

The Polluter Pays Principle and the Energy Transition

Written by Fausto Corvino

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This is an excerpt from *Global Climate Justice: Theory and Practice*. You can download the book free of charge from E-International Relations.

One of the guiding principles of the energy transition is the polluter pays principle (PPP): getting those who engage in emission-generating activities to internalise the social cost of carbon. In this chapter, I distinguish between the backward-looking and forward-looking versions of the PPP. In the first part, I examine the two main objections that have been raised against the backward-looking version of the PPP: i) those who emitted GHGs in the past did not know that their actions would warm the climate, so these actors are not morally responsible for climate change and neither are their heirs; ii) even if past polluters were morally responsible for their emissions, their heirs could not have done anything to prevent past polluters from emitting, and so it is unfair to hold present people responsible for past emissions.

I argue that none of the answers proposed so far to these two objections allow us to hold present individuals morally responsible for all GHGs emissions that occurred in the past. I then introduce the forward-looking version of the PPP (FL-PPP). On the one hand, I explain how the implementation of the FL-PPP is indispensable for the energy transition to live up to ambitious mitigation targets. On the other hand, I argue that the FL-PPP calls for developed countries to transfer part of the resources stemming from the internalisation of the social cost of carbon to developing countries, as developing countries are more exposed to climate harms. I conclude by positing that it is possible to justify the duty of developed countries to finance the transition to low-carbon energy, adaptation policies and compensation measures in developing countries on the basis of the PPP, but without relying on its backward-looking version.

Introduction

Climate change is mainly a matter of global negative externalities prolonged for about two hundred years. From the Industrial Revolution onwards, humans have sustained modern economic growth by failing to internalise the social cost of greenhouse gasses (GHGs), and of carbon dioxide in particular. Until now, those that have emitted GHGs have only paid for the private cost of emission-generating activities (which is a function of both the market interaction between supply and demand for fossil fuels and of the cost of producing emission-generating goods and services) without bearing the cost of collective climate harms caused by GHG emissions at the moment in which GHGs accumulate in the atmosphere (see Fleurbaey et al. 2019; Metcalf 2019, 36–37; Stern and Stiglitz 2021). This of course does not mean that if the social cost of emission-generating activities had been internalized, there would have been no economic benefits for polluters, but these benefits would have been lower (Shue 2015).

Once we introduce the climate variable into the economic history of the last two hundred years, we realise that past generations have maximised their prosperity by borrowing against future generations, i.e., by leaving us with part of the costs associated with the benefits they reaped (see Meyer and Sanklecha 2017) – obviously, some of these benefits have also come to us, in terms of infrastructure, technological know-how, financial capital, etc. These costs manifest themselves today, among other things, in the need to implement a rapid climate transition aimed at limiting global warming to 1.5°C above pre-industrial levels – of course, if present generations had acted earlier, the costs would have been lower (IPCC 2018). In order to do this, it is necessary to reach net-zero CO₂ emissions by 2050

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and net-zero GHG emissions no later than 2070 (IEA 2021; IPCC 2018, 12). Furthermore, since some GHG emissions cannot be abated and we may emit more than is compatible with the 1.5°C mitigation target, it will be essential to achieve so-called negative emissions: removing CO₂ from the atmosphere through anthropogenic actions, either by enhancing natural CO₂ sinks or through appropriate technologies and/or geo-engineering solutions (see Peacock 2021; Gardiner and McKinnon 2020).

One of the cornerstones of the climate transition is the energy transition: decarbonising the global energy system while meeting a growing energy demand worldwide due to population growth and the economic ambitions of developing countries (other sectors that play a central role in the climate transition are agriculture, food, waste production and management, land preservation/restoration and so on, see also Nogrady 2021). The energy transition requires two main things to be effective and one to be fair. First, the price of fossil fuels must rise so that economic agents internalise the social

cost of GHGs as much as possible (Baranzini et al. 2017). In this way we can, on the one hand, incentivise the abandonment of fossil fuels, and, on the other hand, collect economic resources (e.g., carbon revenues) to be used to offset the negative effects of the energy transition on short- and medium-term net-losers (e.g., people who lose their jobs or are penalised by the rising cost of non-renewable energy). Second, the price and reliability differential between polluting technologies and clean technologies (e.g., those using renewable energy sources) must fall substantially – which can only be achieved through major investments in technological research (see Bourban 2021; Helm 2020; Gates 2021). Third, the negative short- and medium-term social impacts of the energy transition must be offset, especially when workers are the victims.

Nonetheless, no energy transition can guarantee the mitigation of all climate threats. Climate change is already occurring, and developing countries are suffering the most. Accordingly, adaptation to present and future climate threats, i.e., natural, economic and social adjustments that can minimise the negative impacts of global warming, must be provided wherever possible (Page and Heyward 2017). Where, however, both mitigation and adaptation fail – either because adaptation encounters unavoidable limits or because it was not done in time – the question of responsibility for climate-induced damage arises (Wallimann-Helmer et al. 2019). Moreover, the energy transition must be contextualised in a historical perspective. If no one can afford to base future economic growth on the exploitation of fossil fuels, this is a consequence of the past unequal appropriation of the carbon budget – i.e., the cumulative CO₂ emissions compatible with a given climate mitigation target, such as the 1.5°C target (of all GHGs, CO₂ is the main driver of climate change, and the vast majority of CO₂ emissions are caused by the combustion of fossil fuels). This raises an issue of fairness vis-à-vis developing countries, insofar as they are asked to give up a similar fossil fuel-based growth path followed by developed countries.

In brief, ambitious climate mitigation based, among other things, on an effective and (globally) fair energy transition, plus an international redistribution of resources, which aims to ensure means of adaptation and loss-and-damage compensation for the blameless (or less blameless) victims of climate change, are the main ingredients of a just climate transition. One normative principle that seems to fit perfectly with this challenge is the polluter pays principle (PPP): you broke it (and/or you cannot stop breaking it, at least in the near future), you fix it. Applied to the climate transition, the PPP would recommend making those who emit GHGs internalise the social cost of their pollution and use this money to invest in green energy technologies, transfer these technologies at affordable prices to developing countries and finance adaptation and loss-and-damage compensation.

There are, however, two possible versions of the PPP. The first version emphasises making sure that anyone emitting GHGs internalises the resulting social cost from now on. This can be done either by introducing a carbon tax on top of the market price of fossil fuels or by capping the maximum amount of CO₂, distributing emissions permits and then allowing private actors to trade these permits (whoever emits more than the permits they have been given will have to buy more permits, and this is tantamount to a tax – the so-called cap-and-trade system) – public authorities, moreover, can internalise the social cost of GHGs by including it in the assessment of public policies and investments (i.e., the higher the social cost of GHGs, the easier it will be to justify stringent climate regulations and green investments). The second version of the PPP emphasises making sure that anyone who has emitted GHGs up to now (thus contributing to the climate problem) internalise *ex post* the social cost of their pollution. This can be

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achieved by presenting present individuals (which most likely are also high-emitters themselves) with an additional bill for the pollution by their predecessors.

The two versions are not equivalent. The first version of the PPP implies that those who reap the benefits of past emissions now will take advantage of the fact that their predecessors have externalised the social cost of these emissions to third parties; and this means that the burden of the climate transition will be distributed in a way that is history-insensitive (let bygones be bygones, we could say) – this is the forward-looking version of the PPP (see also Mittiga 2019, 167–173; Tilton 2016). The second version, on the other hand, implies that those who have inherited wealth unfairly (based on the social costs of GHG pollution that have not been fully internalised) should bear a proportionately higher burden of the climate transition – this is the backward-looking version of PPP (see Roser and Seidel 2017, 118–120). Though different, the two versions are not mutually exclusive. Indeed, many believe the PPP applies in both temporal directions.

This chapter is structured into two parts. In the first part, I analyse the philosophical obstacles encountered by the backward-looking version of the PPP, and I maintain that it falls short of covering all past emissions. In the second part, I explain why the forward-looking version of the PPP is indispensable to the energy transition, focusing in particular on how it can reorient market choices in an efficient way; at the same time, if we adopt a global accounting of the social cost of carbon, the FL-PPP can demand an international redistribution of resources to finance mitigation, adaptation and loss-and-damage compensation, without linking this duty to the complex issue of historical climate injustice. While the PPP is therefore limited in its historical intergenerational reach, it remains relevant to global climate justice in its future-oriented component.

1. The Backward-Looking Version of the PPP

The backward-looking version of the PPP (BL-PPP) is the environmental application of a more general moral principle that many people intuitively consider appropriate in responding to a wrong that occurred in the past: you created the problem, now you solve it. Usually, when it comes to historical injustices, B's heirs (Bh) demand compensation for harms inflicted by A on B, and they address their claims to A's heirs (Ah) if A is no longer there. Take, for example, the case of artworks stolen from Jewish families by the Nazi regime during World War II and the request for compensation made by the heirs of these families to the governments in countries such as Austria or Germany that came into possession of these artworks after the defeat of the Nazis (the story is very well described in the movie 'Woman in Gold', directed by Simon Curtis, 2015). Here is a case of both an intra-generational harm (A→B) and an intra-generational compensatory claim (Bh→Ah), which is grounded in two inter-generational relations (B→Bh; A→Ah).

Historical climate injustice, by contrast, differs from classic cases of historical injustice insofar as those who emitted more than their fair share of GHGs in the past directly harm those who live today and are more vulnerable to the negative effects of climate change because GHG emissions accumulate into the atmosphere and deploy their negative effects many years later (see also Meyer and Roser 2010, 230). Accordingly, historical climate injustice consists of both inter-generational harm (A→Bh) and an intra-generational compensatory claim (Bh→Ah), and the latter is based on one single inter-generational relation (A→Ah), which in turn is called into play for the mere fact that A is no longer here.

If we look at global data on historical emissions, it is easy to see the appeal of BL-PPP. There was a first historical phase, from the beginning of the Industrial Revolution and lasting until the end of the eighteenth century, in which almost all GHG emissions were attributable to United Kingdom (UK). A second phase, from the beginning of the nineteenth century and lasting until 1880, in which emissions overwhelmingly belonged to the UK, the United States (US) and the countries that are now part of the European Union (EU). A third phase began in 1880 and lasted until the beginning of the 1970s, in which Canada, Australia, other members of the EU and some developing Asian countries joined the global polluting club with progressively increasing shares (Ritchie and Roser 2020; Friedrich and Damassa 2014).

Basically, we are faced with a situation where, at least until the 1970s, the responsibility for emissions that caused

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climate change lies almost exclusively with developed countries. And while it is true that developing countries started emitting a lot in absolute terms after that date and then surpassed even developed countries in relative terms, two factors mitigate the responsibility of developing countries for their emissions. The first is that many more people live in developing countries like India and China than in Europe and the US. In 2020, more than 1.4 billion people lived in China and more than 1.3 billion people lived in India, while just over 300 million lived in the US and less than 500 million lived in the EU (see Worldometer 2022). Thus, if we look at per capita emissions, rather than total emissions, developing countries' contribution to climate change drops dramatically. Secondly, many developing countries are net exporters of CO₂, meaning they emitted to produce goods that were then exported to developed countries, especially in the second half of the twentieth century, so many argue that the responsibility for these emissions should be placed on importers rather than exporters (Duus-Otterström and Hjorthen 2019; Grasso 2016).

Given the history of climate change, the BL-PPP opens up two different normative arguments, one strictly compensatory and the other mainly distributive. The compensatory argument suggests that those who caused climate change should take on a proportional burden of coping with climate harms, e.g., by financing adaptation policies and/or compensatory measures in vulnerable countries. The distributive argument, instead, is based on the premise that the carbon budget is a global common good, and therefore those who have arbitrarily appropriated large shares of it are henceforth entitled to fewer emission permits than the heirs of historical under-appropriators (see Roser and Seidel 2017, 118–129; Meyer and Roser 2010). Since the climate transition, however, necessitates that all countries achieve net-zero emissions by the middle of the twenty-first century, the distributive argument turns into the demand that historical over-appropriators finance the transition to low carbon energy in those countries that have historically emitted the least (see also Gajevic Sayegh 2017). Yet, whether BL-PPP is intended as a distributive principle for emissions, or whether it is used only for compensatory purposes, or both, it must prove to withstand the objections that have been raised in the literature to the notion of historical responsibility for climate change. Given the limited space available in this chapter, I focus on two of the strongest objections: the excusable ignorance objection (EIO) and the powerlessness exemption (PE).

The Excusable Ignorance Objection (EIO)

The EIO challenges the moral blameworthiness of inter-generational climate harm (A→Bh). Past polluters, the EIO maintains, undeniably harmed present people, leaving them with less opportunity to cheaply industrialise through fossil fuels and exposing them to today's climate threats. Yet, past polluters were completely unaware of the effects of their emissions; hence, it is unreasonable to hold them morally responsible for inter-generational climate harms. Starting from a given historical reference point, we can assume that the scientific evidence on climate change has become incontrovertible – such as 1990, for example, when the first Intergovernmental Panel on Climate Change (IPCC) report was published (Gosseries 2004, 39–40). According to the EIO, everything that happened before this date should have no moral consequences either in terms of compensatory duties or the distribution of the remaining carbon budget.

A first, possible reaction to the EIO is to bite both the theoretical and the empirical bullet: only post-1990 GHG emissions are morally relevant. This first response would reduce the scope of the BL-PPP only in part, given that more than half of historical emissions have been produced in the last 30 years. A second possible solution is to challenge the empirical premises of EIO. Humans did not really need to wait for the first IPCC report to realise that the burning of fossil fuels, whether for production, consumption or transport, was pushing the planet into a zone of risk, however unspecified. Many people like to remember Svante Arrhenius, a Swedish chemist and Nobel laureate who lived in the second half of the nineteenth century, as the 'father of climate change'. Arrhenius was the first person to conduct a quantitative analysis on the nexus between CO₂ and water vapour in the atmosphere, on the one hand and global warming on the other (Sample 2005). Meanwhile, the first warnings about the risks of global warming (induced by increasing concentrations of CO₂ in the atmosphere) were probably given by Gilbert N. Plass (1956), a Canadian physicist working at John Hopkins University. Moreover, there is little doubt today that oil companies have known since at least the late 1970s about the risks that fossil fuels posed to the climate – and indeed many accuse them of deliberate cover-ups (McGreal 2021).

In this chapter, I do not dwell on this dispute, which is primarily the concern of hard scientists and historians – even

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though I discuss the moral implication on this scientific uncertainty at the end of this section. I focus, instead, on the argumentative strategies that resist the theoretical, rather than empirical, challenges to the EIO. The first theoretical rejoinder to the EIO consists in adopting a strict-liability interpretation of responsibility and maintaining that knowing about the effects of someone's actions is irrelevant for this person to acquire remedial responsibility. Applied to the climate case, the strict-liability argument tells us that developed countries appropriated a much larger share of the carbon budget than they were entitled to, thus causing climate alterations. Thus, irrespective of whether this was intended and/or known, the over-appropriation by A has left B_h with less than they might otherwise have had, and this calls for compensation from A_h to B_h (Neumayer 2000, 188).

This is quite a strong position, in my view. And it is also difficult to justify because it is based on a moral principle that many would find intuitively inadmissible in most other cases: namely, that A has a compensatory duty towards B, beyond what is established by the law, for any harm caused by action X, even including harms that have nothing to do with the reason why A performed X. Suppose, for example, that A and B are playing a game of poker. A cheats and makes B lose. B is full of debt, he loses the last money he has in the game and kills himself. Can we say that A, who certainly performed a morally reprehensible action X by cheating, but was completely unaware of B's economic situation, is responsible for B's death? Can we say further that A must also compensate B's family for any loss or damage that results from B's death? I believe that most people would consider this excessive in the sense that it goes beyond the faults that are morally attributable to A. And if this were the case, there would be no reason why the climate affair should be different from the poker example just described.

A second theoretical rejoinder to the EIO consists of a sort of backward induction: after people acquired scientific certainty about climate change (in the late twentieth century), their emissions levels did not decrease, rather they increased; hence we may infer that even if people had known about climate change in the past (e.g., in the twentieth century), their emissions trend would have remained the same. This is empirically plausible and is also based on a reasonable assumption of anthropological continuity. The problem, however, as rightly observed by Simon Caney (2010, 208-210), is that this solution passes over established arguments of procedural justice. That is, we would consider A morally responsible for something they did not commit – i.e., continuing to emit GHGs despite knowing the negative effects on the climate – just because A_h, which we assume to be anthropologically similar to A, did the same thing under similar circumstances. This does not seem like a very solid solution.

A third theoretical rejoinder to the EIO relies on the disentanglement of moral responsibility for climate change from moral blameworthiness. Alexa Zellentin (2014), for example, has argued that the people that emitted CO₂ before knowing the negative effects of climate change were acting outside their 'sphere of secure competence', and hence, the standards of care were more stringent than with other activities. According to Zellentin, A acts outside her sphere of secure competence with respect to an action X if, after taking all precautions, she is unable to foresee all the risks arising from X. And this may come, I would add, either from the fact that A uses instruments or technologies that go beyond the general knowledge acquired up to that moment – think, for example, of the use of a drug before experimentation is complete – or from the fact that the instruments and techniques in use involve risks, known and quantifiable in probabilistic terms, that are not fully controllable. It is not morally forbidden to act outside one's sphere of secure competence (at least not always), Zellentin maintains, but when someone does so and something goes wrong, the agent is responsible for compensating for any damage that occurs, even if all reasonable precautions have been taken.

Let us consider a case where a person decides to launch fireworks in an apparently isolated area. Let us also assume that this person takes all necessary and legally required precautions. A firework, however, does not follow the expected trajectory and causes damage to a house a few kilometres away. According to Zellentin's theory, although this person is not blameworthy, she is acting outside her sphere of secure competence and therefore has a moral duty of compensation to the owner of the house (in addition to the possible legal duty of compensation that falls on the person who produced the faulty firework). In other words, although this person is not morally blameworthy for launching fireworks, which are commonly sold and can be used legally if all precautions are taken, she is 'outcome responsible' for the damages caused by the faulty fireworks because she should have understood that she was dealing with something that she could not fully control once fireworks speed up and soar into the sky.

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Zellentin's argument suggests that pre-1990 emissions are comparable to fireworks in my example. If correct, and the theory of 'outcome responsibility' outside someone's secure sphere of competence seems reasonable, then the EIO fails. A full discussion of outcome responsibility, which in any case seems reasonable, lies beyond the scope of this chapter. Instead, I focus on the empirical assumption, namely that when people started burning fossil fuels for industrial purposes, they were in a position to foresee that what they were doing could cause risks to the environment (and therefore also to people) that they were unable to control. It is certainly true that, since the start of the Industrial Revolution, everyone had the feeling that humans were interfering with the environment in an unprecedented way. Although numerical estimates of the effects of coal combustion on the environment and on people were not produced until the twentieth century, it is true that anyone living near the industrial towns of northern Britain in the early nineteenth century could see that the sky was blackened by factory effluents. And the effects of pollution on people's health, and even on children's growth, were common knowledge (see Hatton 2017; Hanlon 2020).

What is more difficult (and perhaps wrong) to assume is that factory owners and workers in the nineteenth century, and also in the first half of the twentieth century, could have understood the effects of CO₂ emissions on the climate. That is, while it is correct to argue that our predecessors understood very well the negative and sometimes lethal effects of coal burning on themselves and their communities – and probably also on the people who would live on that land in the future – it is very unlikely that they could have predicted that, many decades later, the GHGs released in Manchester would contribute to increasing the likelihood of floods in Bangladesh, or to desertification in some parts of central Africa. If this were the case, as I believe it is, then it would still be possible to raise the EIO against the BL-PPP as a principle of global climate justice. The EIO would instead fail with respect to local pollution cases, but this would certainly be unsatisfactory from a broader climate perspective.

The Powerlessness Exemption (PE)

The PE holds that a person cannot be considered morally responsible for another person performing an action if the first person is powerless in the face of the second person carrying out this action. In an inter-generational perspective, the PE would maintain that Ah cannot be considered responsible for A carrying out X if Ah could have done nothing to prevent X from occurring (Gosseries 2004, 41–42; see also Moss and Robyn 2019, 275–278). If this argument is sound, it would imply that present people cannot be ascribed compensatory duties for emissions caused before they were born, or also, I would add, before acquiring both individual freedom and political agency (i.e., it would not make sense to hold a 4-year-old child responsible for their emissions). While the EIO challenges the inter-generational harm claim (A→Bh), the PE remains neutral on this and questions, instead, the inter-generational relation (A→Ah) as a vehicle of accountability for historical actions, and in doing so, the PE rejects the intra-generational compensatory claim (Bh→Ah).

As Gosseries (2004, 41–42) correctly points out, there are two possible ways to resist the PE. Either the general moral argument at the basis of the PE could be challenged (showing, for example, how in many intra-generational affairs we pass over the PE and ascribe compensatory responsibility for an action to a person different from the one who performed this action), or the theoretical problem raised by the PE could possibly be circumvented by adopting a collectivist rather than an individualist methodological perspective, thus justifying the claim that compensatory responsibility does not pass from one generational cohort to the next, but remains with the community that endures over time.

The first solution does not work for an empirical reason that is clearly explained by Gosseries (2004, 41–42). In intra-generational cases where A performs an action X that harms B, and C is called upon to pay for the harm caused by A (because A is not in a position to bear the cost or because the legal system prevents A from being held liable to pay for the harm caused by X), C is always in a position of authority vis-à-vis A; a position which may be given, for instance, by an employment contract or by parental authority. In inter-generational dynamics, by contrast, the relationship of authority between the current generation and the previous one does not apply (at least as long as the two generations do not overlap in the political sense of the term, i.e., as long as the younger generation is born – and grows up – it is impossible to claim that the younger generation exercises authority over the older one), and so it is much easier for Ah to claim they are not responsible for A's decision to perform X.

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The second strategy is more complex. It holds, for example, individuals are not responsible for the emissions caused by their predecessors, but rather the community to which they belong, which replicates itself over time and expresses its will through public institutions (see also de Shalit 1995). The community survives (usually) the individuals that make it up at any given time, and therefore the community can (and must) take responsibility for historical injustices. There are three basic problems, at least in my view, with this kind of argument.

First, if we give up on methodological individualism, we cannot embrace moral individualism either. And without moral individualism, we cannot uphold a cosmopolitan conception of justice. Missing the latter, we risk losing solid normative arguments to explain why a person living in Stockholm should accept that public money from her country should be invested in the mitigation of a phenomenon that, at least at the moment, affects people living in developing countries with less means to adapt to climate change (i.e., the classic obstacles we encounter when trying to globalise a theory of justice that has a communitarian basis – see also Page 2006, 120–121).

Second, we would need to hold that states are moral agents despite changes to governments and to forms of government. This would lead us to conclusions that are morally problematic (Caney 2006, 469–471; Mittiga 2019, 164–165). For example, should we accept that a people that has fought and gained independence should bear responsibility for the actions of the state that oppressed them, or that the countries that emerged from the dissolution of the Soviet Union are responsible for the emissions of the Soviet government, or that a people that have recently freed themselves from an authoritarian government should be bound by the public debt (or the emissions) incurred by the (possibly corrupt) elite that previously ran the country? (see also Pogge 2008, 118–122).

Third, even if we lighten our collectivist position and maintain that states can generate inter-generational obligations 'if they possess some specific moral properties' (e.g., being democratic), as rightly emphasised by Caney (2006, 470), this would not suffice to cover all past emissions. Some countries that emit a lot today have never been democratic. Some countries, such as Venezuela, for example, have gone through phases, marked by intense oil exploitation, that some would find difficult to describe as democratic. And, finally, many countries now considered democratic only became fully democratic after they started emitting GHGs for industrial purposes, and still others have had intermediate phases, in the past century, in which they were governed by authoritarian governments – think of Italy, Germany, Chile, Argentina, Portugal, Spain and so forth.

Finally, the fact that a country makes decisions in a democratic way does not necessarily mean that everyone is responsible for these decisions – at least, not everyone who spent time, effort and perhaps even money struggling against these decisions. Can we say, for example, that an activist who dedicates her life to convincing people that wars are useless and unjust is responsible for her country's military interventions or at least as responsible as her fellow citizens who have passively accepted these wars or even supported them? (see also Corvino and Pirni 2021). If we believe that this is not the case, then the collectivist response to the PE loses some of its force.

Can Present People Be Held Responsible for Past Climate Injustice Despite the EIO and PE?

In sum, neither of the two objections (the EIO and the PE) to the BL-PPP allow us to hold present individuals morally responsible for all GHG emissions that occurred in the past. Specifically, by applying the theory of outcome responsibility presented by Zellentin, the EIO can only be withstood to a very limited extent. Only some actors, in fact, can be considered to have acted outside their sphere of secure competence before 1990 – for example, the oil companies that understood that the use of fossil fuels could cause environmental and climate problems. However, the challenge posed by the PE remains: even if we can show that past emitters have compensatory duties towards the current victims of climate change, we should explain why the heirs of historical emitters inherit these duties despite being powerless over past polluters. As we have seen, none of the collectivist solutions analysed above is well suited to the climate problem.

Moreover, in this chapter I do not take into consideration a third, metaphysical objection to BL-PPP, the so-called 'non-identity problem', which holds that members of the present generation cannot claim to be harmed by the polluting activities of the past generations, because without these activities there would have been alternative reproductive choices and, therefore, we would have completely different individuals today, see Parfit 2000; I also

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discuss this issue in Corvino 2019.

It would therefore seem to follow that only those post-1990 emissions (and also the limited pre-1990 emissions for which emitters are outcome responsible) that are not subject to the PE legitimise the BL-PPP; but this would mean that the BL-PPP ends up forgiving a large part of the climate debt accumulated by developed countries over the last two centuries. Accordingly, many seek to overcome these theoretical limitations by holding that the emissions attributable to A have caused harm to Bh, and Ah have benefited from these emissions (in terms of economic growth, infrastructure, technological development and so forth) more than Bh. There may therefore be reasons of either compensatory or distributive justice that require a reallocation of resources from Ah to Bh, irrespective of the moral blame of A (EIO) and of the transferability of the moral responsibility from A to Ah for the unjust actions committed by A (PE). So, the Beneficiary Pays Principle (BPP), rather than the PPP, explains the moral relevance of past emissions. There are two possible interpretations of the BPP. A compensatory interpretation holds that if A inflicted a harm on Bh, and Ah have received benefits from this harm, then Ah cannot condemn the harm committed by A without also forfeiting the benefits they have derived (Butt 2014, 2017; Page 2012). A distributive interpretation, by contrast, suggests that if A seized more GHG emissions than is fair, and Ah received the largest share of the indirect benefits of A's emissions, Ah must contribute more to the climate transition than Bh (Roser and Seidel 2017, 133).

I do not enter here into the issue whether the BPP is normatively sound. I merely point out three theoretical challenges for the supporters of the BPP. First, to prove that the mere benefit Ah derive from the harm inflicted by A on Bh is sufficient to justify either compensatory or distributive duties of justice on the part of Ah towards Bh (see also Huseby 2016). Second, to demonstrate that it is morally wrong for Ah to benefit from the harm inflicted by A on Bh, even if this harm is excused; only in this case can the BPP pass the EIO test and apply to emissions far in the past (see Barry and Kirby 2017, 296–297). Third, to identify sufficiently clearly what share of Ah's current wealth is due to A's GHG emissions.

2. The Forward-Looking Version of the PPP

The forward-looking version of the PPP (FL-PPP) is the environmental equivalent of a more general moral principle that applies to cases in which one agent (or group of agents) repeatedly causes harm to another agent (or group of agents), yet the harm is so embedded in certain social structures that until these social structures are reformed, the former party cannot stop causing harm to latter party but can nevertheless compensate the victims (see, for example, Pogge 2008, 202–221). The energy transition aims at reforming the major social structures that warm the climate. When global GHG emissions become net-zero, the remaining positive emissions cease to bear a social cost. For obvious reasons, this cannot happen overnight. What we can do in the meantime, however, is to compel those that emit CO₂ to internalise the social costs of their pollution. This is necessary both to align the market cost of emission-generating activities with their real cost (efficiency reasons) and to make GHG emitters compensate the victims of harms induced by these emissions (fairness reasons). In other words, the FL-PPP differs from the BL-PPP in that the latter aims to cover the social cost of emissions that have already occurred (and are now manifesting themselves in current climate threats), while the former aims to contain climate threats in the future.

The FL-PPP has both a practical and a theoretical advantage over the BL-PPP. The first advantage is that the internalisation of the social cost of present emissions not only serves a justice purpose but also acts as a market incentive – the latter being indispensable for the energy transition. The second advantage is that the FL-PPP does not imply intergenerational switches, and hence it is not susceptible to the two theoretical objections discussed in the previous section. The FL-PPP does, however, have one major drawback: it does not address past emissions, which might seem to lead to the conclusion that it favours the effectiveness of the energy transition at the expense of global climate justice (Mittiga 2019; see also Tilton 2016, 118).

In fact, this drawback is much less serious than it may seem if we consider that the social cost of carbon (and of GHGs more generally) has a global dimension, i.e., a dimension that encompasses the economic value of future climate damage. Climate damages do not manifest themselves homogeneously throughout the world; rather, climate damages affect developing countries more, both because these countries are geographically and economically more exposed to climate change and because they have fewer possibilities to invest in adaptation (see Tol 2019). This

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implies that, under the FL-PPP, at least part of the revenues accruing to developed countries from internalising the social cost of current and future emissions should be redistributed to developing countries in the form of climate finance (see also Cramton et al. 2017). Let us assume that country *Q* (which polluted massively in the past and continues to do so today) decides to introduce a carbon tax at a rate *Y* per tonne of CO₂ (tCO₂), where *Y* is the marginal social cost of emitting 1tCO₂. Each person that performs an action that causes a given amount *W* of CO₂ emissions would then have to pay for the private cost of *W* plus the social cost of *W*, which is given by $W \times Y$. If *Q* is proportionally less exposed to climate harms than developing countries, then the FL-PPP demands that at least part of *Y* should be passed on to more exposed countries – indeed the radical application of the FL-PPP would maintain that the largest part of *Y* should be redistributed internationally.

A potential problem with global accounting (and consequent revenue redistribution) of the social cost of carbon could be that a government of a developed country that introduces carbon pricing measures gets less revenue than is needed to offset the increased cost of energy and/or protect the net losers of the energy transition domestically (as some of revenues have to be transferred abroad). However, this would be a practical problem that could be solved by supplementing revenues with additional public money collected through other taxes or even by placing a tax on CO₂ emissions higher than their social cost for reasons of efficacy. A matter of normative concern with the global accounting of the social cost of carbon, by contrast, is that there may be developing countries that currently pollute significantly but which are not particularly exposed to climate change. This might imply that these countries could claim almost nothing from developed countries. Without skirting around it too much, two big countries that emitted relatively little in the past but emit massively today are China and India. However, both countries are vulnerable to climate damage and certainly have limited means of adaptation, so they are entitled to retain a larger percentage of the carbon revenues collected domestically than historical polluters.

Lastly, a strong objection entertained by Mittiga (2019, 186–187) with respect to the FL-PPP is that if the energy transition works, then at some point the revenues from GHGs taxation will cease, and then the PPP will not be able, on its own, to explain why industrialised countries have to bear the burden of climate damage that will inevitably occur in developing countries. Therefore, he proposes that in an advanced mitigation stage the FL-PPP should be supplemented with the ability to pay principle (APP), where everyone contributes in proportion to their capabilities. This is certainly a pressing issue; however, if green technologies were to become competitive with polluting ones (both in terms of costs and reliability), then developing countries could follow a development path similar to historical polluters without polluting. At this point, global climate justice would mainly consist of patent and technology transfer on the one hand, and climate finance for adaptation and loss-and-damage compensation on the other. Both things could more easily be financed by developed countries once they have reached the final stage of the energy transition, both because renewables can bring major savings on energy costs in the long term and because developed countries would be progressively relieved of the burden of supporting the net-losers of the energy transition domestically (primarily workers tied to fossil fuel industry and poor households). If these circumstances occur, it is therefore possible to assume that the FL-PPP will be able to fulfil its task as a principle of global climate justice at least until climate neutrality is achieved – as the latter does not presuppose the absolute zeroing of GHG emissions (and consequently of carbon revenues), but only net zeroing.

Conclusions

In this chapter, I distinguished between the backward-looking and the forward-looking versions of the Polluter Pays Principle – respectively, the BL-PPP and FL-PPP. First, I discussed the two strong objections that limit the applicability of the BL-PPP: the ‘excusable ignorance objection’ and the ‘powerlessness exemption’. I argued that the various responses proposed in the literature to the two objections fail to substantiate a long-range duty of inter-generational compensation for past emissions. However, this should not dishearten us about the relevance of the PPP. Indeed, what the energy transition calls for is the implementation of the FL-PPP, not the BL-PPP. If all incumbent polluters compensated developing countries for past climate injustice tomorrow morning, this would have no effect in terms of incentives to abandon fossil fuels in favour of clean energy – except indirectly, by making poorer countries richer, but there would be no guarantee that these resources would be used by developing countries for climate mitigation rather than for increasing emission-generating activities.

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What would seem to be missing by giving up the BL part of the PPP is the global redistribution of resources, which is a key part of the just climate transition. However, it should be noted that without the BL part, only the historical responsibility of the PPP is lost, not the global one. The FL-PPP, in fact, is based on the internalisation of the social cost of carbon and developing countries are more exposed to climate damages: this implies that the FL-PPP justifies a global redistribution of resources to finance mitigation, adaptation and loss-and-damage compensation for developing countries. The global redistribution dictated by the FL-PPP is probably lower than the one that we would have with the BL-PPP, but it has the advantage of being linked to present and future damages caused by people that have the possibility to compensate the major victims of a warmer climate.

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