes flash flooding, and is associated with increased cancer rates from air pollution. Rockfill dumped in valleys contains sulphuric acid and heavy metals such as selenium, and results in persistent pollution and fish deformities (Palmer et al., 2010; Hitt and Chambers, 2014: 915–926). Coal slurry dams also constitute an environmental threat: they leach heavy metals into the water table and wells, and in 1972 the failure of a dam wall at Buffalo Creek West Virginia ‘sent a twenty-foot-high wall of coal slurry into the hollow below, killing 125 people and leaving 4000 homeless’ (Goodell, 2006: 40–41). A 2019 analysis has shown that coal ash pits at 242 US power stations

are leaching heavy metals such as cobalt, arsenic, cadmium, lithium and selenium into the water table (Milman, 2019; Russ et al., 2019).

A 2013 Chicago School of Public Health study explains that coal burning 'produces airborne pollutants of particulate matter, sulphur dioxide, oxides of nitrogen, carbon dioxide, mercury, arsenic, chromium, nickel, other heavy metals, acid gases (HCL, HF), hydrocarbons (PAHs), and varying levels of uranium and thorium in flash.' The key effects have included acid rain, neurological damage, respiratory diseases and cancers, along with global heating and its multiple consequences for human insecurity, biodiversity loss, extreme weather and conflict (Burt et al., 2013). Acid rain, which damaged millions of hectares of forests and lakes in the Northern hemisphere but has abated in recent decades, remains at alarming levels in China, affecting 250 cities and 28 per cent of its area (Barnett, 2015: 257–260; Larssen et al., 2006: 418–425; Larson, 2010; Press Trust of India, 2011).

Coal burning is a major contributor to fine particulate air pollution (particles less than 10 μm—PM10—and 2.5 μm—PM2.5), along with wood fires and oil and gas combustion in transport. PM2.5, which is one-thirtieth the diameter of a human hair, is of especially serious concern because it can enter the lungs and bloodstream and there contribute to heart disease and stroke, lung cancer, chronic lung disease and respiratory infections (Undark Magazine, 2018). Using Global Burden of Disease data, the Boston-based Health Effects Institute estimated that in 2016 'worldwide exposure to PM2.5 contributed to 4.1 million deaths…a substantially larger number of attributable deaths than other well-known risk factors (such alcohol use, physical inactivity, or high sodium intake)'. Household air pollution due to burning of solid fuels (including coal) for heating and cooking contributed to another 2.6 million premature deaths (State of Global Air, 2018). A *Nature* study has estimated that, in 2010, 3.3 million premature human deaths from outdoor air pollution occurred, with power generation (of which coal is the largest contributor) causing 18 per cent or 593,000 deaths worldwide (some 243,000 in China, 17,000 in the United States, 90,000 in India, 14,000 in Russia, and 4250 in Japan). An Indian study found that 'between 80,000 and 120,000 deaths are caused by coal-related emissions', along with '20 million new diagnoses of asthma and an estimated cost of $3.3-$4.6 billion each year in hospitals and health spending' (Lelieveld et al., 2015; Krien, 2017: 49). Another study centered on China that included industrial and household coal burning estimated that 366,000 premature deaths in that country alone could be attributed to coal burning in 2013 (Wong, 2016).

It is puzzling that the extraordinary mortality due to coal burning and other forms of particulate pollution has not seized the imagination of the international community in the way that civil war, terrorism and weapons of mass destruction have. In part, this may reflect the international policy blindness to systemic and subtle forms of insecurity in favor of those which are more immediate, violent and spectacular (Burke, 2013). This effect gives rise to the 'slow violence' named by Rob Nixon, given that the damage wrought by coal use (and other environmental violence) takes place gradually and often invisibly: 'a violence that occurs gradually and out of sight, a violence of delayed destruction that is dispersed across time and space, an attritional violence that is typically not viewed as violence at all' (Nixon, 2011: 2). It may also reflect a moral and strategic myopia about the multiple threats to human health and the Earth's living biodiversity that will result from anthropogenic environmental change in coming decades and centuries (Hance, 2016). This myopia rests easily within neoliberal, extractive economies that must be radically transformed to support a human way of life that can exist within the boundaries of the Earth's carrying capacity. The capture of state politics by the energy sector, for example, makes state action both very necessary and difficult: governments will need to cease fossil fuel subsidies and challenge market failures that ensure the use of polluting technologies and damage sustainable energy policy (Pegels et al., 2018: 27).

Coal industry advocates often seek to counter the climate-related argument against phasing out coal by pointing to the promise of 'negative emissions' technologies such as Carbon Capture and Sequestration (CCS). However, there are no signs of technologically and economically viable CCS solutions becoming available within a timeframe that can mitigate global coal emissions consistent with a 1.5°C heating goal (Anderson and Peters, 2016; Smith et al., 2016). There are only two coal-focused CCS projects underway anywhere in the world, both of modest scale and success, and industry is reducing its investment in CCS research. There are no large-scale (500 MW plus) projects in operation, and CCS technology requires enormous capital investment in plant modifications and pipelines. It also more than doubles a plant's fuel costs (and causes a 'feedback loop' of emissions) due to the increased energy required to operate the CCS technology. Further concerns arise with increased emissions of other pollutants such as sulphur dioxide, nitrogen oxides and particulate matter, and the potential for stored CO_2 to escape. A potentially more promising technology—oxy-combustion—is years away from commercial viability and cannot be retro-fitted to existing plants. While CCS may eventually be of use in other industry applications, it shows no signs of being capable of mitigating 100 per cent of coal emissions before 2050 (Holmes à Court, 2018; Supekar and Skerlos, 2015a, 2015b; Baxter, 2017).

3. The coal treaty: design models and adoption pathways

We considered three initial design models for a coal elimination treaty: a humanitarian arms elimination treaty such as the land mine and biological weapons conventions, which have become part of the system of International Humanitarian law (IHL); a convention under the World Health Organization (WHO); or a previous environmental agreement such as the Montréal Protocol on Ozone-Depleting Substances. We ruled out the IHL model because the harms associated with coal are produced by modern energy and political systems rather than armed conflict, which make it a poor fit for the normative framework of the international humanitarian law regime. However, neither of the better alternative models present a simple pathway to the negotiation and adoption of a CET. In the discussion below, we thus consider three potential adoption pathways: a protocol to the United Nations Framework Convention on Climate Change (UNFCCC); the Health Assembly of the WHO; and a stand-alone treaty negotiated under the auspices of the General Assembly similar to the process that led to the Treaty on the Prohibition of Nuclear Weapons (TPNW). Our discussion of each pathway introduces design elements that we consider ideal for the treaty as a whole.

We conclude that a Montréal style agreement using the General Assembly as a pathway may be the most viable but leave open all three pathways for consideration. What is especially appealing about a TPNW-analogous pathway is that it provides a model in which momentum can be begun by public discussion of the humanitarian and ecological impacts of coal. It also provides a reasonable threshold for adoption and entry into force while allowing non-member states to sign and accede in their own time.

3.1. Option 1: the Montréal model as a protocol to the UNFCCC

The 1987 Montréal Protocol on Substances that Deplete the Ozone Layer is the best broad model for a coal elimination treaty—although many of the details should differ. It provides for the progressive elimination of a group of chemical substances which

have the common effect of depleting atmospheric ozone and accelerating global heating, damaging ecosystems and degrading human health (Scott, 2017: 275–278). It thus seeks to address similar planetary and human security concerns to those raised by coal and makes a material contribution to climate change mitigation. The Montréal Protocol also has an adaptive structure that can take in new scientific and expert advice to strengthen it, and an interesting accountability mechanism that is widely considered successful: a 'non-compliance procedure' whereby an Implementation Committee can consider any complaints raised by one party or by the treaty secretariat regarding compliance by another party (Rowlands, 2008). Indeed, to strengthen such a "soft law-plus" model, accountability and enforcement can be enhanced by opening the process to civil society, and by using satellite and GPS technologies for verification.[3]

Based on emerging science around carbon reduction pathways that can provide the best chance of arresting global heating at 1.5°C, the treaty should provide for the elimination of coal's production, sale and burning by 2030. Bearing in mind the IPCC's view that staying within 1.5°C guardrail requires a 45% reduction in global emissions by 2030 (IPCC, 2018: 12), the 2030 goal is chosen to emphasize the value of eliminating 40 per cent of global emissions well before the IPCC's net zero deadline in 2050, to create time and space for solutions across other (more complex and challenging) emissions sectors to be found. Furthermore, if the warnings of scientists about the potential for a two-degree temperature increase to result in a 'hothouse Earth' scenario are correct and we must achieve net zero by the early 2040s, phasing out coal by 2030 will be a crucial step in pushing the climate system toward a more stable trajectory (Steffen, 2020; Steffen et al., 2018).

If negotiations begin soon, this date allows time for transition plans to be implemented. The production of coking coal for steel plants might be extended beyond that, but it should be for the minimum time possible (not beyond 2035–40) and the agreement could include provisions for international cooperation and investment in the development and implementation of sustainable steel-making technologies. Indeed, new technologies—such as the hydrogen-fueled blast furnace developed by Thyssenkrupp and the concentrated solar power being trialed by Heliogen—are already showing promising signs of success (Delbert, 2019; Mazengarb, 2019). Preventing families burning coal in their homes will also be necessary; whilst this raises important government responsibilities to eliminate energy poverty in a sustainable way, the fact that the domestic burning of coal is highly lethal underscores the enormous public health benefits of phasing it out.

It is possible that larger coal-using states from the global South may seek to phase in their elimination later than 2030, drawing on the international environmental law principle of "Common but Differentiated Responsibilities" (CBDR). We do not deny the value of the CBDR principle, but we are concerned that such staging or delay would be highly risky, given that China and India between them now account for 35 per cent of global CO_2 emissions, and given the urgency of the climate crisis and the very serious biodiversity, security and economic consequences of heating beyond 1.5°C (Global Carbon Project, 2019). In seeking an early climate win across one major sector—to buy time for the complexities of industry, land use and transport to be addressed—the entire global community should aim to eliminate coal as one. We would also emphasize the enormous public health costs of coal pollution in states like India and China, which kills and sickens millions of people annually. While lifting communities out of energy poverty remains an important goal, government responsibilities for poverty alleviation ought not to be discharged through the maintenance of energy systems that are highly polluting and lethal.

Arguments are often put that coal is important to equalizing development paths that the North has already enjoyed (at, we would emphasize, enormous cost in human health, pollution and ecosystem damage from acid rain, power stations and mines). However, equally cost-effective non-fossil fuel energy alternatives—wind, tidal, nuclear, hydro, solar and battery—now exist and can deliver electricity at scale. Distributed microgrid solar with batteries is an especially attractive option in the developing world that eliminates energy poverty and empowers communities (REN21, 2019). While our preference is for fully renewable technologies such as solar and wind that have minimal environmental impacts, state agencies are now spoiled for choice when planning energy systems to support development.

At the same time, questions of climate justice remain important, acknowledging that per capita emissions in the global South remain much lower than those in the North. One very practical way of discharging climate justice obligations is for the North to assist developing countries to transition via the creation of a new mini-climate fund—a Fossil Fuels Transition Fund—which could be raised by taxes on fossil fuel imports and sales (much like a carbon price) and be directed to assisting the workers and communities around closed plants, to hospital treatment for coal-related disease, and to new investment in renewable electricity generation and new job-creating sustainable industries. These funds could be restricted to developing countries using a GDP-per-capita ceiling (see also the valuable proposal for a 'Global Transition Fund' in Newell and Simms, 2019: 7). In this way, perceived "costs" of transition can be turned into opportunities for revitalization by the implementation of "just transition" or "green new deal" policies in which fossil-fuel workers are supported to retrain and partnerships between communities, governments, business and trade unions create sustainable new industries to provide quality employment—as has been achieved successfully in Germany (Sheldon et al., 2018; Ritter, 2018; Mavrogenis n.d; Reitzenstein and Popp, 2019). It should also be recognized that climate justice requires rapid global emissions reductions; the global South contains many climate-vulnerable states (especially in Africa, the Caribbean and the Pacific) and climate-vulnerable regions within large states, all whose interests and survival are best served by rapid climate mitigation.

We are aware that the practical politics of negotiations may result in a signing and phase-out date later than we propose. However, in this text we choose to emphasize urgency and ambition. The TPNW model, which we outline below, also provides a natural way for a second wave of states to phase in their accession and their own elimination path, even if delay is far from ideal. Our concern about the CBDR principle in this context is its uncertain diplomatic effect. If climate governance history is any guide, its use could provide some of the world's largest greenhouse emitters with a mechanism to delay action in ways that doom global efforts to stabilize and limit dangerous climate change. On the other hand, if the use of the CBDR principle were to draw big coal-using states into the agreement in a timeframe consistent with the global 1.5°C goal, it may prove beneficial.[4]

In principle, the most logical place for a CET would be as a

[3] We thank Rachel Fleishman for these points.

[4] As we note earlier, another source of our concern is that it would introduce additional complexity into the negotiations and open the way to conflict over how responsibilities are allocated, because states have not reached a consensus on allocation or staging principles, especially within the global south. In our view, CBDR becomes less important when an agreement does not need to be initially comprehensive to come into force, unlike agreements under the UNFCCC. If states do wish to utilize the CBDR in a coal agreement, however, Newell and Simms (2019: 7) offer a plausible coal sequencing scenario.

protocol to the United Nations Framework Convention on Climate Change. This would help to avoid the widely recognized problem of fragmentation in international environmental law and draw on the political impetus that produced the Paris agreement (Biermann, 2014). There can be no doubt that a coal protocol would accord fundamentally with the objective of the UNFCCC, as set out in Article 2, to achieve 'the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system' (United Nations, 1992). Objections that the agreement breaks with the Paris model of voluntary 'nationally determined contributions' (NDCs) to climate change mitigation would automatically be overcome by the fact that it was negotiated and adopted by the UNFCCC membership; programs to phase out coal burning would be incorporated naturally into future NDCs. In this way, it would be consistent with the UNFCCC's core aims.

However, we are aware that given the impasse around the UNFCCC's rules of procedure, a coal protocol would need to be adopted by a consensus of states' parties to the UNFCCC. This provides a small group of states—or even a single state—with an easy opportunity to block its creation. The political realities of the situation may make this pathway an abortive one.

3.2. Option 2: the World Health Organization

If a coal protocol is likely to be blocked in the UNFCCC, two other potential routes to the adoption of a treaty then appear: a standalone treaty negotiated by conference established by the General Assembly, or a Convention under the auspices of the WHO. As Shirley Scott points out, the WHO has the power under Article 2(k) of its constitution to 'propose conventions, agreements and regulations…with respect to international health matters'—which has successfully occurred in the case of the 2003 Framework Convention on Tobacco Control (Scott, 2017: 61). Given the enormous human mortality from coal mining and pollution, such a treaty would sit squarely under the WHO's purview—given that its constitution mandates the organization and its member states to work for 'the attainment by all peoples of the highest possible levels of health'—whilst also having benefits for ecosystem health and climate change mitigation. The public health similarities between tobacco and coal are striking: as the WHO's own history of the tobacco convention explains, prior to the Convention's agreement 'the tobacco epidemic was a public health problem of epic proportions…smoking and other forms of tobacco use worldwide resulted in the loss of at least 3.5 million human lives in 1998 and was expected at that time to cause at least 10 million deaths a year by 2030 if the pandemic was not controlled, with 70% of these deaths occurring in developing countries' (WHO, 2009).

As well as being normatively appropriate, the WHO regime provides a viable pathway to adoption. A convention would have to be adopted by a two-thirds majority of the WHO's deliberative body, the Health Assembly, which voids the power of a small number of spoiling states while still requiring a significant threshold of agreement (WHO, 2014: Rule 70).

3.3. Option 3: a coal elimination treaty

If a coal 'protocol' could strike political obstacles from a few member states of the UNFCCC, how can we find an alternative model which presents a more achievable threshold for adoption, enables momentum to build, and remains open to initially reluctant states to join later? The Treaty on the Prohibition of Nuclear Weapons (TPNW, or 'nuclear ban treaty'), which was adopted by a vote of 122 states at a conference held at the United Nations in 2017, suggests a third pathway to the adoption of a coal elimination treaty. This pathway is both a political one, based around a progressive mobilization of civil society and sympathetic state actors towards an international conference, and a legal and procedural one based in the UN system.

Normatively, the TPNW arose out of widespread international concern about the humanitarian and environmental consequences of any use of nuclear weapons, and a subsequent desire to ensure that they were never used again (Borrie, 2014: 625–646). Whilst these norms were present in the NPT, and clearly stated at its review conferences, they were countered by a norm of nuclear possession enjoyed by the five nuclear weapon states listed in the treaty, which—via the doctrine of nuclear deterrence—created grave risks of inadvertent or deliberate nuclear use (Thakur, 2017). Thus, politically, the treaty emerged from a frustration that thousands of nuclear weapons are still deployed on high alert nearly five decades after the NPT was first adopted, a situation that many states considered to be in violation of the fundamental purposes of the regime—much as the continuation of rising levels of greenhouse emissions violates the fundamental objective of the UNFCCC (United Nations, 1992: Article 2). Given that the disarmament process had stalled, and the 2015 NPT review conference ended in failure without the adoption of a consensus statement, member states decided to move the initiative outside the existing structures of the non-proliferation regime.

The General Assembly first used an Open-Ended Working Group throughout 2015–16 to step outside the moribund Conference on Disarmament and develop the concept of a nuclear ban treaty. Then on December 23, 2016 the General Assembly voted to establish a conference to negotiate a treaty by a vote (in the First Committee on Disarmament) of 123 for, 38 against and 16 abstaining. The simple majority voting used by the General Assembly on 'non-important' questions—as per Article 18 of the UN Charter—has great democratic value in enabling international society to initiate actions to solve major global problems. At the same time, with an over two-thirds affirmative vote, the conference on the ban treaty had overwhelming international legitimacy. After 27 days of negotiations, the ban treaty was adopted on July 7, 2017 by an affirmative vote of 122 states (one against and one abstention) with the nuclear weapon states and many of their allies absent. The treaty prohibits signatory states from developing, testing, producing, acquiring, possessing, stockpiling, using or threatening to use nuclear weapons. The speed of this process is worth noting; just seven years after humanitarian consequences were raised at the 2010 NPT Review Conference, and four years after the Norway conference, a ban treaty was adopted.

The treaty will come into force 90 days after the fiftieth instrument of ratification is received; as of early 2019 it had 35 ratifications and 81 signatories (UNODA, n.d.). It will remain open to other states to join at any time and creates scope for states allied with nuclear weapon states to join, provided they are not in violation of its terms. This model thus allows a natural way for states to stage their entry according to their national circumstances. One significant difference between a coal agreement and the TPNW is that, whereas entry into the TPNW requires immediate compliance with its terms, entry into a CET would require serious intent to meet its terms by a future compliance date. Should that date have passed, states parties might negotiate a short window in which a new entrant can come into compliance consistent with holding global heating at 1.5°C.

The political and diplomatic process that led up to the TPNW is suggestive for a coal elimination treaty. The humanitarian concerns driving the process were stated clearly in the outcome of the 2010 NPT review conference, and then picked up by civil society and nongovernmental organizations (NGO) in coalition with sympathetic governments. Norway provided funds to an international

coalition of peace and humanitarian NGOs—the International Campaign to Abolish Nuclear Weapons (ICAN), which was subsequently awarded the 2017 Nobel prize for peace—and Norway, Mexico and Austria respectively hosted conferences during 2013–14 on the humanitarian impact of nuclear weapons, which were attended by numerous states, the International Committee of the Red Cross (ICRC), NGOs and civil society organizations. As set out in the Austrian Pledge published after the third conference, the process was similar to that pursued by the landmine, biological and chemical weapons treaties 'to *stigmatize, prohibit* and *eliminate* nuclear weapons in light of their unacceptable humanitarian consequences and associated risks' (Potter, 2017: 75–108). This staged process—which first stigmatizes a substance normatively, prohibits it through treaty adoption, and proceeds through treaty implementation towards its elimination—is exactly that which can be pursued in regard to coal. The alliance that developed between sympathetic states and civil society is also a compelling example. In the case of a CET, environmental NGOs and law firms, community groups opposed to coal mining, and governments in the South Pacific and other climate-vulnerable states can combine to lead the first stages of an international process of awareness-building around the health and climatic impacts of coal, with the aim of building diplomatic momentum towards a full treaty. This approach—as Mitchell and Carpenter's (2019) important recent study of human security-driven innovations in international law argues—pivots from trying to 'make emissions reduction palatable to the interests of the "most responsible" states [to] highlighting the moral obligations of those states to avoid harming vulnerable others.'

Without prejudging the politics around the issue, we imagine that initial pressure and momentum towards a CET would come from an alliance between civil society and climate-vulnerable and high-ambition states. If the 'High Ambition alliance' constructed by Chile in the lead up to COP25 is used as a guide, there are at least 70 states who may vote for a coal treaty—comprising 59 nations who have 'signaled their intention to submit an enhanced climate action plan' (or NDC) and 11 nations who have 'started an internal process to boost ambition and have this reflected in their national plans by 2020.' (This group substantially overlaps with 66 countries who offered at the 2019 UN Climate Action Summit either 'developed plans to achieve net zero CO_2 emissions by 2050 [or had] identified this target as a long-term national goal, or [were] advancing consultations on a long-term strategy for climate-neutrality in line with the Paris Agreement.') The group of 70 includes 15 European states, 22 from Latin America and the Caribbean, 14 from Oceania (the Pacific), 12 from Sub-Saharan Africa, three from Northern Africa, two from Western Asia, one from Southeast Asia and one from Central and Southern Asia—a spread across North and South, but predominantly from the developing world (Prensa Presidencia Chile, 2019).

4. Conclusion

We have argued a broad and urgent case for a coal elimination treaty that would come into force by 2030, based on its multiple global benefits for climate change mitigation, human health, ecosystem protection, and international security. While we have emphasized the very negative effects of coal, the profound benefits of even beginning discussion around an international treaty to phase out coal—which will place further pressure on its social license and market viability—are even more compelling. Climate scientists and epidemiologists have modelled scenarios in which *more rapid* carbon emission reductions to stabilize heating at 1.5°C–2°C would have dramatic benefits for global human health, preventing 150 million premature deaths worldwide between 2020 and 2100 (Shindell et al., 2018).

This proposal is ventured with an awareness of the deep conflict and stalemate in global climate action and negotiations. Its value is not based upon a need for universal consensus; rather, its value lies in identifying a sector that can make an enormous early contribution to climate mitigation and in empowering community and state actors who have been marginalized by UNFCCC processes. While it must reflect a significant threshold of support to be adopted, it can then place additional moral and normative pressure on the burning of fossil fuels and provides an architecture whose membership can be expanded. The Treaty's core *normative* purpose is like that of numerous other international treaties on prohibited means of warfare, polluting substances, crimes against humanity, war crimes, and traffic in endangered species (Mitchell and Carpenter, 2019). In all these areas there remain non-participants and violations; the power of such agreements lies in their ability to create and cement new norms in international law and push international society towards a new reality. As such, this proposal should not be dismissed because it may initially lack 'the participation of the key stakeholders and actors' (Blondeel et al., 2020: 2); its value lies in the ability to place profound pressure upon them to initiate a coal transition, while reflecting the will of a significant proportion of global society.

We have also emphasized the value of such a treaty to the climate change mitigation and governance regime, whether or not it is eventually negotiated within its structures. A coal elimination agreement will considerably enhance its effectiveness and global legitimacy and begin a cascade of market and policy shifts that will give humanity the best chance it has to stabilize and reverse global heating. As discussion around the treaty begins, and especially as diplomacy picks up momentum, markets will direct investment away from coal into renewable energy or more sustainable commodities, and legislators will be emboldened to block new projects on the grounds that they are both environmentally and economically irresponsible. Such a process has already begun but given the vast scale of planned coal development and its potentially devastating impact, cannot be trusted to continue on its own. Climate scientists have shown that international society now has less than three decades to reduce global greenhouse emissions to zero or face a dire and unmanageable future. We venture this proposal as a successful pathway toward its prevention.

Declaration of competing interest

None.

CRediT authorship contribution statement

Anthony Burke: Conceptualization, Investigation, Resources, Writing - original draft, Writing - review & editing. **Stefanie Fishel:** Conceptualization, Investigation, Resources, Writing - original draft.

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