

Ten reasons why carbon markets will not bring about radical emissions reduction

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Almost two decades since the Kyoto Protocol was adopted, global greenhouse gas emissions are still rising rapidly. We argue that the global climate policy focus on carbon markets has played a significant role in the failure to reduce emissions. There are 16 compliance carbon markets in operation across the world. Many more are planned, although there have been numerous problems with carbon trading, including ineffectiveness, weak regulation and implementation, instances of fraud, little to no emissions reduction and major legitimacy issues for governments and the private sector. In this paper we take a “strong” position, arguing that carbon markets do not have a role to play in a policy scenario that requires radical emissions reductions in order to avoid dangerous greenhouse gas concentrations. We put forward 10 reasons why carbon markets should not be the preferred climate policy choice, which we have collated from positions taken by grassroots social movement organizations, think tanks, NGOs and other political advocacy groups as well as individual scientists and scholars.

Keywords: carbon markets ■ carbon trading ■ climate change ■ climate policy ■ radical emissions reductions

Introduction

The global scale and impacts of the climate crisis are now widely recognized, as is the need to radically reduce greenhouse gas emissions [1,2]. If we are to avoid dangerous climate change, the world will need to dramatically reduce emissions in the next two to three decades [3]. It is estimated that for an 80% probability of staying below a “safe” 2°C of temperature increase, the world’s “carbon budget” to 2050 is equivalent to 900 gigatonnes of carbon dioxide (GtCO₂) [4]. And, crucially, a fair distribution of the carbon-intensive resources we can feasibly exploit would need to occur in order to avoid major conflict and severe inequality.

The prevalent mode of climate policy around the world has been carbon trading. Many carbon trading mechanisms are operating or are in the process of being introduced. There are 16 compliance carbon markets in operation across the world, and a further 16 under discussion or planned for new jurisdictions [5]. In the last two decades, numerous problems have arisen with

regard to carbon markets, illustrating weak regulation, some instances of fraud, little to no emissions reduction and major legitimacy issues for governments and the private sector. Thus, the question is: can carbon trading contribute to the task of rapid decarbonization?

Analysis of carbon trading must be informed by the magnitude of the problem it is trying to address. As Cameron Hepburn has noted: “A great deal rides on the success or failure of this global socioeconomic experiment in commoditizing and trading carbon” [6]. At present, the implemented and scheduled emissions trading schemes and carbon taxes put a carbon price on approximately 7% of global emissions (3.3 GtCO₂e/year) [7]. If the world’s governments were to come to an agreement for meaningful emissions reduction commitments – as planned for the 21st Conference of the Parties (COP21) in Paris in 2015 – carbon trading would likely be proffered as a key mechanism for achieving this. Further, an expanded globally integrated carbon market is sometimes considered the “ideal” institutional architecture

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for achieving environmental effectiveness [8]. In contrast, we argue that expanding the market will only exacerbate existing problems. Our paper puts forward the case against carbon trading. We present 10 reasons why we believe carbon markets will not contribute to the task of reducing emissions on the scale necessary.

We recognize that this is a “strong” position to take, which is often dismissed as “ideological” or “naïve” [9]. In response, we point out, first, that there are very good reasons – based on strong empirical and theoretical analyses – to propose we abandon carbon trading. In this paper, we summarize and synthesize the existing evidence base, which has consistently and convincingly shown the manifold problems with the theory and practice of carbon markets. Second, all positions on the topic should be regarded as “ideological,” in the sense that they are informed by, and indicative of, political views about the appropriate role of markets in society [10]. Third, in line with many climate scientists, policymakers and civil society groups – such as those who recently presented at the Radical Emissions Reduction Conference [11] – we believe that time and speed are of the essence when it comes to reducing global carbon emissions. With no meaningful emissions reductions to show for, and evidence of regulatory failure, the track record of carbon trading is unacceptable. Further experimentation, attempting to make carbon markets work, will be far too risky.

A final note on the basis of our perspective. We are not arguing that carbon trading policy in the abstract is to blame for society's failure to respond to climate crisis. There is a systemic and geopolitical backdrop to climate policy failure. We can point to numerous interlocking reasons for spiraling emissions and political inertia [12,13]. The key obstacles are: the trebling circulation of fossil fuel capital via the rapid industrialization of China, Brazil, India and other emerging nations, the global boom in “unconventional” gas and oil, the new dynamics of an emergent multipolar world, the ongoing refusal of the US to ratify the Kyoto and Post-Kyoto United Nations Framework Convention on Climate Change (UNFCCC) agreement, fragmentation of the UNFCCC negotiations and deficiencies in carbon accounting rules – for example, the focus on national production emissions rather than consumption emissions.

However, we will make the case that the *type* of climate policy instituted is a crucial part of the puzzle one is faced with when seeking to understand global society's failure to deal with the climate crisis. The logic of carbon trading and chronic “design flaws” in carbon markets across the world render it a weak method of emissions management. More fundamentally, we argue that this style of reform belies a utopian faith that

marketization can be squared with climate protection, and a broader political failure to directly harness state and intergovernmental power to address the systemic causes of trebling greenhouse gas emissions.

Carbon trading: a brief introduction and history

Carbon trading is a form of market-based regulation that seeks to incentivize the reduction of greenhouse gas emissions associated with selected forms of commodity production and exchange. The theoretical basis for emissions trading is environmental economics, which is a recent chapter in neoclassical economics, analyzing ecological degradation and pollution as “externalities” not reflected in the price of goods exchanged in otherwise efficient markets. To deal with such externalities, new methods of environmental valuation and market-based solutions to protect the environment have been introduced across the world [14].

In the 1960s, Ronald Coase challenged the view that government regulation and Pigovian taxes should be the preferred route to deal with environmental problems [15]. He argued that optimal economic allocation could occur through arbitrage between actors if the conditions of clearly defined property rights and zero transaction costs were met. Coase's claim was theoretical only and did not address how or whether the result of collective bargaining between agents would align with necessary environmental limits. In the next decade, further intellectual work developed and modified the principle to include a role for governments in a new practice of environmental market creation [e.g., 16–19].

Emissions trading is purported to fold the negative market externality back into the market via the assignment of property rights to greenhouse emissions. In carbon trading, a range of greenhouse gases is measured in a common metric, usually equivalent tonnes of carbon dioxide (tCO₂e). In order to “internalize” the unacknowledged costs of emissions, these economists argued that the changed cost structure of production generated by trade will incentivize changes in market behavior.

Over the last three decades, a near consensus has emerged among policymakers that carbon trading is the optimal, most “cost efficient” means to reduce emissions. Efficiency (optimal use of scarce resources) comes from permits for CO₂e being tradable. In perfectly functioning markets, polluting firms facing high costs for emissions reduction may buy excess permits from firms with low costs, which in turn profit from sale of their excess permits. This arbitrage (the bids and offers between buyers and sellers) is theorized to produce net gains for all involved (“welfare”) and create an equilibrium carbon price at the margin – that is, the “optimal level of the externality” where marginal net

benefits enjoyed by polluting firms are equal to marginal external costs to society [20].

Economists often argue that carbon trading ensures environmental integrity better than carbon taxation [21, Ch. 13]. Carbon taxes rely on governments to set a price on emissions at optimum levels over time. No quantitative limit on emissions is set. The emissions “cap” in a cap-and-trade scheme is understood as a more effective means to create scarcity and efficient allocation of emissions rights. However, this advantage is undermined in conditions when there is uncertainty about the marginal costs of supplying a good (in this case, a “safe” level of greenhouse gas emissions) [22].

Design of carbon markets occurs through domestic and international law. The emergent pattern in carbon markets is legislation for cap-and-trade schemes in developed nations, linked to carbon offset programs in developing countries. Carbon rights are considered either permits to emit (the right to emit a defined unit of greenhouse gases) or rights to emissions reductions (units representing emissions avoided or stored in “sinks”). Offset credits can be sold to firms with obligations to reduce their emissions in industries regulated by cap and trade. Rules that permit linkage to carbon offsets are central to the “efficient” distribution of costs [23]. Put another way, offsets contribute to the “flexibility” in terms of where reductions will be undertaken [24]. Rules for temporal displacement through banking and borrowing permits are a second major source of flexibility [25].

Politically, the popularity of market mechanisms was established in opposition to “command and control” regulation, such as installing technology-based environmental standards, environmental taxes or legislative bans on harmful substances and practices. At the broadest level, preference for carbon markets occurred in the context of shifting norms and agency bound up in the reorganization of the global economy from the 1970s [26]. The resulting shift in state preferences for privatization, deregulation and marketization is part of what social scientists term “neoliberalism” [for a concise overview, see 27].

Much of the political advocacy for emissions trading came from economists active in public institutions in the 1980s and 1990s. Key proponents include Robert Stavins, who initiated Project 88 with two US senators. Project 88 was initially a report, and a series of meetings, discussing the range of market-based mechanisms for climate mitigation [28,29]. The project assisted in building the case for SO₂ trading in California under the *Clean Air Act* 1990 [30,31]. SO₂ trading became the basis for the US’ successful campaign to include emissions trading in the 1997 Kyoto Protocol to the UNFCCC.

In Britain, David Pearce was another key actor, co-authoring the *Blueprint for a Green Economy* [32]. The book argued strongly for market-based environmental regulation, as did his policy work on the design of UK’s first carbon levy in 1990 [33]. Experts in the OECD and United Nations Conference on Trade and Development (UNCTAD) were also producing reports analyzing and advocating for market instruments for emissions management in the early 1990s [34,35].

In these early days, advocacy by the newly professionalized environmental NGOs as well as corporations also played a key role. The Environmental Defense Fund and Nature Conservancy argued for emissions trading in the US. Trading has appealed to these NGOs on the basis of arguments that cap-and-trade schemes ensure greater ecological integrity than a carbon tax [6]. The embrace of marketized models of emissions management also reflects a broader trend of green-corporate partnerships emerging at the time [36]. For example, the Environmental Defense Fund partnered with BP in operating its in-house emissions trading scheme announced in 1997. This and other pilot schemes served as a way for firms to legitimate emissions trading – their preferred policy against carbon taxation [37].

Carbon trading is most often conceived as being a “carrot” that can produce profit, whereas taxes are seen as a “stick”, producing additional costs for business [6]. A new corporate lobby became attracted to carbon trading. For instance, the International Emissions Trading Association (IETA) was created in 1999 to coordinate businesses specializing in the new task of constructing carbon markets. These new experiments included the development of a voluntary market running parallel to compliance markets.

For European states, carbon trading was also a desirable alternative to carbon taxation. Harmonized international taxes are difficult for countries to agree on and to implement. And, again, this tax was strongly opposed by emissions-intensive industries [38]. In the EU, policymakers abandoned attempts to reach consensus between member states on an EU-wide CO₂ tax in 1992 [31]. Also due to US pressure, there was a shift in Europe in the mid-1990s towards emissions trading schemes.

At an international level, carbon trading appealed to state officials on the basis that it allows wealth transfers to the developing world (a condition for developing country consent) and allows for flexibility in the distribution of emissions abatement (a condition for developed countries). This element of carbon trading had been a crucial part of the bargain struck at negotiating table of the UNFCCC. Both emissions trading and carbon offsets are encoded in the Kyoto Protocol. Article 17 of the Protocol specified emissions trading as a means for Annex B nations to reach the protocol’s

2012 emissions reduction target of an average of 5.2% below 1990 levels.

The Protocol and new agencies under the UNFCCC also institutionalized North–South carbon offsetting through the CDM and Joint Implementation (JI) [Articles 6 and 12, 39]. The CDM was originally conceived of as a fund for sustainable development, but the model took on market dimensions in the process of negotiations. CERs from CDM projects can be sold to firms or governments and counted toward an Annex I nation's mitigation targets, as can Emissions Reduction Units (ERUs) from JI.

The US and Umbrella Group including Japan, Australia, New Zealand and Canada was instrumental in ensuring the inclusion of the Flexible Mechanisms under the 1997 Kyoto Protocol [40]. Considerable opposition to aspects of carbon trading policy arose within the Group of 77. For instance, the Alliance of Small Island States (AOSIS) and Brazil have opposed reliance on offsets, and Bolivia and Venezuela have opposed carbon trading. But there is no unanimity. Developing country representatives have been leaders in the movement to expand carbon markets to new jurisdictions. The Coalition for Rainforest Nations' advocacy of an incentive-based model for REDD policy since the mid-2000s is an example of Southern states contributing to the expansion of carbon markets [41]. These member states have been engaged in numerous initiatives to develop institutional arrangements necessary for carbon market participation and trial REDD at the national and international level [42].

It is important to note that carbon trading is one part of a complex, global arena of climate policy, where multiple types of policy reform are being practiced and proposed (e.g., technology standards, supports for technological innovation, removal of public subsidies from emissions-intensive industries and so on). Our focus on emissions trading, rather than any other type of climate policy, or any particular combination of policies, is a response to the political emphasis placed on emissions trading through international and national initiatives.

Carbon markets and offset programs continue to expand worldwide. In 2005, the EU ETS became the first regional carbon market and is still the most significant to this date. There are 16 carbon trading schemes in operation and a further 16 that are planned across the world. Most are operating at a regional level [5]. The most significant national climate policies in terms of coverage and political emphasis that have been either installed or debated in recent times have been carbon trading schemes. Notable examples include Australia, Canada, Japan, New Zealand, China's trial emissions trading programs and the potential for state-level emissions trading as part of the US Climate Action Plan.

Intergovernmental organizations, particularly the World Bank and UN agencies as well as bilateral aid agencies, have been trialing carbon offset programs in the developing world since the 1990s. For example, the World Bank's Prototype Carbon Fund is a public–private partnership that has served the dual purpose of carbon market advocacy as well as being an implementation network for the CDM [43]. This transnational network of six states and 17 corporations developed some of the first CDM projects and has paved the way for a spate of such partnerships that have built the ongoing emphasis on carbon markets. The World Bank Forest Carbon Partnership Facility (FCPC) and UN-REDD Programme operate in a similar way. They have run national programs to trial REDD in anticipation of its inclusion in a post-Kyoto framework under negotiation within the UNFCCC.

Finally, we focus critical attention on carbon trading because some state representatives and civil society members have opposed an over-reliance on emissions trading and offsets [41,44]. The background political issue is North–South burden sharing. This is reflected in the Kyoto Protocol statements that any purchase of international credits (“removal units”) and use of emissions trading by Annex B nations should be “supplemental to domestic actions” undertaken for the purpose of meeting the target. This was confirmed in the 2001 Marrakesh Accords [45]. However, quantified definitions of “supplemental” use have not been agreed to at an international level. Meanwhile, discussions about “new market mechanisms” are running in UNFCCC negotiations over a post-Kyoto framework. There is a need to clarify what, if any, role carbon trading should play in the task of rapid emissions reduction.

Unpacking the carbon trading critique

In all locations where carbon markets have been installed, they have attracted criticisms from policy-makers, think tanks, NGOs, charities and other civil society advocacy groups. Many of these actors have argued that carbon markets constitute “climate injustice” in that they do not reduce emissions, and their practice exacerbates inequalities associated with climate change and uneven development [46,47]. Opposition has also come from the political Right. Conservative “Tea Party”-type protests were held in Australia over the ETS in 2011. Here, the criticism has been on the basis of opposition to government regulation.

Importantly, there are a range of different positions held in environmental and social justice networks, including a middle ground taken up by some environmental NGOs who see carbon markets as an important step forward [48]. Many have engaged with details of policy to improve the environmental integrity and social

protections of carbon markets and offset programs. Others have participated directly in instituting carbon market initiatives, such as the BP scheme mentioned above, offset standards and projects for voluntary and compliance markets.

Numerous experts engage in public policy debates over carbon pricing, many of them economists and lawyers acting as advisors, or participants in government consultation processes. As in NGO networks, expert communities are diverse in their views. Though the majority of experts writing on carbon trading focus on discussions about policy design, a minority have put forward more fundamental critiques of emissions trading [e.g., 49–51].

The perspectives of these actors involve implicit and explicit ideas about what carbon markets are for, and whose purpose they serve. Economic theory tells us carbon trading is an effective mechanism for emissions reduction at least cost. However, many scholars recognize that in practice, tradable permit markets are political instruments, as much as they are economic ones [52]. Some have observed that carbon markets are the outcome of diplomatic bargains, and a vehicle for coalition building [44,53]. It is commonly implied or stated that good policy design will require sufficient political investment and a powerful constituency for high emissions caps and institutional capacity building [54]. In contrast, critics argue that carbon markets are, above all, a means for nation-states and fossil fuel capital to avoid the task of decarbonization, with effects that perpetuate uneven development [55–57].

There are also differences in views about what carbon markets can *potentially* deliver. Carbon markets are flexible and change over time; they do not have a fixed, abstract essence [58,59]. Both economists and social scientists have emphasized that carbon markets involve experimentation [6,60]. This experimentation should involve assessment and debate about whether they should be an ongoing focus of climate policy. It is our view that, given the manifold problems with carbon trading in theory and practice, there is a case for abandoning the experiment.

We argue that there is sound theoretical and empirical evidence to support this “strong” view. We put forward 10 reasons why carbon markets are counterproductive, which we have collated from the positions expressed by social movement organizations, think tanks, NGOs and other political advocacy groups as well as individual scientists and scholars. The arguments are divided into two types. First, we put forward evidence that illustrates that carbon trading has involved flawed practices (the first five arguments). Second, we put forward arguments that carbon trading cannot be reformed (the following five arguments). In doing so, we shift from major design

flaws to more structural and theoretical problems with the carbon trading experiment. Yet the issues we identify cannot be neatly divided into problems of design, on the one hand, and problems of theory and conception, on the other. Practice and theory, we argue, always need to be analyzed together when it comes to critically analyzing the political economy of carbon markets.

■ Carbon markets as failure

Carbon markets can be seen as a failure in the sense that they have not delivered on their core aim: to reduce greenhouse gas emissions. Evidence for direct causal links between carbon trading markets and emissions can be difficult to establish. The existing analyses of the EU ETS show it has fallen well short of the emissions reduction targets in the first two phases [61,62]. There was a temporary reduction in emissions in Europe between 2008 and 2010. However, it is widely recognized that this was mainly due to the downturn in production caused by the financial crisis [63,64].

In the first phase of the EU ETS (2005–2007), over-allocation of free permits (EUAs) to participating firms led to a drop in carbon price to nearly zero in December 2007. Prices have stayed persistently low in phase II (2008–2012) and problems continue into the third phase, in large part due to the surplus of approximately 970 million allowances, which have been carried over into phase III (2013–2020) [61,65]. The 2013 decision to “backload” 900 million excess permits from the beginning of phase III to the end will not be enough to address the still increasing surplus [66].

In New Zealand, the emissions trading scheme in place since 2008 has not reduced emissions, in large part because the scheme did not have a cap, involved limited coverage (including a delay in extending to more emissions-intensive sectors), and put no limits on international carbon credits [67,68]. The Australian carbon trading scheme installed in 2011 and repealed in 2014 was highly likely to have failed to reduce domestic emissions and lock in a fossil fuel economy. Based on the Australian Federal Treasury's own modeling, emissions were set to rise until 2028 and reduce marginally by 2050 [69,70]. The majority of emissions reductions were projected to come from international abatement.

■ Carbon markets as loophole

Carbon trading enables the developed countries to appear to be reducing emissions, while passing on the abatement task to the developing world. Carbon offsetting is central to this feature of carbon markets. Offsets are a loophole and an unjust form of mitigation that distracts from the central task of transitioning away from fossil fuel extraction in the North – where emissions abatement is most politically crucial [see 71–73].

While offsets were not heavily relied upon in the EU in the first two phases, the use of international credits have increased rapidly and is anticipated to balloon by 2020 [74]. Controversial industrial gas offset projects involve minor technical adjustments to factories producing nylon and refrigerant gases (HFCs) mostly generated in middle-income countries, China, Brazil and India. In May 2012, industrial gas projects made up 84% of CDM offset credits (CERs) in the EU ETS [75]. An early conservative estimate for offsets feeding into the EU was that between 1/3 and 2/3 of carbon credits bought into the EU ETS did not represent real carbon reductions [76].

The problems with industrial gas offsets have been recognized by EU regulators [77]. While industrial gas offsets were discredited some time ago, the EU has been slow to remove these offsets in large part due to pressure from industry, which was then able to flood the market with industrial gas credits [78]. Industrial gas offsets are now excluded from the EU ETS, and participating firms are now restricted to purchasing credits from Least Development Countries (LDCs). Like the decision to backload excess emissions, this is a positive amendment. However, changes to the linking Directive under phase III allow for an unprecedented 50% of emissions reductions to come from offset credits (50% is hardly “supplemental” to domestic reductions). As they stand, these changes are unlikely to address the structural surplus of emissions in the scheme [66].

In Australia, international trading was scheduled to begin in 2015, and up to 50% of emissions rights retired were allowed to come from international credits, and use of domestic “carbon farming” offsets was unlimited [79]. The majority of international credits allowed were to be EUAs – the very credits over-allocated to firms in the EU ETS. More generally, Australia's approach to regulating carbon offsets is shaped by a national protective agenda to rely on emissions abatement outside fossil fuel industries, particularly in the land sector [80,81]. In New Zealand, unlimited offset credits have brought the carbon market to a halt [82]. In California, plans to link the state's ETS to REDD offsets continue the tradition of outsourcing responsibility to reduce emissions to parties in the global South [83,84].

■ Carbon markets as unjust development

Carbon trading has come with a promise to be a new mechanism for sustainable development. However, benefits are not widely shared. The distribution of CDM finance mirrors the historical flow of foreign direct investment to middle-income countries such as China, Brazil and India [85]. In practice, sustainable development goals are only paid lip service in offset programs [86–88]. Numerous examples of problems with offsets

have been detailed in NGO and academic studies [see 72,87,88]. For example, Emily Boyd has shown that the stated goals of sustainable development and community participation were not realized in two offset projects [89]. She shows local and state barriers to effective and fair implementation of a land rehabilitation project in Brazil, and a mismatch between the values of local people and the values underlying the extension of a conservation park in Bolivia. The discrepancy between sustainable development goals and practice is not uncommon. A global survey of patterns on project approvals and analysis of 10 case studies concludes that sustainable development has not been delivered by the CDM [90].

In many cases, offsets have been shown to produce additional environmental and social problems. For instance, Bachram found water table depletion at the site of early forest plantation pilots in the World Bank Prototype Carbon Fund, and conflict over land access between the impacted community and officials [91]. Pilot offset projects from avoided deforestation and other land management practices have exacerbated issues surrounding land tenure for forest and indigenous communities in postcolonial states [71,92]. The term “green grabbing” is now being used to convey that carbon offsets and other forms of marketized conservation revalue land and resources in ways that can alienate local populations. They liken carbon market extension to longer histories of appropriation for environmentally destructive purposes by colonial and global market actors [93].

Beyond local experiences, the broader problems lie in the logics of market governance that have been instituted. A desk study of Project Design Documents created for CDM forestry offset projects showed that socio-economic assessments are frequently nonexistent or lack detail [94]. This puts the potential for sustainable development into question. The regulatory structure of the CDM is such that national agencies are responsible for sustainable development. This makes sustainable development a separate, secondary process to calculating carbon reductions, and monetary values are the jurisdiction of the UNFCCC agencies [95]. Further, Ervine argues that the market-based structure of CDM finance makes it a poor tool for addressing development and climate change [96]. The market-based *ex post* structure of CDM finance means initial project costs are covered by a combination of debt, equity and grants to a lesser extent. This creates risks for marginal actors that may rely on bank loans or microfinance to participate. She anticipates that with contracting carbon market finance, CDM-related debt may grow.

■ Carbon markets as fossil fuel subsidy

Over-compensation for fossil fuel industries has meant that the profit margins of some of the most polluting

firms have increased. While companies with obligations to participate in the EU ETS have been allocated more free permits than they need, almost all of the costs were passed on to consumers [97]. Heavily compensated energy-intensive industries (iron and steel, refineries and (petro)-chemical utilities) enjoyed windfall profits of €14 billion between 2005 and 2008 [98]. Electricity producers, too, were free to pass on to consumers the full “opportunity cost” of compliance by increasing electricity prices, resulting in windfall profits of between €23 and €71 billion in the second phase [99].

Industry lobbying has guaranteed that over 75% of the manufacturing industry will continue to receive permits for free at least until 2020 (meaning extra revenue to polluters instead of state coffers of around €7 billion per year) [100]. Every attempt to end these handouts has met strong lobbying from energy-intensive industries [97,101]. In phase III (2013–2020), only the energy sector will be required to buy permits at auction, and even then, exceptions have been made for utilities in Central and Eastern Europe, including those with a high dependence on coal for electricity generation.

The New Zealand and Australian ETS has repeated the pattern of overly generous compensation [67,102–104]. In New Zealand, compensation is linked to emissions intensity of output, and there are no penalties for increasing emissions. In Australia, it was estimated that between \$2.3 and \$5.4 billion in windfall profits would go to brown coal generators who are passing on more than the full costs of the carbon price to consumers [105]. Analysis of the compensation and exemptions awarded to black coal, liquefied natural gas (LNG) and steel industries in the Clean Energy Future (CEF) is unjustified and costly [106]. Lo and Spash point out that the excess permits awarded to the most polluting firms can be traded at a profit, whereas permits purchased, mainly by less energy-intensive industries, cannot [102]. These significant transfers of public money to firms illustrate that far from being cheap, carbon trading has proven to be costly to the public and consumer purse [64,107,108].

■ Carbon markets as regressive

There is a risk that carbon markets can have regressive effect. Like taxes on consumption, cap-and-trade schemes applied to fossil fuels have an effect on both energy prices and all other goods and services. As a result, the burden of carbon costs is disproportionately placed on low-income households since they spend more in real terms on goods impacted by carbon pricing, such as electricity, fuel and groceries. The inequality of carbon pricing is starker when considering the issue of windfall profits discussed above.

In the EU and Australia, no meaningful price signal has been sent to firms receiving grandfathered permits, while consumers experience the full cost passed through [97,102].

There is an ongoing discussion about revenue recycling in the economic literature, recommending that the regressive elements of carbon trading (and other forms of mitigation policy) can be compensated for with appropriate social policies, such as house insulation, micro-generation, energy efficiency and public transport programs [109,110].

In practice, governments have recycled revenues from carbon pricing in various forms, including: not allocating revenues to any purpose (UK, Norway, Ireland); covering administrative costs (Lithuania, Ireland), energy efficiency programs (Lithuania, Czech Republic); international climate aid (Germany), renewable energy subsidies (Germany) [see 111]; research and development and progressive tax reform (Australia). Controversially, the European electricity producers’ lobby negotiated a proportion of the revenue from auction permits under phase III of the EU ETS to go to the development of what critics see as questionable energy projects. Revenue from the 300 million auctioned permits was allocated to carbon capture and storage (“clean coal”) and agrofuels along with other clean energy projects [61]. In Australia, critics of the former ETS argue that the federal government underestimated the impacts of carbon pricing on households in the medium and long term. This puts the adequacy of compensation into question [112]. Volatility of carbon prices, particularly with Australia’s former plans to link to the EU scheme, would have compromised the capacity of the state to use future revenue to ease household costs.

■ Carbon markets as corruption

The EU carbon market has been susceptible to fraud [100]. In 2010, for example, “carousel fraud” or “missing trader fraud” in the EU ETS was revealed to have cost the public purse more than €5 billion in lost Value-Added Tax (VAT) revenues [113]. There are ongoing litigations of carbon traders accused of fraud, and a CDM verification agency has been suspended. Fraudulence has also been documented in certified UN offset projects and “carbon neutral” credits developed for sale on the voluntary market [114]. While some responses from the European Commission have been positive, others have been worrying. Reyes points out that the decision to hide the serial numbers of permits will increase, rather than decrease, the possibility of fraudulent activity [115].

Chan analyzed the US proposed climate legislation in 2009, concluding that it failed to account for the complexity of financial markets and that it did not go

far enough to regulate secondary carbon markets [116]. She concluded that the speculative nature of the secondary markets has the potential to create a carbon bubble and spur the development of “subprime carbon.” With regard to the extension of carbon trading to REDD, NGOs have argued that the potential for fraud is too great. Given the significant sums of money involved, there is incentive and potential for manipulation of carbon measurements to exaggerate results and increase payments [117,118].

Lohmann [119] sees carbon as an unregulatable commodity. He contends that corruption is not reducible to the misdeeds of individual entrepreneurs, but to the architecture of carbon markets themselves. His point is that the fundamental idea of establishing baselines (an estimated past against which the hypothetical future is measured) makes it impossible to know whether a project is “additional”; hence, it is impossible to argue that problems stem from a given activity being “non-additional” [119].

■ Carbon markets as utopian faith in pricing

Environmental economics privileges economic relations over social and ecological life. The discipline has refigured nature as natural capital. In Polanyi’s [120] terms, we can read carbon markets as the construction of a “commodity fiction” based on utopian efforts to separate parts of the carbon cycle out from society, in order to place it under the direction of the price signal [47,80,121]. Contrary to the depiction in neoclassical economic theory, carbon markets are political constructs, constituted by the constellation of social forces that dominate them [122].

Critics observe that carbon pricing in practice does not match the models contained in economic textbooks. Spash [49], for example, argues that claims to efficiency in carbon market schemes cannot be substantiated with static equilibrium analysis, and that the impact of carbon pricing is highly unpredictable [49]. He also argues that these models ignore the often-considerable concentrations of power in any given marketplace, particularly in the fossil fuel-based energy sector.

In the case of forest carbon offset programs in the developing world, the incentive approach ignores the institutional barriers to implementing and enforcing governance. “Fragile states” are often not in a position to make the decision to forgo rents from destructive industries within the largely unchanged political economy of global markets for minerals, timber and palm oil [123]. REDD programs in Papua New Guinea are testimony to this [124,125]. At a local level, there are risks that introducing monetary incentives for valuation of carbon reductions/sequestration will “crowd out” motivations and behaviors that contribute to broader

conservation outcomes in the short and long term [126; see also 127,128].

In practice, market efficiency criteria are commonly at odds with social development objectives [128]. To genuinely reconcile ecological, social and efficiency goals would void the economic instrument [95]. These contradictions, among other social limitations, mean that there are insurmountable obstacles to building coalitions that bridge the interests of business and environmentalists [58].

■ Carbon markets as scientism

Carbon markets reflect faith in the universal applicability of science. Scientific knowledge is essential for the process of assigning rights to greenhouse gas emissions. Commodification requires processes of commensuration – that is, creating equivalences between demarcated portions of the carbon cycle “where qualitatively distinct things are rendered equivalent and saleable through the medium of money” [129]. MacKenzie [130] has dubbed the socio-technical processes involved in producing carbon commodities “making things the same.”

Underlying this logic is a reductive view of nature. Differences between greenhouse gases are profound in ecological and social terms. The economic assumption that the carbon cycle can be measured accurately, quantified and parceled up into property rights is simplistic. The controversy over measuring the global warming potential of HFC gases is testimony to the problems of measurement [130,131]. Lohmann [132] argues that problems stemming from these differences, such as the impossibility of aggregated quantitative measurements of emissions “removals” by “carbon sinks,” are not recognized by UNFCCC parties or the IPCC. The abstraction involved in forming CO₂e commodities means scientific unknowns are frequently suppressed [121].

There is also a broader problem of assuming like for like. Numerous critics have pointed out that above- and below-ground carbon is different, and that proceeding with attempts to create equivalent, tradable carbon rights is problematic [57,132,133]. Fossilized carbon that composes energy fuels, such as coal and oil, is produced over thousands of years, becoming effectively inert. Other types of carbon have less stable properties. For instance, carbon that is stored in landscapes is part of the living carbon cycle where carbon is constantly transferring between inorganic forms (CO₂ in the atmosphere) and organic forms (plants, algae, animals, etc.), in flux over decades. Sequestering carbon in terrestrial ecosystems through conservation projects will not remove it from the active atmosphere–land–ocean cycle, and these ecosystems are vulnerable to changes in land use.

■ Carbon markets as technocracy

Carbon markets are constructed by a transnational network of economic agents (economists, scientists, engineers, policy advisors, parliamentarians, etc.) and complex technologies (computers, global positioning system satellites, factories, gasses, accounting systems, etc.) [130]. New actors attracted to the trade in carbon are entering into contracts with communities in the South. In the process, new values, rights, responsibilities and liabilities are defined. The commodification of carbon involves assigning value to emissions in the abstract, and are derived as a function of marginal abatement costs [134]. Lohmann observes that carbon market management has created reams of complicated carbon accounting data and cost-benefit analyses. These new managerial systems produce new technocratic elites, yet also new zones of ignorance by abstracting from where emissions are made [121,131,135].

In regard to oversight, very limited accountability and transparency results from the complexity of carbon market governance [49,135]. The privileging of expert knowledge creates power imbalances between would-be market actors. For instance, corporate operators who can aggregate their activity are best placed to benefit from participation in new markets such as REDD. In contrast, local communities who may take a once-in-a-lifetime decision to participate are taking much greater risks [136].

Again, the theoretical origin of technocratic governance is neoclassical economics. In normative terms, economics has re-gearred questions of sustainability away from being moral and environmental issues to being technical problems resolvable through economic calculation [36,137,138]. Carbon markets are now associated with a style of politics that renders “carbon” a problem to be managed by experts [139].

■ Carbon markets as obstacle

A new coalition of campaigners has come together to argue that the EU ETS should be scrapped to make way for other forms of climate policy [100]. They argue that carbon pricing has acted as political barrier to other action – in other words, carbon trading is not a “first step” toward broader, better reform. Instead, carbon trading locks in emissions increases and is used as an excuse to abandon other energy policies that contribute more meaningfully to the task of decarbonization [65,79]. For instance, Australia's 2012 *Energy white paper* was based on the assumption that emissions will be outsourced overseas, while the domestic coal and gas industries can be expanded. Under the cover of carbon pricing, the report argued for further energy privatization, and the removal of measures that support renewable energy sources [140].

With the regressive impacts of carbon pricing in mind, others have argued for carbon taxation with

progressive effects on income distribution such as taxing luxury goods [110] or hypothecated carbon income and corporate taxes to fund energy transition and meet international obligations [141]. Carbon taxes promise to be far simpler to administer and implement, and they would cut out an array of brokers and speculators who profit from and often manipulate the carbon trading system [142]. Using Germany's “Energiewende” as example, Reyes also predicts that a discontinued EU ETS would allow for more, “national transition planning” [65]. It would give citizens and governments the power and opportunity to implement a wide range of possible policy options, from energy efficiency measures to renewable energy targets – most of which are currently crowded out by governments’ focus on carbon trading.

Finally, calls from environmental justice movements to keep fossil fuels in the ground imply a return to direct regulation. State subsidies and other assistance to polluting industry must be removed and shifted to renewable energy, and existing laws regulating mining, agriculture and forestry must be enforced and strengthened to meet ecological and social justice criteria [79]. In terms of international action, some now argue for “cooperative decarbonization” between smaller groups of nations focused on particular industries or commodities such as coal [143–145].

Conclusion

We will soon be marking the 20th anniversary of the Kyoto Protocol, which instituted the logic for carbon markets. Yet greenhouse gas emissions are still increasing rapidly. The time for radical action has come, if humanity wants to stand a chance of avoiding runaway climate change. The evidence synthesized in this paper suggests that carbon markets will not play a role in any plan to radically reduce greenhouse gas emissions.

This overview of the theoretical and empirical reasons for withdrawing from the projects of creating carbon markets has sought to demonstrate that we will not be able to design and implement ecologically effective and socially just carbon trading schemes. Many people engaged in climate policy analysis and debate may conclude that the problems with carbon trading can be dealt with by simpler, smaller scale market design with better regulatory oversight [90,146]. This implies that the flawed practice of carbon trading is the problem, not the political and intellectual rationale behind it. There are major failures of neoclassical economic theory underpinning carbon trading, particularly with regard to the underlying vision of “nature,” and its optimism about market dynamics and inattention to power relations. More broadly, the pattern of institutional arrangements and social forces behind emissions trading shows path dependency in the wrong direction.

Because carbon trading is built on questionable economic theory and has been instituted through particular patterns of decision making, it is not amendable to reform. The political economy of carbon trading is such that organized industry lobbies representing both industrial and financial sectors have enormous power to secure schemes that bolster existing emissions-intensive accumulation processes rather than disrupt them. This is compounded by an ongoing utopian faith in market mechanisms and technocratic decision making within the state and expert elite. We conclude that a return to direct regulatory measures as the central means for change is a more fruitful focus for pragmatic state and expert policymakers.

Now is the time to redirect political energy to alternative action. We acknowledge that alternative visions and implementation for just climate policy reform that meets the task of rapid decarbonization will certainly require change at a rapid pace. Yet we believe that the case for pursuing alternatives to carbon trading is strong. A great deal of novel and creative work will be enormously difficult, for sure. In other ways, the shift we are calling for involves

harnessing existing legislative powers to ensure environmental and social protection against emissions-intensive industries.

Progressive tax reform promises to be much more popular with national populations than regressive carbon pricing. Alternative forms of international cooperation focused on transition away from fossil fuel dependence would have the benefit of being focused on the root causes of energy imbalance and not on emissions in abstract. Of course, democratization of government policy processes would need to occur, including breaking the hold of industry lobbies on resource and environmental ministries across the world. One important part of the struggle to refocus government action to climate stabilization will be to broker new uncompromising visions for reform. Actors in expert policy circles have a role to play in arguing for alternate progressive policies, including ideas that are currently considered “ideological.”

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References

- 1 IEA. *World energy outlook: redrawing the energy-climate map*. International Energy Agency, Paris, France (2013).
- 2 World Bank. Turn down the heat: why a 4°C world must be avoided. World Bank, Washington DC, USA (2012).
- 3 Hansen J, Kharecha P, Sato M *et al*. Assessing “dangerous climate change”: required reduction of carbon emissions to protect young people, future generations and nature. *PloS One*, 8(12), e81648 (2013).
- 4 Leaton J, Ranger N, Ward B, Sussams L, Brown M. *Unburnable carbon 2013: wasted capital and stranded assets*. Carbon Tracker & The Grantham Research Institute, London, UK (2013).
- 5 ICAP. *Emissions trading worldwide: international carbon action partnership (ICAP) status report 2014*. International Carbon Action Partnership, Berlin, Germany (2014).
- 6 Hepburn C. Carbon trading: a review of the Kyoto mechanisms. *Annu. Rev. Environ. Resour.* 32, 375–393 (2007).
- 7 World Bank. Mapping carbon pricing initiatives: developments and prospects. Ecofys for World Bank, Washington, DC, USA (2013).
- 8 Flachsland C, Marschinski R, Edenhofer O. Global trading versus linking: architectures for international emissions trading. *Energy Policy* 37(5), 1637–1647 (2009).
- 9 Michaelowa A. Book review: failures of global carbon markets and CDM? *Climate Policy* 11(1), 839–841 (2011).
- 10 Böhm S, Dhahi S. Commentary. Fault lines in climate policy: what role for carbon markets? *Climate Policy* 11(6), 1389–1392 (2011).
- 11 Tyndall Centre for Climate Change. *Radical emissions reductions conference*. Royal Society, London, UK (2013).
- 12 Helm D. Climate-change policy: why has so little been achieved? *Oxf. Rev. Econ. Policy* 24(2), 211–238 (2008).
- 13 Roberts JT. Multipolarity and the new world dis(order): US hegemonic decline and the fragmentation of the global climate regime. *Global Environ. Change* 21, 776–784 (2011).
- 14 Markandya A, Barbier E. *A new blueprint for a green economy*. Earthscan, London, UK (2013).
- 15 Coase RH. The problem of social cost. *J. Law Econ.* 3, 1–44 (1960).
- 16 Dales JH. Land, water, and ownership. *Can. J. Econ.* 1(4), 791–804 (1968).
- 17 Dales JH. *Pollution, property and prices: an essay in policy-making and economics*. University of Toronto Press, Toronto, ON, Canada (1968).
- 18 Crocker TD. *Urban air pollution damage functions: theory and measurement*. Final Report. University of California, Riverside, USA (1971).
- 19 Montgomery WD. Markets in licenses and efficient pollution control programs. *J. Econ. Theory* 5(3), 395–418 (1972).
- 20 Pearce DW, Turner RK. *Economics of natural resources and the environment*. John Hopkins University Press, Baltimore, MD, USA (1990).
- 21 Garnaut R. The Garnaut climate change review: final report. Cambridge University Press, Cambridge, UK (2008).
- 22 Hepburn C. Regulation by prices, quantities, or both: a review of instrument choice. *Oxf. Rev. Econ. Policy* 22(2), 226–247 (2006).
- 23 Garnaut R. *Carbon pricing and reducing Australia's emissions*. Commonwealth of Australia, Canberra, Australia (2011).
- 24 Fankhauser S, Hepburn C. Designing carbon markets. Part 2: carbon markets in space. *Energy Policy* 38, 4381–4387 (2010).
- 25 Fankhauser S, Hepburn C. Designing carbon markets. Part 1: Carbon markets in time. *Energy Policy* 38, 4363–4370 (2010).

- 26 Newell P, Paterson M. The politics of the carbon economy. In: *The politics of climate change: a survey*. Boykoff, MT (Ed.): Routledge, London, UK (2009).
- 27 Harvey D. *A brief history of neoliberalism*. Open University Press, Oxford, UK (2005).
- 28 Centre for Science and International Affairs. *Market-based policy mechanisms for addressing global climate change*. ENRP Project 88/ Round II Project Report P-92-02. Stavins, RN (Ed.): Kennedy School of Government, Harvard University, Boston, MA, USA (1992).
- 29 Wirth TE, Stavins RN. *Project 88: harnessing market forces to protect our environment: initiatives for the new president: a public policy study*. Environmental Policy Institute, Washington D.C., USA (1988).
- 30 Bernstein S. *The compromise of liberal environmentalism*. Columbia University Press, New York, USA (2002).
- 31 Braun M. The evolution of emissions trading in the European Union: the role of policy networks, knowledge and policy entrepreneurs. *Account. Organ. Soc.* 34, 469–487 (2008).
- 32 Pearce DW, Markandya A, Barbier E. *Blueprint for a green economy*. Earthscan, London, UK (1989).
- 33 Pearce DW. The political economy of an energy tax: the United Kingdom's Climate Change Levy. *Energy Econ.* 28(2), 149–158 (2006).
- 34 UNCTAD. *Combating global warming study on a global system of tradeable carbon emission entitlements*. United Nations, New York, USA (1992).
- 35 OECD. *Managing the environment: the role of economic instruments*. Organisation for Economic Co-operation and Development, Paris, France (1994).
- 36 Rosewarne S. Selling the environment: a critique of market ecology. In: *Beyond the market: alternatives to economic rationalism*. Rees, S, Rodley, G, Stilwell, F (Eds.). Pluto Press, Leichardt, Australia (1993).
- 37 Meckling J. Corporate policy preferences in the EU and the US: emissions trading as the climate compromise? *Carbon Clim. Law Rev.* 2, 171–180 (2008).
- 38 Wettestad J. The making of the 2003 EU emissions trading directive: an ultra-quick process due to entrepreneurial proficiency? *Glob. Environ. Polit.* 5(1), 1–23 (2005).
- 39 UNFCCC. *Kyoto Protocol to the United Nations Framework Convention on Climate Change*. United Nations Framework Convention on Climate Change, 1–11 December, Kyoto, Japan. (Opened for signature 16th March 1998, entered into force 16th February 2005) (1997).
- 40 Grubb M, Vrolijk C, Brack D. *The Kyoto Protocol: a guide and assessment*. Royal Institute of International Affairs, London, UK (1999).
- 41 Okereke C, Dooley K. Principles of justice in proposals and policy approaches to avoided deforestation: towards a post-Kyoto climate agreement. *Glob. Environ. Change* 20, 82–95 (2010).
- 42 Pearse R. Mapping REDD in the Asia-Pacific: governance, marketisation and contention. *Ephemera* 12(1), 181–205 (2012).
- 43 Streck C. New partnerships in global environmental policy: the Clean Development Mechanism. *J. Environ. Dev.* 13(3), 295–322 (2004).
- 44 Paterson M. Who and what are carbon markets for? Politics and the development of climate policy. *Clim. Policy*, 12(1), 92–97 (2011).
- 45 UNFCCC. Decision 15/CP.7 Principles, nature and scope of the mechanisms pursuant to Articles 6, 12 and 17 of the Kyoto Protocol, Conference of the Parties to the United Nations Framework Convention on Climate Change, 7th session, Marrakesh, FCCC/CP/2001/13/Add.2 (29 October–10 November 2001).
- 46 Goodman J. From global justice to climate justice? Justice ecologism in an era of global warming. *New Polit. Sci.* 31(4), 499–514 (2009).
- 47 Bond P. Emissions trading, new enclosures and eco-social contestation. *Antipode*, 44(3), 684–701 (2012).
- 48 Pearse R. Making a market? Contestation and climate change. *J. Aust. Polit. Econ.* 66, 166–198 (2010).
- 49 Spash C. The brave new world of carbon trading. *New Polit. Econ.* 15(2), 169–195 (2010).
- 50 Aldred J. The ethics of emissions trading. *New Polit. Econ.* 17(3), 339–360 (2012).
- 51 Baldwin R. Regulation lite: the rise of emissions trading. *Regul. Gov.* 2(2), 193–215 (2008).
- 52 Sovacool BK. The policy challenges of tradable credits: a critical review of eight markets. *Energy Policy*, 39(2), 575–585 (2011).
- 53 Parks BC, Roberts JT. Climate change, social theory and justice. *Theory Cult. Soc.* 27(2–3), 134 (2010).
- 54 Meckling J. The future of emissions trading. *Wiley Interdiscip. Rev. Clim. Change*, 5(5), 569–576 (2014).
- 55 Lohmann L. Capital and climate change. *Dev. Change* 42(2), 649–668 (2011).
- 56 Böhm S, Misoczky MC, Moog S. Greening capitalism? A Marxist critique of carbon markets. *Organ. Stud.* 33(11), 1617–1638 (2012).
- 57 Smith K. *The carbon neutral myth: offset indulgences for your climate sins*. Transnational Institute, Amsterdam, The Netherlands (2005).
- 58 Lohmann L. A rejoinder to Matthew Paterson and Peter Newell. *Dev. Change* 43(5), 1177–1184 (2012).
- 59 Paterson M, Newell P. Of heroes, villains and climate capitalism: a response to Larry Lohmann. *Dev. Change* 43(5), 1171–1175 (2012).
- 60 Callon M. Civilizing markets: carbon trading between *in vitro* and *in vivo* experiments. *Account. Organ. Soc.* 34, 535–548 (2009).
- 61 Reyes O. *EU emissions trading system: failing at the third attempt*. Carbon Trade Watch and Corporate Europe Observatory, Barcelona, Spain (2011).
- 62 Morris D, Worthington B. *Cap or trap? How the EU ETS risks locking in carbon emissions*. Sandbag, London, UK (2010).
- 63 EEA. *Greenhouse gas emission trends and projections in Europe 2012: tracking progress towards Kyoto and 2020 targets*. European Environment Agency, Copenhagen, Denmark (2013).
- 64 Corporate Europe Observatory. *EU ETS myth busting: why it can't be reformed and shouldn't be replicated*. Corporate Europe Observatory, Friends of the Earth, Centre for Civil Society et al., Brussels, Belgium (2013).
- 65 Reyes O. *Life beyond emissions trading*. Corporate Europe Observatory, Brussels, Belgium (2014).
- 66 Morris D. *Slaying the dragon: vanquish the surplus and rescue the ETS*. Sandbag, London, UK (2014).
- 67 Bertram G, Terry S. *The carbon challenge: New Zealand's emissions trading scheme*. Bridget Williams Books, Wellington, New Zealand (2010).
- 68 Saddler H, Denniss R. *New Zealand's expanding carbon footprint: analysis of New Zealand's emissions trading scheme: major flaws and barriers to emissions cuts*. Greenpeace New Zealand, Auckland, New Zealand (2009).
- 69 Commonwealth of Australia. *Strong growth, low pollution: modelling a carbon price*. Treasury, Canberra, Australia (2011).

- 70 Pearse R. Carbon trading for climate justice? *Asia Pac. J. Environ. Law* 18 (forthcoming).
- 71 Hall R. *REDD myths: a critical review of proposed mechanisms to reduce emissions from deforestation and degradation in developing countries*. Friends of the Earth International, Amsterdam, The Netherlands (2008).
- 72 Gilbertson T, Reyes O. *Carbon trading: how it works and why it fails*. Dag Hammarskjöld Foundation Uppsala, Sweden (2009).
- 73 Clifton S. *A Dangerous obsessions: the evidence against carbon trading and for real solutions to the climate crunch*. Friends of the Earth England, Wales and Northern Ireland, UK (2009).
- 74 Elsworth R, Worthington B, Morris D. *Help or hindrance? Offsetting in the EU ETS*. Sandbag, London, UK (2013).
- 75 Point Carbon. *Use of offsets for compliance within EU ETS up 86% on 2011*. <http://www.pointcarbon.com/aboutus/pressroom/pressreleases/1.1902674> Point Carbon (2012).
- 76 Wara M, Victor DG. *A realistic policy on international carbon offsets*. Program on Energy and Sustainable Development Working Paper. Stanford University, Stanford, CA, USA (2008).
- 77 Carrington D. EU plans to clamp down on carbon trading scam. *The Guardian*, 26 October. (2010).
- 78 CEO. *Laughing all the way to the (carbon offset) bank: collusion between DG Enterprise and business lobbyists*. Corporate Europe Observatory, Brussels, Belgium (2011).
- 79 Pearse R, Dehm J. Rudd's plans to float carbon price a sham. *Chain React.* (118), 24 (2013).
- 80 Pearse R. Back to the land? Legitimation, carbon offsets and Australia's emissions trading scheme. *Glob. Change Peace Secur.* 25(1), 43–60 (2013).
- 81 Goodman J, Roberts E. *What a scam!: Australia's REDD offsets for Copenhagen*. Aid/Watch and Friends of the Earth Australia, Sydney, Australia (2009).
- 82 Greenpeace. *The future is here: new jobs, new prosperity and a new clean economy*. Greenpeace New Zealand, Auckland, New Zealand (2013).
- 83 Conant J. Outsourcing global warming solutions. *Race Poverty Environ.* 18(1), 77–82 (2011).
- 84 Greenpeace. *Outsourcing hot air: the push for sub-national REDD offsets in California's carbon market from Mexico and beyond*. Greenpeace, Amsterdam, The Netherlands (2012).
- 85 Bailey I, Gouldson A, Newell P. Ecological modernisation and the governance of carbon: a critical analysis. *Antipode*, 43(2), 682–703 (2010).
- 86 FERN. *Carbon markets will not deliver for southern governments, forests and people*. Forests and the European Union Resource Network (FERN) *et al.*, Brussels, Belgium (2011).
- 87 Böhm S, Dabhi S (Eds.) *Upsetting the offset: the political economy of carbon markets*. Mayfly Books, London, UK (2009).
- 88 Bond P, Dada R (Eds.) *Trouble in the air*. Centre for Civil Society and Transnational Institute, Johannesburg, South Africa (2007).
- 89 Boyd E. Governing the Clean Development Mechanism: global rhetoric versus local realities in carbon sequestration projects. *Environ. Plan. A*, 41(10), 2380 (2009).
- 90 Boyd E, Hultman N, Timmons Roberts J *et al.* Reforming the CDM for sustainable development: lessons learned and policy futures. *Environ. Sci. Policy*, 12(7), 820–831 (2009).
- 91 Bachram H. Climate fraud and carbon colonialism: the new trade in greenhouse gases. *Capital. Nat. Social.* 15(4), 1–16 (2004).
- 92 Cabello J, Gilbertson T (Eds.) *No REDD: a reader*. Carbon Trade Watch and Indigenous Environment Network, Barcelona, Spain (2010).
- 93 Fairhead J, Leach M, Scoones I. Green grabbing: a new appropriation of nature? *J. Peasant Stud.* 39(2), 237–261 (2012).
- 94 Corbera E, Friedli C. Planting trees through the Clean Development Mechanism: a critical assessment. *Ephemera*, 12(1/2), 206–241 (2012).
- 95 Paton J, Bryant G. Valuing pollution: problems of price in the commodification of nature. *Econ. Labour Relat. Rev.* 23(1), 87–106 (2012).
- 96 Ervine K. Carbon markets, debt and uneven development. *Third World Q.* 34(4), 653–670 (2013).
- 97 Coehlo R. *Green is the color of money: the EU ETS failure as a model for the "green economy."* Carbon Trade Watch, Barcelona, Spain (2012).
- 98 de Bruyn S, Markowska A, de Jong F, Bles M. *Does the energy intensive industry obtain windfall profits through the EU ETS?* CE Delft for European Climate Foundation, The Hague, The Netherlands (2010).
- 99 Point Carbon. *EU ETS Phase II – the potential and scale of windfall profits in the power sector*. WWF and Point Carbon Advisory Services, Brussels, Belgium (2008).
- 100 CTW. Civil society organisations demand that the EU scrap its emissions trading scheme. Carbon Trade Watch (CTW) *et al.*, Barcelona, Spain (2013).
- 101 Reyes O. *Paying the polluters: EU emissions trading and the new corporate electricity subsidies*. Carbon Trade Watch and Corporate Europe Observatory, Barcelona, Spain (2012).
- 102 Lo A, Spash C. How green is your scheme? Greenhouse gas control the Australian way. *Energy Policy* 50, 150–153 (2012).
- 103 Spash C, Lo A. Australia's carbon tax: a sheep in wolf's clothing? *Econ. Labour Relat. Rev.* 23(1), 67–86 (2011).
- 104 Bullock D. Emissions trading in New Zealand: development, challenges and design. *Environ. Polit.* 21(4), 657–675 (2012).
- 105 Mountain, B. *Transitional assistance, or windfall profits? The financial impact of the carbon price and compensation payments on Victoria's brown coal generators*. CME for Environment, Victoria, Melbourne, Australia (2013).
- 106 Wood T, Edis T. *The new protectionism under carbon pricing: case studies of LNG, coal mining and steel sectors*. Grattan Institute, Melbourne, Australia (2011).
- 107 Rosewarne S. Meeting the challenge of climate change: the poverty of the dominant economic narrative and market solutions are subterfuge. *J. Aust. Polit. Econ.* 66, 17–50 (2010).
- 108 Rosewarne S, Goodman J. The ETS is a huge cost for almost no benefit. *Sydney Morning Herald*, 9 December. (2009).
- 109 Büchs M, Bardsley N, Duwe S. Who bears the brunt? Distributional effects of climate change mitigation policies. *Crit. Soc. Policy* 31(2), 285–307 (2011).
- 110 Gough I. Carbon mitigation policies, distributional dilemmas and social policies. *J. Soc. Policy* 42(02), 191–213 (2013).
- 111 Haita C. *Recycling the auction revenue from Phases I and II of the EU emissions trading scheme*. International Centre for Climate Governance, Venice, Italy (2013).
- 112 Perry N, Rosewarne S, White G. Clean energy policy: taxing carbon and the illusion of the equity objective. *Ecol. Econ.* 90, 104–113 (2013).
- 113 Europol. *Carbon credit fraud causes more than 5 billion euros damage for European taxpayer*. Europol, 9 December, <https://www.europol.europa.eu/content/press/carbon-credit-fraud-causes-more-5-billion-euros-damage-european-taxpayer-1265%20/> (2009).
- 114 Martin P, Walters R. Fraud risk and the visibility of carbon. *Int. J. Crime Justice Soc. Democr.* 2(2), 27–42 (2013).

- 115 Reyes O. *Letting the market play: corporate lobbying and the financial regulation of EU carbon trading*. Carbon Trade Watch and Corporate Europe Observatory, Barcelona, Spain (2011).
- 116 Chan M. *Subprime carbon? Rethinking the world's largest new derivatives market*. Friends of the Earth, Washington, DC, USA (2009).
- 117 Kill J, Pearson B. *Forest fraud: say no to fake carbon credits*. Forests and the European Union Resource Network (FERN), SinksWatch in collaboration with CDM Watch, Gloucestershire, UK (2003).
- 118 Global Witness. *Forest carbon, cash and crime: the risk of criminal engagement in REDD+*. Global Witness, Holborn, London, UK (2011).
- 119 Lohmann L. Regulation as corruption in the carbon offset markets. In: *Upsetting the offset: the political economy of carbon markets*. Böhm, S, Dabhi, S (Eds.) Mayfly Books, London, UK, 244–254 (2009).
- 120 Polanyi K. *The great transformation: the political and economic origins of our time*. Beacon Press, Boston, MA, USA (2001[1944]).
- 121 Lohmann L. Uncertainty markets and carbon markets: variations on Polanyian themes. *New Polit. Econ.* 15(2), 225–254 (2010).
- 122 Ervine K. Diminishing returns: carbon market crisis and the future of market-dependent climate change finance. *New Polit. Econ.* 19(5), 723–747 (2013).
- 123 Karsenty A, Ongolo S. Can “fragile states” decide to reduce their deforestation? The inappropriate use of the theory of incentives with respect to the REDD mechanism. *Forest Policy Econ.* 18, 38–45 (2011).
- 124 Greenpeace. *Papua New Guinea: not ready for [REDD]*. Greenpeace Asia-Pacific, Sydney, Australia (2010).
- 125 Lang C. REDD projects in Papua New Guinea “legally untenable.” In: *No REDD: a reader*. Cabello, J, Gilbertson, T (Eds.). Carbon Trade Watch and Indigenous Environment Network, Barcelona, Spain (2010).
- 126 Corbera E. Problematizing REDD+ as an experiment in payments for ecosystem services. *Curr. Opin. Environ. Sustain.* 4(6), 612–619 (2012).
- 127 McAfee K. The contradictory logic of global ecosystem services markets. *Dev. Change* 43(1), 105–131 (2012).
- 128 McAfee K. Nature in the market-world: ecosystem services and inequality. *Development* 55(1), 25–33 (2012).
- 129 Castree N. Commodifying what nature? *Prog. Hum. Geogr.* 27(3), 273–297 (2003).
- 130 MacKenzie D. Making things the same: gases, emission rights and the politics of carbon markets. *Account. Organ. Soc.* 34(3–4), 440–455 (2009).
- 131 Lohmann L. Toward a different debate in environmental accounting: the cases of carbon and cost-benefit. *Account. Organ. Soc.* 34(3–4), 499–534 (2009).
- 132 Lohmann L. Marketing and making carbon dumps: commodification, calculation and counterfactuals in climate change mitigation. *Sci. Cult.* 14(3), 203–235 (2005).
- 133 Dooley K. *Misleading numbers: the case for separating land and fossil based carbon emissions*. FERN, Brussels, Belgium (2014).
- 134 Corbera E, Brown K. Offsetting benefits? Analyzing access to forest carbon. *Environ. Plan. A* 42(7), 1739 (2010).
- 135 Lohmann L. Carbon trading, climate justice and the production of ignorance: ten examples. *Development* 51(3), 359–365 (2008).
- 136 Munden Project. *REDD and forest carbon: market-based critique and recommendations*. The Munden Project (2011).
- 137 Nelson JA. Economists, value judgments, and climate change: a view from feminist economics. *Ecol. Econ.* 65(3), 441–447 (2008).
- 138 Spash CL. Ethics and environmental attitudes with implications for economic valuation. *J. Environ. Manag.* 50(4), 403–416 (1997).
- 139 Swyngedouw E. Apocalypse forever? Post-political populism and the spectre of climate change. *Theory Cult. Soc.* 27(2–3), 213–232 (2010).
- 140 Commonwealth of Australia. *Energy white paper 2012: Australia's energy transformation*. Department of Resources, Energy and Tourism, Canberra, Australia (2012).
- 141 Goodman J, & Rosewarne S. Climate policy: from carbon tax to direct action? *Chain Reaction* 110, 23–24, November (2010).
- 142 Sovacool BK. Building umbrellas or arks? Three alternatives to carbon credits and offsets. *Electr. J.* 23(2), 29–40 (2010).
- 143 Green F, Finighan R. *Laggard to leader: how Australia can lead the world to zero carbon prosperity*. Beyond Zero Emissions, Melbourne, Australia (2012).
- 144 Christoff P. & Eckersley R. ‘A Coal Non-Proliferation Treaty?’, paper presented to the *Beyond Coal workshop*, Cosmopolitan Civil Societies Research Centre, University of Technology Sydney, Australia, 16-17 December (2013).
- 145 Martin A. Commodity exports and transboundary atmospheric impacts: regulating coal in an era of climate change. *Environ. Polit.* 23(4), 590–609 (2014).
- 146 Chan M. Lessons learned from the financial crisis: designing carbon markets for environmental effectiveness and financial stability. *Carbon Clim. Law Rev.* 2, 152–160 (2009).