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Equity, Climate Justice and Fossil Fuel Extraction

Principles for a managed phase out

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Abstract

Equity issues have long been debated within international climate politics, focused on fairly distributing reductions in territorial emissions and fossil fuel consumption. There is a growing recognition among scholars and policymakers that curbing fossil fuel supply (as well as demand) can be a valuable part of the climate policy toolbox; this raises the question of where and how the tool should be applied. This paper explores how to equitably manage the social dimensions of a rapid transition away from fossil fuel extraction. Fossil fuel extraction leads to benefits for some people (such as extraction workers) and harms for others (such as pollution-affected communities). A transition must respect and uphold the rights of both groups, while also staying within climate limits, as climate impacts will fall most heavily on the world's poor. This paper begins by reviewing how extraction affects economies and communities and the different transitional challenges they face. Based on that review, it then examines three common equity approaches - economic efficiency, meeting development needs, and effort-sharing. Drawing lessons from the strengths and weaknesses of these approaches, the paper proposes five principles as a basis for equitably curbing fossil fuel extraction within climate limits:

1. Phase down global extraction at a pace consistent with limiting warming to 1.5°C;
2. Enable a just transition for workers and communities;
3. Curb extraction consistent with environmental justice;
4. Reduce extraction fastest where doing so will have the least social costs;
5. Share transition costs fairly, according to ability to bear those costs.

Key policy insights:

- Fossil fuel extraction is unlikely to be a viable path to development because the Paris Agreement goals require most fossil fuel use to be ended within a generation;

- Extraction should be phased out fastest in diversified, wealthier economies that can better absorb the transitional impacts;
- Governments of extracting countries should enact ambitious industrial policy to diversify their economies, alongside economic and employment policies to enable a just transition;
- The costs of a just transition should be borne by those most able to bear it: poorer countries can reasonably demand financial support.

1. Introduction

Equity issues have long been debated within international climate politics. They are not only compelling from a moral standpoint, but also of political concern. Climate change is a global commons problem, and preventing extreme climate disruption will require global cooperation, in which governments and societal actors will participate only if it seems fair (IPCC, 2014a).

This paper aims to explore how to equitably manage the social dimensions of a rapid transition away from fossil fuel extraction. The climate equity discussion has thus far focused on territorial emissions and consumption of fossil fuels (See IPCC 2014a). However, avoiding the worst excesses of climate change will also require action to curb fossil fuel extraction, on which the equity discussion is more nascent (Caney 2016, Lenferna 2017, Armstrong 2019, le Billon and Kristoffersen 2019). This paper aims to contribute to that discussion. The measures it proposes are intended to complement efforts to address equity in relation to territorial emissions.

In section 2, we review the distributional issues arising from a phase out of fossil fuel extraction. In section 3, we discuss three equity frameworks appearing in the broader climate policy literature, and their ability to address these issues. Drawing from this analysis, in section 4 we propose five principles for managing the concerns. In section 5, we examine the policy implications of those principles.

2. Equity issues in fossil fuel extraction and transition

2.1 A rapid phase out of fossil fuels

Roughly 1°C of warming has occurred since pre-industrial times (IPCC, 2018), and has caused significant damage and loss of life from floods, storms, droughts, wildfires and habitat change. The Paris Agreement (UNFCCC 2015a) set a goal of holding warming “well below” 2°C and pursuing efforts to keep warming to 1.5°C. Though ambitious, even 1.5-2°C may pose catastrophic risks, such as from ice-sheet collapse causing sea level rise of many meters (IPCC 2018), or from tipping the earth into an unstable state of upward-spiralling feedbacks (Steffen et al. 2018).

Still, emissions continue to rise (UNEP 2019). There is a strong case that new approaches are needed. Among these, restricting fossil fuel extraction may have both economic and political advantages compared to conventional end-of-pipe approaches (Green and Denniss 2018), contrary to policy makers' tendency to treat energy and climate policymaking separately (Bang and Lahn 2019).

Avoiding the above dangers implies a very limited remaining carbon budget: just 500 GtCO₂ (as of January 2020), for a 50% probability of keeping warming below 1.5°C, or 340 GtCO₂ for a 66% probability (IPCC 2018; deducting subsequent emissions). Note that these probability benchmarks, established by convention, imply accepting a significant risk of failure.

These budgets amount to respectively 12.5 or 8.5 years' worth of current global emissions of about 40 Gt/yr (Le Quéré et al. 2018). Bearing in mind that non-OECD countries account for 79% of global coal extraction, 73% of oil and 63% of gas (BP 2019), even a near-immediate phase out in OECD countries and a 25-year phase out in non-OECD, beginning immediately – which is well beyond anything currently considered politically plausible – would largely exhaust the budgets.¹ (See also Muttitt 2016).

While the specific timeframes will depend on what probabilities of failure are accepted, and on how much one relies on the future availability of carbon dioxide removal (CDR) technologies,² we conclude in general that achieving the Paris Agreement goals entails a rapid phase out of fossil fuel extraction, and a dramatic turn from current patterns of investment, policy and subsidies (SEI et al 2019).

2.2 Impacts of extraction and transition

Advocates of fossil fuels highlight the benefits of their extraction and use: jobs, energy, revenues. Opponents emphasize the costs: pollution, corruption, inequality (Kantha et al. 2016). In this paper we do not try to weigh the benefits of transition against costs, which is anyway a somewhat abstract question. Rather we note that they are generally experienced by different people, creating both winners and losers (Newell and Mulvaney 2013; Healy and Barry 2017). In this section we review these issues, with a focus specifically on a transition away from fossil fuels.³

¹ Based on current oil, gas and coal emissions (Le Quéré et al. 2018), and assuming geographically equal emissions factors, OECD currently extracts fossil fuels equivalent to 9.2 GtCO₂/yr and non-OECD 25.3 GtCO₂/yr. If OECD were to phase out on a straight line within five years and non-OECD within 25 years, the resulting emissions would be 340 GtCO₂, even before considering other sources such as cement and land use change.

² The IPCC (2018: 96) warns that “CDR deployed at scale is unproven, and reliance on such technology is a major risk in the ability to limit warming to 1.5°C.”

³ The equity concerns that may arise in a post-carbon economy, such as from lithium or cobalt mines (Horvath and Romero Medina 2019; Amnesty International 2016b) or bioenergy plantations (Colbran 2011; Gonzalez 2016), are beyond our scope. Nor have we

Energy provision

Extraction of fossil fuels has historically provided cheap and secure supplies of energy, both to meet basic needs and to fuel economic development. However, the important equity issues that arise in relation to energy supplies are the subject of equity frameworks on territorial emissions. To avoid duplication, we focus on aspects specific to extraction, such as employment and public revenue.

National and local economies

Fossil fuel extraction is often seen as providing a route to socio-economic development (Strambo and Gonzalez Espinosa 2020). Extraction can be a major economic sector in a country or region, a dominant engine in a major hub like Maracaibo (Venezuela), Newcastle (Australia) or Port Harcourt (Nigeria), and virtually the sole employer in small coal mining towns. For some communities with a strong industrial heritage, coal mining can play an important cultural role (Carley et al. 2018).

On the other hand, large-scale resource extraction has caused some economies to suffer from "Dutch Disease", where increased input costs and currency appreciation make other exports uncompetitive (Stevens et al. 2015). Some scholars have suggested a political dimension of the "resource curse", where extraction-derived economic rents are correlated with corruption, bureaucratic inertia, lack of democracy, conflict and repression (Karl 1997, Ross 2012).

While there is an extensive literature examining the circumstances that lead to a resource blessing or a resource curse (see Stevens et al. 2015 and Ross 2015), a central equity issue is that, in any instance, some people will benefit and others will be harmed. Consider, for example, Iraq in the 1970s and 1980s, a classic image in US and European consciousness of a state damaged by oil. On one hand, Saddam Hussein used oil revenues to launch disastrous wars and to reinforce his dictatorship. On the other, oil revenues underpinned rapid growth in general prosperity, expansion of education and the region's best healthcare system (Aburish 2001; *Middle East Health* 2012). It would be simplistic to claim Iraqis on balance benefited from oil, and equally simplistic to claim they suffered.

Employment

One obvious benefit of fossil fuels is employment in coal mines and at oil and gas fields. There are also suppliers, such as construction workers, welders, divers and pilots. Less directly, there

explored ways in which the conceptual framing of "energy" and "transition" may lend themselves to perpetuation of injustices, in particular by emphasizing narrowly defined techno-economic matters to the exclusion of the social and political (Lohmann and Hildyard 2014).

are jobs processing the products of extraction, in oil refineries or coal power plants. More broadly still, there are local jobs in extraction-dependent regions, from mechanics to coffee shop owners.

While job numbers are likely to be greater in clean energy than fossil fuels (UNIDO and GGGI 2015; Pollin et al. 2014; UKERC 2014), they have often been of lower quality, in terms of compensation, benefits, or union rights (Emden and Murphy 2019). Unions' campaigning over decades has managed to secure relatively high wages and better terms of employment not yet present in newer sectors. There will be further transitional challenges where geography and skills needs differ from the status quo (Caldecott et al. 2017).

To address these concerns, the labour movement has developed a set of principles through which workers and communities can undergo a *just transition* (ITUC 2015; UNFCCC 2016) (see sections 4.1, 5.1). With thoughtful planning, proper investment, and policies to protect workers' rights, governments can minimise hardships and indeed create benefits.

Public revenues

Many governments rely on oil and gas revenues, which may be used to fund health, education or social programmes, to invest in infrastructure, or to service sovereign debt. Regardless of the resource curse, a rapid *transition* away from extraction, without replacing the fossil fuel revenues with other sources, would reduce delivery of public services, increase indebtedness, and/or reduce public sector employment. Like the coal miner or the welder, a government-employed nurse or teacher will have their livelihood potentially impacted by transition.

Local impacts

Extraction can also bring pollution, harming both public health and the ecological resources that underpin livelihoods in farming and fishing. In cases where communities have protested extractive operations, they have often been met with state-sponsored or company-sponsored violence. The beneficiaries of extraction are often distant from those adversely affected, a problem made worse by the prevalence of corruption in relation to extraction (Andersen et al. 2017; Arezki and Bruckner 2011).

For example, in Nigeria's Niger Delta, oil pollution and gas flaring have chronically damaged people's health, causing respiratory diseases, blood disorders and various cancers (Ejiba et al. 2016; UNEP, 2011), while the response of the state and corporations to local opposition has been largely oppressive and violent (Manby 1999; Okonta and Douglas 2003). In India, the majority of coal mining occurs in the eastern states of Chhattisgarh, Jharkhand and Odisha, home to a quarter of India's 100 million Indigenous/tribal (called Adivasi) population, in ways that routinely breach their human rights (Amnesty International, 2016a). These two cases unfortunately represent a broad pattern, mirrored in numerous other places (Larson 2004, Maass 2009, Bassey 2016).

Corporate profits and protections

One set of actors that has consistently benefited from extraction is fossil fuel corporations, who have continued to expand during the decades that they knew their products caused climate change, and in some cases distorted public debates and impeded policy-making (Ekwurzel et al 2017; Supran and Oreskes 2017). With private profits generally rationalised as a reward for risk-taking, it is ironic that these investments are legally protected from the energy transition, under a range of bilateral and multilateral investment treaties (Cotula 2015; Hildyard and Muttitt 2006), insulating them from risks of stranded assets. Such protections incentivise the corporations to keep adding more fossil fuels, while constraining governments' ability to address the problem through regulation (Bernasconi-Osterwalder and Haas 2017; Tienhaara 2018). This paper focuses on managing the transitional impacts on people and societies; however, we note that fairness may require removing corporate protections in order to apply protections to the workers, communities and societies that do not currently enjoy them.

2.3 Comparative transitional challenges

Irrespective of the positive and negative impacts, there are many economies today that are deeply entangled with fossil fuel extraction. Structural changes in an economy necessarily take time: to build new industries, institutions, infrastructure and human capital. Ending extraction will be challenging everywhere it happens, but the higher the degree of economic dependency, the greater the challenges.

For example, consider coal mining in Germany compared to China. Any equitable solution to ending German coal extraction must take into account the workers and communities in mining regions. But Germany's 15,000 coal miners account for 0.03% of the national workforce (Statistik der Kohlenwirtschaft 2017),⁴ whereas China's 5.2 million account for 0.6% of its workforce (Feng 2017, World Bank 2017). Assuming each country can reasonably transition the same proportion of its workforce and economy per year, China would then need twenty times as long as Germany to make the transition.⁵ Moreover, Germany's \$900 million coal mining wage bill amounts to 0.03% of GDP; China's \$50 billion to 0.5%.⁶ Assuming the costs of just transition (such as retraining and social protection) are proportional to the wage bill, this suggests that Germany has sixteen times greater resources relative to what is needed than does China, as well as a broader

⁴ Assuming mining's share of lignite employment remains at 75% (employment statistics no longer disaggregate mining from power plants).

⁵ Mining accounts for a much larger share of employment in the mining regions, such as Lusatia in Germany or Shanxi in China. However, given that national governments should be expected to help enable the transitions in those regions, the national comparison remains apt.

⁶ Average mining and quarrying wages in 2015: US \$795/month in China; \$4,985/month in Germany (ILO 2017).

base of employment elsewhere to absorb the displaced workforce, labour policies and welfare budgets to support it.

Germany and China thus differ along two important dimensions: the relative scale of the transition, and the countries' ability to mitigate and absorb its adverse impacts. Figure 1 illustrates the challenges of transition on these dimensions for various coal-extracting countries.

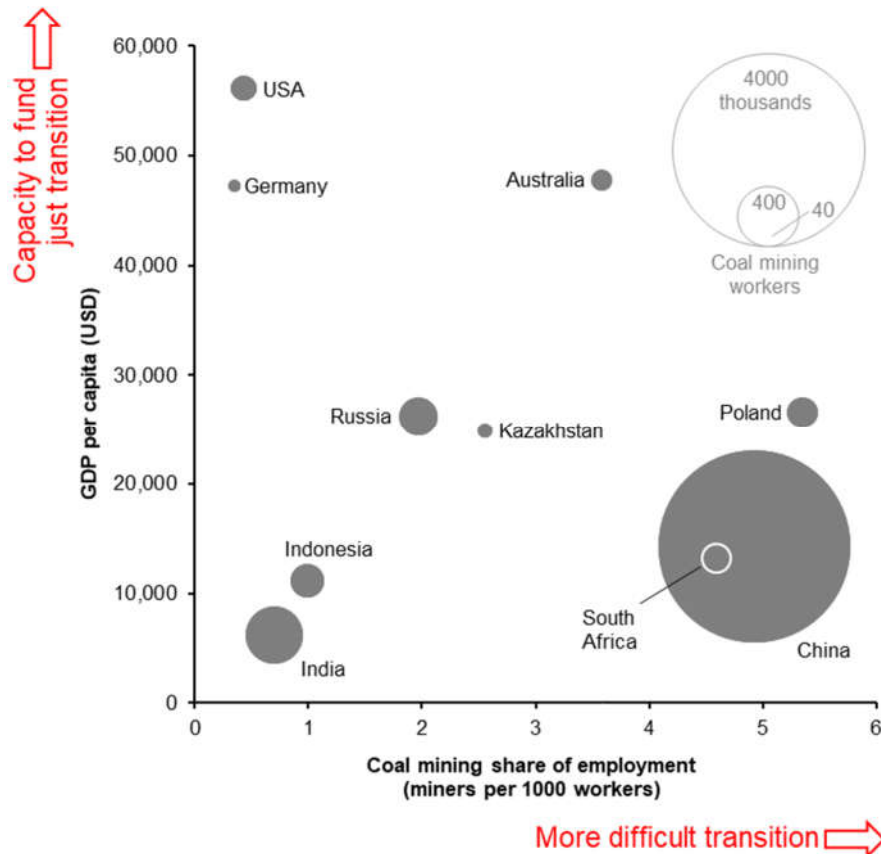


Figure 1: Coal mining share of employment versus per-capita GDP (PPP), selected countries, 2015 (or nearest year for which data available). Size of bubbles reflects absolute number of coal mining workers. (Sources: IMF 2018; government and media reports – see Supplementary Information)

Oil and gas extraction are less labour-intensive than coal, but often account for a significant share of government revenues. The number of public sector workers indirectly affected may thus be much larger than those directly employed. For example, in Algeria, the oil and gas sector employs around 3% of the workforce (350,000 workers) (Belalloufi 2014); oil and gas also account for 34% of government revenue and hence the salaries of a further 1.7 million workers, or 14% of Algeria's workforce (IMF 2016, 2018).

There are significant difficulties in moving away from heavy oil dependence. Inflated currency, wages and land values often make non-oil sectors uncompetitive in heavily dependent countries, while rent-seeking and patronage create political barriers to change. Most oil-dependent countries have long held economic diversification as a priority policy objective, with very limited success. Alsharif et al (2016) find that only in eight out of 35 countries has oil's share of exports consistently decreased since 1960. Even in a relatively successful case, Indonesia, oil's share took 30 years to fall from 50% in 1970 to about 15% in 2000. In Saudi Arabia, oil's share fell from 95% only to 85% over the same period, in spite of diversification being a policy priority throughout the period (Banafea et al. 2018).

The relative challenges of various oil-producing countries are illustrated in Figure 2.

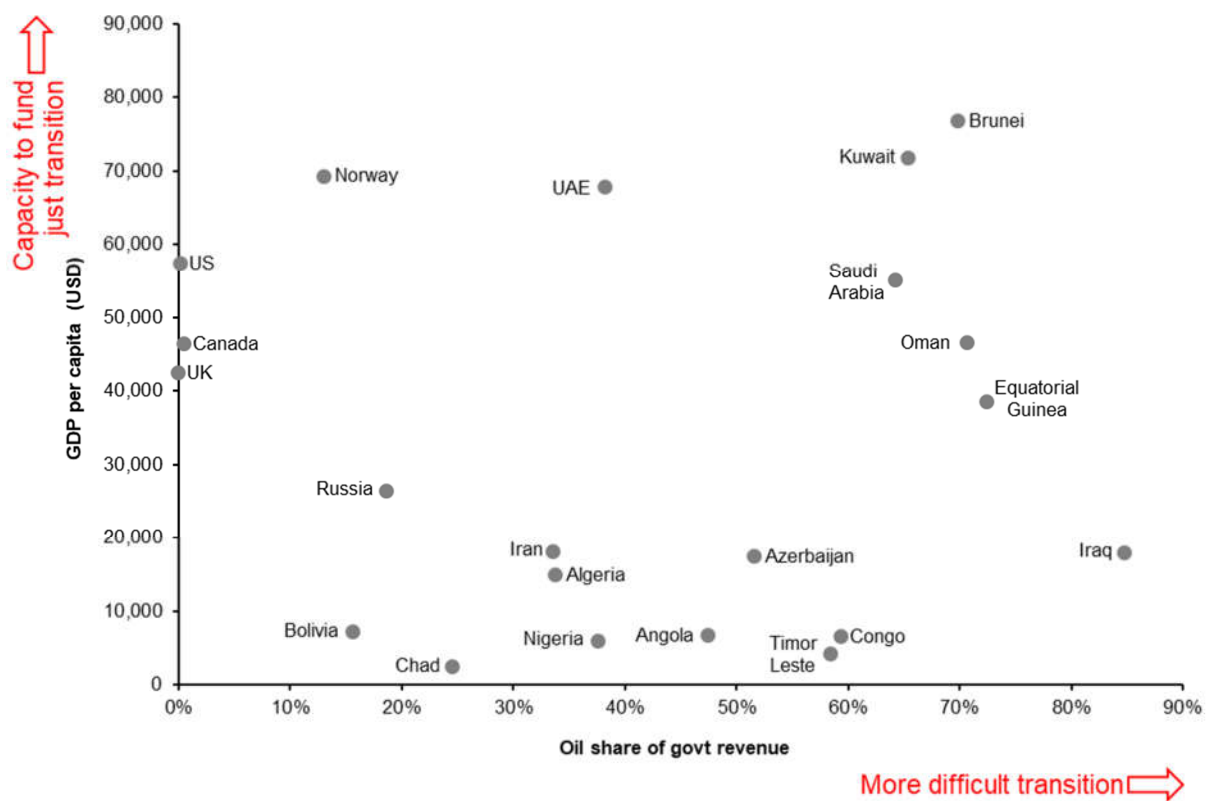


Figure 2: Oil's share of central government revenue versus per-capita GDP (PPP), selected countries, 2016 (or nearest year for which data available). (Sources: IMF 2017; IMF Article IV reports; national accounts – see Supplementary Information)

3. Representative approaches to equity and extraction

In this section, we consider three allocation approaches that typify climate policy literature, and weigh these against the challenges of transition identified in section 2.

3.1 Allocate according to economic efficiency

A dominant view is that the cheapest or most profitable resources should be the ones extracted, with the allocation of the carbon budget best left to liberalized markets. This keeps things simple: there is no difficult political discussion of who must stop extracting; rather, the allocation question is left to markets. The equity case for this approach is that lower energy prices would benefit the world's energy-poor, who spend the largest share of their incomes on energy (Bradley, Lahn and Pye 2018). A key problem with this approach is that leaving the allocation to markets means forgoing policy restriction of fossil fuel supply (Gaulin and le Billon 2020), which is a valuable and necessary lever of climate mitigation (Green and Denniss 2018; Muttitt 2016). A second problem is that the social costs of a rapid transition go far beyond energy prices for consumers. Markets tend to externalise any social and environmental costs that are not explicitly regulated. Indeed, any social and environmental impacts that do not directly impact the producer's costs are not reflected in market prices, even quite considerable and socially consequential impacts such as retraining for affected workers or community reinvestment.

A response typically given by proponents of a market approach is to couple it with either tradable permits or compensatory payments (Coase 1960) to address any equity concerns separately. For some purposes, financial transfers are appropriate and necessary, as we discuss below. But they cannot be an adequate solution, as illustrated by the fact that for major oil producers pursuing economic diversification, progress has not generally been any faster when revenue availability was greater (Hvidt 2013). Especially in poorer countries, redirecting economies requires time, no matter the amount of compensatory payments directed at the problem, if a robust and sustainable post-extraction economy is to be created.

3.2 Allocate according to development needs

A second approach allocates the remaining carbon budget to address equity concerns, prioritising extraction where it can lift people out of poverty (Caney 2016, Morrissey 2016). This approach often directly conflicts with economic efficiency (Lenferna 2018), as not all fossil fuels are economically equal. Take Tanzania, whose low human development index (HDI) of 0.54 (UNDP 2018:24) would seem to designate it as a priority for extraction. According to Rystad Energy (2018), however, most of Tanzania's gas resources would require an oil price above \$125 per barrel to be viable.

Moreover, extraction does not straightforwardly yield social benefits, as we saw in section 2; it creates both winners and losers, distributed in complex ways. Allocating extraction to the poorest countries makes sense only if the poorest communities and individuals within those countries benefit from it.

Allocating in relation to development needs also runs into the problem of the rapidly dwindling 1.5°C carbon budgets: just 8.5 or 12.5 years of current global emissions. The viability of extraction as a developmental path is questionable when extractive projects commonly last 30 or 40 years and may leave a legacy of stranded assets and unmet liabilities (Cust et al. 2017; Fuhr and West 2014). Notably, one lesson from the resource curse is that better outcomes are generally achieved when development proceeds more slowly, taking time to build institutional knowledge and local capacity as Norway did (Stevens et al. 2015; Karl 1997). This option becomes unavailable in the context of climate urgency.

Morrissey (2016) observes that the fossil fuel reserves of countries with HDI below 0.7 are roughly equivalent to the carbon budget for 1.5°C. However, the budget quickly vanishes if one does not assume that all other countries immediately stop extracting, including such Southern countries as Gabon, Ecuador, Mongolia and Iran. We noted in section 2.1 that even a near-immediate phase out in OECD countries and a 25-year phase out in non-OECD would largely exhaust a 1.5°C carbon budget. This leaves no room for additional fossil fuel extraction. Indeed, the more urgent the climate problem becomes, the smaller the available budget to address equity concerns, whilst the equity consequences of a more rapid transition are magnified.

Combining a development-needs rationale with Coasian-style adjustment payments, Ecuador proposed (ultimately unsuccessfully) to leave its Yasuni-ITT oilfield untapped in return for international compensation payments of half the value of the oil, to help meet its national development needs. This approach would, however, be unviable scaled up as a global climate solution, as it would in effect create a shadow virtual oil industry, transferring vast revenues without any actual trade in goods.⁷ Ecuador's claim for compensation was rooted in the doctrine of permanent sovereignty over natural resources (UN 1962), which was a vital aspect of Southern countries' emergence from colonial domination. However, this doctrine must be altered when extraction of those resources is harmful to others (Armstrong 2019) and would compromise other countries' sovereignty over their atmosphere and ecosystems.

⁷ One reason the Yasuni-ITT initiative failed was that some donors feared setting a precedent for other oil exporters (Marx 2012; Scholz 2013). To answer this, the proposed replicability of the proposal was restricted to biologically and culturally sensitive tropical forests (Larrea 2009). This restriction would obviously limit the approach's value as a general solution to fossil fuels and climate change; meanwhile, several writers pointed out that Ecuador's duty to respect rights should not be contingent on its international relations (Acosta et al. 2009; Lang 2013).

3.3 Allocate fair shares of the transitional effort

With respect to equity in territorial emissions reductions, another approach is to fairly share the global *effort* of mitigating emissions, rather than the remaining emissions *budget* (IPCC 2014a). Under the 1992 United Nations Framework Convention on Climate Change (UNFCCC 1992), developed countries “should take the lead in combating climate change and the adverse effects thereof”, as countries have committed to protect the climate “on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities”. As detailed in the Rio Declaration (1992), the developed countries’ additional obligations follow “in view of the pressures their societies place on the global environment and of the technologies and financial resources they command”, that is, as a consequence of the greater responsibility for environmental pressures (eg historical emissions) and greater capacity to manage them (eg higher per capita GDP).

Unfortunately, these criteria do not neatly translate to extraction. The nature and magnitude of an economy’s dependence on extraction can imply much greater differences in relative transitional challenges than is the case when just taking emission levels or capability into account. Figure 2 illustrates some examples. To use a typical measure of capability, Oman has similar per-capita GDP to Canada. But whereas oil provides a negligible share of Canada’s public revenues, in Oman it is more than 70%. Although the two countries have similar financial resources, it will be easier for Canada to undergo a faster transition, given its more diversified economy. Turning to responsibility, after fifteen years of extraction, Chad could be said to have greater historic responsibility than Mozambique, which is just starting. But with a quarter of Chad’s public budgets coming from oil, ceasing extraction will be more challenging than in Mozambique; and furthermore, the climate arguments against developing new fossil fuels are that much stronger today than when previous resources were developed.

Each of the three approaches outlined above has strengths and weaknesses, and none is straightforward. We shall draw out useful features from each in the following sections.

4. Principles for equity and extraction

In this section, we aim to derive a set of guiding principles on how to address the challenges of equitably managing the phase out of fossil fuel extraction. To do so, we first address four distributional questions, drawing on the reviews both of issues in section 2 and of approaches in section 3:

- How should the impacts of climate change on vulnerable people be balanced with the impacts of transition on those dependent on fossil fuels?
- How should the negative impacts of current extraction be incorporated?

- Who should undergo the fastest transition?
- Who should pay the costs of transition?

4.1 The pace of transition

Avoiding the worst dangers of climate change requires a rapid energy transition. On the other hand, a more rapid transition will lead to greater social costs, for workers and for local economies. Recall (section 2.3) that even partial diversification from high fossil fuel dependence - such as for Germany's coal-miners or Indonesia's oil revenues - has taken many decades.

A key political and perceptual difference between those impacted by the transition and those impacted by climate change itself is that the former are a more well-defined and identified group. The ILO (2020) estimates that around 12 million people worldwide are employed in mining and quarrying; a subset of these people extract oil, gas and coal. As we saw in section 2.2, others work in related supply, contract or processing jobs, or in the local economy of extraction regions. We can picture these people, and what they do in their work; in principle we could list their names. We cannot do the same for victims of climate change.

However, we also know the impacts of climate change will be felt by a vastly larger number of people, and most severely by the poorest (Special Rapporteur 2019). The impacts could well be profound, global, and irreversible, though at the same time less tangible or easily comprehensible. For example, the IPCC (2014b) warns that if climate change is unchecked, there is a one-in-five chance that yields of wheat, maize, rice and soya will decrease by more than 50% by 2100 and a further one-in-five chance that they will decrease by between 25% and 50%. The resulting hunger would be experienced on an unprecedented scale, by billions not millions of people, yet still the outcomes are probabilistic, their timing and shape uncertain.

While we cannot directly weigh these two types of impact against each other, we do know that the transitional impacts are relatively familiar from other processes of industrial change, they are largely predictable and subject to human forces rather than biophysical processes beyond human control. In any trade-off, it makes sense then to maximise efforts to mitigate the larger, more unpredictable, less familiar, and potentially catastrophic impacts of climate change, while investing heavily in equitably addressing the more predictable, manageable costs of transition (Weitzman, 2011; Grubb 2014; Kartha and Baer 2015).

We should therefore prioritise "pursuing efforts" to keep warming below 1.5°C, the most stringent target for which substantial evidence of feasibility has been amassed (IPCC 2018). The need for a just transition – and the management of other social costs – should be taken into account to determine not the pace of transition, but the manner in which it is implemented and the resources devoted to it. Neither driving a rapid transition, nor making it just, should be used as an excuse

for not delivering on the other. In any case, a just transition is in fact likely to be faster than an unjust one (TUC 2008; Evans and Phelan 2016).

From these considerations, we draw a first principle that, given the severe nature of the climate threat, fossil fuel **extraction should be curbed so as to ensure warming does not exceed 1.5°C**, as an absolute objective. From this temperature objective, flows a rapid pace of transition.

Having established that pace of transition, our second principle is that it must be managed in a way that ensures **a just transition for workers and communities**. The principle of just transition is codified in International Labour Organization guidelines (ILO, 2015), and the Paris Agreement, in its preambular text, recognizes “the imperatives of a just transition of the workforce”.

A just transition entails (Rosemberg 2010; ITUC 2015): creating decent new jobs (i.e. with fair pay, reasonable conditions and union rights) by investing in alternative sectors; retraining transition-affected workers to help them get alternative jobs; protecting the rights and income of workers and communities throughout the transition; and democratically engaging those stakeholders in the process of transition (see section 5.1).

4.2 Winners and losers from extraction

We saw in section 2.2 that in some cases, fossil fuel extraction causes severe damage to health, loss of livelihoods and violation of people’s rights. Furthermore, corruption can prevent any benefits from extraction being shared, while bringing its own social ills. In such cases a transition brings not just social costs but also social benefits.

All else being equal, it makes sense to phase down extraction fastest where the benefits of doing so are greatest. Thus, civil society groups in California have called for the priority closure of oil wells within 2,500 feet (about 750 metres) of homes, schools and hospitals, as a first step towards the wider managed phase out of the state’s oil production (Last Chance Alliance 2020). Some Southern movements have long proposed keeping fossil fuels in the ground, especially in ecologically and/or socially sensitive areas (Oilwatch 2015).

The situation is more complicated where extraction creates both significant benefits and significant harms. In the case of rights violations, the issue is not one of balancing different interests: human rights have an absolute character that cannot be traded off against other benefits (Bratspies 2015; Osofsky 2005). In the context of racial justice in particular, Martinez-Alier (2003a) observes that human dignity is not commensurate with money. In some cases, extraction activities and institutions may be reformed to stay within acceptable social and environmental boundaries; where this is not possible, the only option may be to close them down (Honty and Gudynas 2015).

Observing that environmental injustice frequently arises from the political marginalisation of those who suffer it (Adeola 2000), some writers have emphasised the procedural aspects of environmental justice (Schlosberg 2004; Bell and Carrick 2017): ensuring that those affected by energy decisions participate in them.

Drawing these observations together, we propose a third principle that ending fossil fuel extraction should be prioritised where communities disproportionately experience the harms of extraction and not the benefits, such as where pollution undermines development. In cases where extraction violates people's rights, it should be reformed or stopped immediately. These issues should be addressed in ways that ensure affected communities have a strong voice and democratic process. In short, **extraction should be curbed consistent with environmental justice.**

4.3 Who stops extracting fastest?

Let us look again at the discussion of representative approaches in section 3. Economic efficiency seeks to minimise costs, but limits these to energy production costs and not transitional costs. Compensatory payments will often be insufficient to address these latter costs, as economies with deep dependence will require time to transition as well as money. The development-needs approach improves on this by recognising countries' different situations and corresponding needs, but fails to answer the question posed by the resource curse – that extraction creates burdens for some people, not just benefits – and moreover attempts to allocate a carbon budget that may be too small to deliver on the developmental objective. The effort-sharing approach transcends both questions by focusing instead on transitional impacts, but the concepts of “capability” and “responsibility” as applied to emissions do not translate neatly to extraction.

Drawing these considerations together suggests a hybrid approach, wherein we should seek to minimise transitional costs in a targeted way, where they are felt most keenly, while fairly sharing the residual costs that remain. Our fourth principle then is that **extraction be reduced fastest where the social costs of doing so are the least.** Recalling the relative challenges we saw in section 3.3, this notion of lowest social cost of transition has two dimensions: firstly where dependence on extraction for providing employment or public revenues is lowest, and secondly where financial or institutional capacity to absorb and overcome transitional difficulties is the greatest.

That does not mean that other countries do not need to act: given the limited carbon budget and the challenges of economic diversification, more extraction-dependent and poorer countries may take more time phasing out extraction, but should still begin now. Indeed, delay in starting would lead to greater social impacts from a later, more rapid transition (Muttitt et al 2019).

Clearly this approach does not optimise for economic efficiency, expressed in terms of energy markets. But the efficiency questions raised for the development-needs approach, as in the Tanzania example in section 3.2, are less significant for our more hybrid approach focused on the transition away from the status quo. While it might lead to (say) a cheaper field offshore Norway to be closed down earlier than a more expensive one offshore Nigeria, the status quo has already been shaped by markets; we are not proposing new expansion, expensive or otherwise.

4.4 Who bears the costs?

A differentiated pace of phasing out extraction will not be enough to fully address equity concerns between countries. The remaining carbon budgets are so small that extraction-dependent poor countries will have to go through a faster transition than they can be reasonably expected to undergo unaided (however fast Northern countries phase out their extraction): generally within two or three decades.

As the costs of phasing out fossil fuels are incurred for the (global) common good, they should be shared fairly, rather than allowed to fall on those unfortunate enough to bear them directly. Indeed, it is unlikely that poorer fossil fuel-producing countries will be able to limit extraction without financial, institutional and technological support to enable a just transition (see Pollin and Callaci 2018; Green and Gambhir 2019). Our fifth principle is therefore that **the largest burden should be borne by those with the broadest shoulders (i.e., “ability to pay”)**, echoing the UNFCCC principle of respective capabilities.

What about responsibility for past extraction? There are conceptual challenges to assigning moral responsibility to the country in which it occurs, owing to the international nature of trade and investment. Extraction has often been undertaken in developing countries, but with its benefits realised in Northern countries (Martinez-Alier 2003b; Roberts and Parks 2009). Some countries were driven to extract by IMF structural adjustment programmes, or by corrupt domestic elites in cooperation with transnational corporations, who extracted both the fossil fuel resource and the profits therefrom. Some had urgent development needs, and extraction appeared to be a singular option for meeting them (Moss 2016), echoing the notion of “survival emissions” in contrast to “luxury emissions” (see also Agarwal and Narain 1990; Shue 1993; Rao and Baer 2012).⁸

Still, further exploration is certainly warranted, as “simply choosing in the present to do damage in the future is quite straightforwardly wrong”, as Shue (2015: 10) notes. One strong argument for

⁸ These conceptual problems do not generally arise in relation to corporations’ moral responsibility for extraction, which may play an important role in assigning legal liability (Ganguly et al. 2018; Setzer and Byrnes 2019; Muffett and Feit 2017).

maintaining a notion of responsibility for past extraction remains: to morally distinguish a country that restricts extraction to help address climate change, from a free-rider that continues regardless.

4.5 Equity within nations

Whereas every country has a multiplicity of sources of territorial emissions, extraction generally occurs in geographically specific places where the resources are located, affecting specific workers or communities. Therefore while much of our discussion has used nation states as a convenient analytical unit, *intra*-national equity issues are equally important.

Two of our principles - just transition and environmental justice - are already typically applied within nations. Our fourth and fifth principles - effort-sharing and cost-sharing- can be applied between nations in the first instance, then secondly within nations. For example, the Appalachia region has a high dependence on coal mining but is part of a very wealthy country, the United States. It would be unjust and politically untenable to abandon such communities, but neither can support reasonably be expected from other countries. The onus falls on the broader US – via national government – to support Appalachia, using its available financial resources and broadly diversified economy to absorb the otherwise disruptive impacts. And while Appalachia might not be expected to transition as fast as less-dependent regions among the US's multiple sources of extraction, it will still move faster than regions in other countries that do not have the benefit of US wealth.

4.6 Principles of equity in extraction

Drawing together our three starting principles with our conclusions on the relative pace of transition and the sharing of the costs, we summarise an approach to equity as embodied in five principles:

1. Phase down global extraction at a pace consistent with limiting warming to 1.5°C;
2. Enable a just transition for workers and communities;
3. Curb extraction consistent with environmental justice;
4. Reduce extraction fastest where social costs of transition are least — in those economies least dependent on extraction and with greatest resources to absorb the transition;
5. Share transition costs fairly, according to ability to bear those costs.

In section 5, we shall examine how to apply these principles.

5. Policy implications

This final section aims to sketch a first outline of how the principles could be applied in practice. The aim is not to propose near-term wins within existing political dynamics, but rather to explore what would be a fair approach, as a benchmark for the real policy process.

5.1 Policy mechanisms

Principle 1: Phase down global extraction consistent with 1.5°C

There are many ways policymakers can act to restrict fossil fuel extraction, from economic instruments such as extraction taxes to regulatory approaches such as licensing moratoria or quotas (Lazarus et al. 2015; Piggott et al 2018). Principle 1 requires that such policies are applied globally at a sufficient level of ambition to limit warming to 1.5°C.

Principle 2: Enable a just transition for workers and communities

Key elements of a just transition can be characterized as follows (ITUC 2015; Rosemberg 2010; Gambhir et al. 2018):

- *Sound investments*, including by the public sector, in low-emission and job-rich sectors;
- *Social dialogue* and democratic consultation of social partners (trade unions and employers) and other stakeholders;
- *Research* and early assessment of the social and employment impacts of climate policies;
- *Training and skills development* to support affected workers in obtaining decent employment in new sectors;
- *Social protection* for workers and communities disrupted by job losses and displacement (e.g., social insurance, employment guarantees, public works employment); and
- *Local economic diversification* plans that support decent work and enable communities to thrive in the transition.

Labour policy consistent with a just transition will be a vital component of enabling quality jobs in new sectors and ensuring the right to organize and bargain collectively, as key drivers of good working conditions and fair pay. Active industrial policy can ensure that new clean energy investments are targeted to transition-impacted regions.

As diverse societies begin to engage in the process of moving beyond fossil fuel extraction, more experience is accumulating; several publications compile case studies of just transition policies in practice (Just Transition Centre 2018; Oei et al. 2019; Kumar, Americo and Billingham 2016; Rosemberg 2017; Labor Network for Sustainability 2016).

Principle 3: Curb extraction consistent with environmental justice

An internationally justiciable human rights regime exists, though its limits should be recognized. It tends to emphasise Northern conceptions of individualised rights, such as the focus on civil and political, rather than communal and economic rights (Gonzalez 2015; Bell and Carrick 2017). As noted in section 4.2, enabling participation of affected communities is thus vital.

Special attention should be given to the impact of extraction on Indigenous communities, who are often dependent on local environmental resources and marginalized in political and legal processes (Schlosberg and Carruthers 2010; Acuña 2015). The UN Declaration on the Rights of Indigenous Peoples gives formal international recognition of a right to those lands, and of Free Prior Informed Consent before new development may proceed (UNGA 2007).

Principle 4: Reduce extraction fastest where social costs of transition are least

International sharing of efforts to reduce extraction could be enabled by policy arrangements parallel to those existing under the UNFCCC. A first step would be reporting on extraction activities, alongside emissions inventory reporting. With the Paris Agreement, an additional obligation is that nations produce long-term low emission development strategies, which could also include extraction (UNFCCC 2015a, Article 4).

As for how governments break out of extraction-dependence, economic diversification will be a vital objective, delivered especially through an active industrial policy that enables alternative sectors (Gambhir et al. 2018; Caldecott et al. 2017). While the choice of policies will depend on an economy's circumstances (Esanov et al. 2012), one common approach is to build industries with *linkages* to the extractive sector (Stevens et al. 2015). However, the most obvious of these for addressing the macroeconomic problems of oil dependence – such as refining, petrochemicals and energy-intensive industries – are not resilient to a low-carbon transition. Norway has had some success in creating a strong domestic supply chain for its oil industry, and then enabling those suppliers to diversify into providing for other sectors (Wicken 2017).

Equally important are innovation, education and employment policies (Rosemberg 2015). The UNFCCC (2016) provides advice, expertise and sharing of best practice on economic diversification and just transition, including the creation of decent work and quality jobs.

Principle 5: Share transition costs fairly

With respect to Principle 5 – that transition costs be shared fairly -- the UNFCCC makes explicit provision for wealthier countries to provide support to poor countries to support their climate mitigation and adaptation efforts. This underlies many of the specific obligations of developed countries, as well as the institutional mechanisms that have been established by the UNFCCC such as the Green Climate Fund.

The need for major flows of international support would necessarily require institutions and processes for mediating that support, that are additional to, rather than competing with, existing climate finance for mitigation and adaptation. Undeniably, however, the history of other international cooperation efforts aimed at long-term social benefits – such as overseas development aid and philanthropic aid – is mixed and complex (Arndt et al, 2015; Gisselquist and Tarp, 2019; McGillvray et al, 2006). This implies that efforts are needed to build and reform institutions, as much as to apply processes through them.

5.2 Effort-sharing between countries

Given the limited remaining carbon budgets, continued business-as-usual fossil fuel extraction will not be viable in any country, so all must begin a managed phase out of fossil fuel extraction. The difference is in the speed of phase out and the support for doing so. Figure 3 illustrates how principles 4 and 5 could apply to four broad categories of countries.

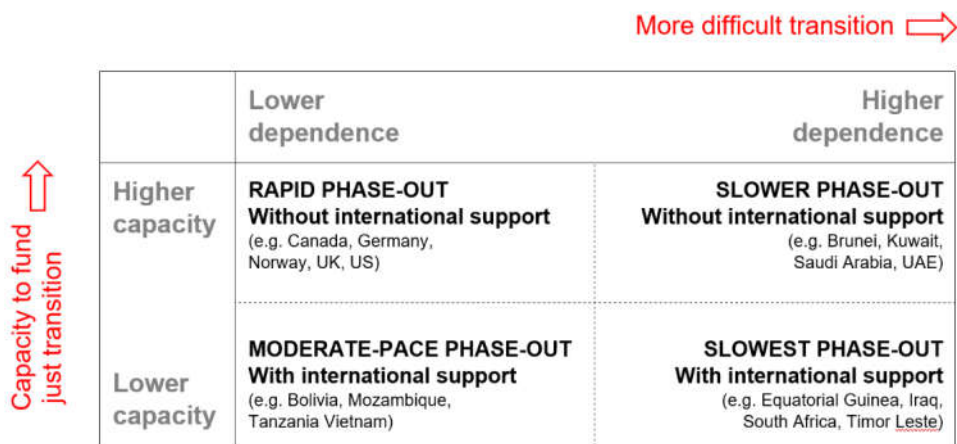


Figure 3: Countries' differing roles in an equitable global phaseout of fossil fuel extraction

While the application of Principles 4 and 5 is relatively straightforward and intuitive in the top-left and bottom-right quadrants, for the other two it is more ambiguous and potentially more controversial.

The top-right quadrant includes major OPEC members such as Saudi Arabia and Kuwait. Notwithstanding those states' obstructionism in climate negotiations (Depledge 2008), the transition will profoundly affect their people. Clearly, given their wealth, such countries cannot claim financial support from other countries, but given the severe challenges in shifting their economies away from oil dominance, nor can they reasonably be asked to transform their economies as rapidly as countries that are much less dependent on extraction (such as those in the upper left).

The lower left quadrant contains countries with low income, although with modest dependence. In these countries, the transition can be faster than in more dependent poor countries, but only if significant financial support is provided to enable it. A more complicated case is where a low-income country has a low level of current dependence but significant future hopes for extraction. For example, Mozambique currently produces negligible amounts of gas, but plans to rapidly develop its offshore resources to come on stream in the 2020s, with gas revenue projected by the IMF (2019) to reach 50% of public revenue in the 2030s. According to the above principles, transitional support would be offered for the existing workers already engaged in construction, but not compensation for refraining from gas development.

That is not to suggest that wealthy countries do not have moral obligations to countries such as Mozambique; rather that such an obligation is no greater to gas-endowed Mozambique than to other post-colonial and poor countries

Our aim here is to explore how principles of fairness might be applied to help break a climate-related commons impasse, by guiding the phase out of fossil fuels.

6. Conclusions

As governments tackle fossil fuel supply as a part of climate mitigation efforts, then how countries, impacted communities, and affected actors perceive the fairness of these steps will affect their feasibility. Based on a review of the key impacts of a fossil extraction phase out, we have proposed here five principles as guidelines, and an initial discussion of what their practical policy application would entail. Our aim in this paper is not to propose a framework to be rigidly imposed, but rather one to help democratic actors work through the equity issues that arise from winding down fossil fuel extraction. Societies that choose – through participative and democratic processes with affected communities – to move faster than suggested should certainly be encouraged.

Future studies could valuably examine potential mechanisms and institutions to apply the principles, as well as political pathways to get there. The complex questions around historic responsibility also deserve further research.

We do not claim that the necessary institutions of governance and cooperation are already in place, nor that the current political atmosphere is a welcoming one for such institutions to emerge. However, if the institutions and politics do not exist, there is a need to create them. The shift away from fossil fuels raises profound equity concerns that, if left unresolved, could well continue to hobble our ability to deal with the increasingly urgent climate crisis.

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Supplementary information

The tables below provide the data and sources for Figures 1 and 2.

Table S11: Coal mining share of employment versus per-capita GDP (PPP), selected countries, 2015 (unless other year stated)

	Per-capita GDP (PPP) / USD [1]	Number of coal mining workers	Total workforce [2]	Coal miners per 1,000 workers
Australia	47,769	45,100 [3]	12,592,000	3.6
China	14,328	3,875,300 [4] (2017)	787,073,000	4.9
Germany	47,255	14,792 [5]	42,781,000	0.3
India	6,192	353,000 [6]	503,835,000	0.7
Indonesia	11,155	121,000 [7] (2014)	122,582,000	1.0
Kazakhstan	24,920	29,478 [8]	9,110,000	2.6
Poland	26,622	98,000 [9]	18,326,000	5.3
Russia	26,208	150,000 [10] (2018)	76,289,000	2.0

South Africa	13,230	97,952 [11]	21,349,000	4.6
USA	56,175	69,450 [12]	160,839,000	0.4

Table SI2: Oil's share of central government revenue versus per-capita GDP (PPP), selected countries, 2016

	GDP per capita [1]	Oil share of revenue
Algeria	15,026	34% [13]
Angola	6,844	47% [14]
Azerbaijan	17,439	51% [15]
Bolivia	7,218	16% [16]
Brunei	76,884	70% [17]
Canada	46,437	0.4% [18]
Chad	2,445	24% [19]
Congo	6,676	59% [20]
Equatorial Guinea	38,639	72% [21]
Iran	18,077	34% [22]
Iraq	17,944	85% [23]
Kuwait	71,887	65% [24]
Nigeria	5,942	38% [25]
Norway	69,249	13% [26]
Oman	46,698	71% [27]
Russia	26,490	19% [28]
Saudi Arabia	55,158	64% [29]
Timor Leste	4,187	58% [30]
UAE	67,871	38% [31]

UK	42,481	0.0% [32]
US	57,436	0.1% [33] (federal lands and waters)

Sources:

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