# Introduction

## Paradox in Paris

As climate change emerged as one of the major global challenges of our time, carbon markets were put forward by governments around the world as its defining policy framework. Market-based climate policy was hailed for its unique ability to use price incentives to achieve environmental goals cost effectively. By creating new economic winners and minimising losers from climate action, carbon markets promised to encourage political consensus for decarbonisation. Following the 1997 Kyoto Protocol, which placed emissions trading and carbon offsetting at the heart of the international climate regime, carbon markets were established in a wide range of jurisdictions. In the two decades following Kyoto, carbon markets had been implemented at supranational, national, regional, and city-scales in the European Union, the United States, China, Japan, Canada, Australia, New Zealand, South Korea, and Switzerland. Carbon offset projects had similarly proliferated throughout developing and ex-Soviet Union countries (World Bank 2017 p. 12). When the Paris Agreement once again made market-based measures a key mechanism for achieving national emissions reduction commitments, momentum towards carbon markets appeared to be stronger than ever.

Yet, as negotiations got underway for the Paris Agreement, the place of carbon markets was far from certain. Just a month out from the meeting, business organisations representing many of the world's largest polluting companies and financial institutions were sounding the alarm about the absence of references to market mechanisms in the draft negotiating text (International Emissions Trading Association 2015). The carbon market provisions that eventually emerged will have significant implications for the operation of the new 'bottom-up' Paris model of global climate governance, where governments set their own targets, subject to periodic review. While the Paris Agreement abandoned the Kyoto practice of seeking agreement between countries on targets, like Kyoto, it makes it possible that climate action in one country will count towards the commitments of another country through emissions trading or carbon offsetting (UNFCCC, 2015 Article 6). However, after almost twenty years of experience of carbon markets, the text of the Paris Agreement gave very little indication about how to achieve its market-based vision.

Uncertainty over the proper role of carbon markets reflected troubles in the world's major existing carbon trading schemes, most importantly, the European Union Emissions Trading System (EU ETS). Over ten years of operation, promises that the EU ETS would harness market forces to slow global warming had been unsettled by systemically low carbon prices, heavy financial losses, and ongoing controversy over much needed reforms. These pressures had intensified in the period between the failed Copenhagen climate conference and Paris. European allowance prices headed and remained under €10 after 2012, from earlier highs of over €30 (Intercontinental Exchange 2017). This is well below the levels estimated by carbon market advocates to be necessary to meet the Paris ambition to limit warming to 1.5°C (High-Level Commission on Carbon Prices 2017). Together with the even greater drop in UN carbon offset prices to less than €1, this sparked an 80 per cent collapse in the trading value of global carbon markets between 2011 and 2015 (World Bank 2012 p. 10, 2015 p. 13). In response, major banks and other businesses that had aimed to profit from trading carbon began to lose interest in the market (Straw & Platt 2013; World Bank 2015 p. 35). Just as the world was turning its attention to the next global agreement on climate change, significant political oxygen within Europe was forced to turn inward to long and drawn out debates over the question of whether and how to rescue the EU ETS (Wettestad & Jevnaker 2016).

The Paris Agreement thus reflected a paradox in global climate policy: strong commitment to the superiority of market-based approaches, if not their institutional requirements, persists in the context of crises in existing carbon trading schemes and a rapidly warming climate. In the current conjuncture, how this paradox of carbon markets is understood, and responded to, has become a significant factor in shaping the course of the crisis of climate change. However, dominant narratives in existing research do not sit well with the practical experience of marketised climate policy. Some strands of literature on carbon markets were overly optimistic about their capacity to lower emissions, create new climate-friendly industries, and accommodate improvements in policy design. However, critical perspectives have often been so focused on opposing the market-based policy approach that they have missed opportunities to explore what the experience of carbon markets reveals about the co-production of capitalism and climate change.

This book offers an account of what went wrong with the marketisation of climate change and what it means for the future of global climate action, by placing its analysis of carbon markets in the context of a 'climate-changing capitalism'. This moves research on market-based climate policy forward by foregrounding the capitalist relations, actors, and institutions that are changing the climate, in order to better understand how carbon markets, as a constituent part of the climate crisis, are changing capitalism. A central premise of the book is that climate policy must simultaneously address climate change as a socio-ecological, economic, and political crisis. From this perspective, the efficacy of carbon markets is co-dependent on their impacts on, among many other factors, the burning of fossil fuels, investments in renewable energy, the distribution of income, the operation of financial markets, the regulatory capacity of states, and the strategies of climate activists.

The analysis proceeds by developing concepts of 'appropriation', 'commodification' and 'capitalisation' as a typology of capitalist relations with, and within, nature. Each is explored in relation to different meanings of 'carbon'. Climate change is produced through capital's drive to appropriate carbon by burning fossil fuels. Carbon markets commodify carbon by representing different forms of carbon appropriation as tradeable carbon allowances and credits. States are central to both relations, in delivering fossil fuels for capital and instituting carbon markets. While the appropriation of carbon has traditionally supported accumulation in fossil fuel industries, the commodification of carbon makes processes of appropriation a direct object of capitalisation, as carbon-derived financial assets potentially emerge as new forms of capital. Thus, the book posits commodification as a key mediator of the internal relations between accumulation by appropriation in the sphere of 'reproduction' and accumulation by capitalisation within circuits of capital.

Through a detailed study of the EU ETS and its links with the UN offsetting mechanisms, the book identifies three contradictions of carbon markets in a climate-changing capitalism. First, carbon markets apply principles and tools of formal market equality to address what is a substantively unequal socio-ecological problem. This allows less effective forms of climate action to be substituted for more effective forms of climate action, which are rendered equivalent. Second, the economic viability of carbon markets depends on the maintenance of fossil fuel industries that require phasing out. This creates significant tensions for states seeking to support carbon markets as a new site of accumulation. Third, carbon markets shape climate politics in a way that prioritises the singular logic of price incentives over pluralistic policy debate. This undermines the political and institutional conditions necessary for a more targeted and multi-pronged framework for climate action. The book argues that the contradictions of carbon markets combine to hinder pathways out of the broader climate crisis despite, and sometimes through, reforms within the marketised policy paradigm. Before outlining the structure of the book, it is necessary to provide some more historical and institutional context on carbon markets and an overview of the key ways they have been understood.

## A Short History and Overview of Carbon Markets

The policy predecessor to carbon markets was sulphur dioxide trading in the United States. From the 1970s, under significant influence from the emerging neoclassically oriented environmental economics discipline and its construction of ideas of 'efficiency', the Environmental Protection Authority began to introduce elements of emissions trading in its regulation of pollution (Lane 2012). Growing support for the market-based approach vis-à-vis 'command and control' measures among sections of government, business and non-government environmental organisations resulted in amendments to the Clean Air Act in 1990 that established a nation-wide sulphur dioxide trading scheme. The scheme aimed to address acid rain problems by reducing sulphur dioxide emissions from fossil fuel-powered electricity generators by 50 per cent compared to 1980 levels. Its key innovation was that, within the overall cap, emissions allowances allocated or auctioned to certain power plants could be traded to cover the pollution of other power plants. According to the prevailing economic theory, the ability to trade would enable the marginal price movements of sulphur dioxide allowances, not the decisions of state regulators, to decide how the overall environmental goal would be met.

Dominant interpretations of the environmental success of the sulphur dioxide trading scheme played an important role in international negotiations on climate change. Economic assessments of the scheme highlighted its achievements in lowering abatement costs compared with direct regulation, spurred by greater than anticipated cost reductions in low-sulphur coal and scrubber technologies that remove sulphur dioxide emissions (Schmalensee et al. 1998; Stavins 1998). Economists argued that the omniscience of the price mechanism produced the most efficient combination of fuel changes and new technologies compared to anything that could have been mandated by governments (Burtraw et al. 2005 pp. 268–70). Other studies challenged this interpretation, pointing towards unrelated factors at play, such as changes in the transport industry reducing fuel costs (Ellerman & Montero 1998), and other government policies, such as performance standards and support for research and development, in driving technological innovation (Taylor et al. 2005 p. 370). Indeed, in Europe, more direct regulatory measures achieved greater sulphur dioxide emissions reductions than the United States over the same period (Milieu et al. 2004; Vestreng et al. 2007). Nonetheless, the US government used the purported success of sulphur dioxide trading to push for a market-based approach to achieving greenhouse gas emissions targets under the 1997 Kyoto Protocol.

US negotiators extolled the cost-efficiency of tradeable permits in advancing their goal of 'binding but flexible' commitments in the Kyoto Protocol (Grubb et al. 1999 pp. 88–91). At the time, many European negotiators opposed or were sceptical of market-based measures. The US sought to overcome this opposition by making the inclusion of carbon trading instruments a condition for agreement on key European demands for binding emissions reduction targets. The US also successfully overturned opposition from developing countries that viewed market-based approaches as diluting the responsibility of developed countries with historically high emissions to act. This was achieved through the transformation of a Brazilian idea for a clean development fund for developing countries, financed by a levy on developed countries that did not meet their targets. This proposal was flipped by US negotiators into a mechanism where emissions reductions from clean development projects in developing countries could be sold to developed countries and count towards their targets (Grubb et al. 1999 pp. 94, 101–3). The Clean Development Mechanism (CDM) was thus born as one of three market-based mechanisms in the Kyoto Protocol, alongside its close relative, Joint Implementation (JI), and Emissions Trading between developed countries. All three mechanisms introduced flexibility in how emissions targets could be met (UNFCCC, 1997).

The CDM and JI follow the same carbon market model, known as 'baseline and credit'. Both instruments facilitate the development of individual projects, such as the construction of wind farms, the installation of energy efficient light bulbs, or the destruction of potent industrial gases, which claim to reduce greenhouse gas emissions in different ways. The reduction claim is assessed according to the difference between actual greenhouse gas emissions and a baseline scenario of what would have occurred in the absence of the project. The difference is rewarded with an amount of carbon credits equal to the quantity of emissions reduced by the project. Carbon credits – Certified Emission Reductions (CERs) in the case of the CDM and Emission Reduction Units (ERUs) in the case of JI – can be sold to governments and, with the development of the EU ETS, individual companies. These state and corporate actors can then surrender the credits to meet their respective climate commitments, as an alternative to reducing their own emissions. The CDM and JI both follow this basic framework but are institutionally and geographically distinct, with separate UN governing bodies and different project locations. CDM projects must be located in countries that are not part of Annex I to the 1992 United Nations Framework Convention on Climate Change (UNFCCC). These are countries that didn't have emissions targets under Kyoto and are mostly developing countries. JI projects must be located in Annex I countries that did have Kyoto targets, including European, Anglosphere and ex-Soviet Union countries, and Japan (UNFCCC, 1997).

The period following the Kyoto conference witnessed a dramatic shift in the centre of gravity for global carbon markets. Despite US negotiators achieving almost everything that was on their agenda at the outset of negotiations, the US Senate never ratified the Kyoto Protocol and President George W. Bush withdrew Bill Clinton's executive support for it in 2001 (Grubb et al. 1999 p. 112; Meckling 2011 pp. 134–5). The success of the market-based agenda therefore failed to bring about global intergovernmental climate consensus. Yet, in the aftermath of Kyoto, oil companies BP and Shell instituted internal carbon trading systems and the United Kingdom and Denmark implemented national-level schemes (Betsill & Hoffmann 2011 p. 93). The EU then shifted from an ambivalent position to carbon market leaders by legislating, in 2003, what would become the world's largest international carbon market as the 'cornerstone' of EU climate policy (European Commission 2016 p. 1; Wettestad 2005).

The EU ETS, which started on 1 January 2005, operates differently to the CDM and JI as a 'cap and trade' carbon market. Rather than awarding carbon credits for emissions reductions, a quantity of carbon allowances, known as European Union Allowances (EUAs), each representing one tonne of carbon dioxide-equivalent ($CO_2$-e), is created that is equal to an overall emissions level. Currently, emissions of $CO_2$, nitrous oxide ($N_2O$) and perfluorocarbons (PFCs) in certain sectors are covered and the cap is set at 21 per cent below 2005 levels by 2020. EUAs are distributed to operators of more than 11,000 'installations' – generally power stations or manufacturing facilities – by governments through free allocation or auctioning, depending on specific country and industry circumstances. Installations are situated in all 28 EU member states (including, at the time of writing, the United Kingdom), as well as Iceland, Liechtenstein and Norway. They are responsible for around 45 per cent of EU emissions. Industries including electricity generation and gas supply, oil refining, iron and steel, aluminium, cement, ceramics, paper, chemicals, and aviation are covered. This geographical and sectoral coverage has evolved over three distinct phases: phase one, a 'trial' period from 2005 to 2007, phase two, coinciding with the Kyoto Protocol commitment period from 2008 to 2012, and a post-Kyoto third phase from 2013 to 2020 (European Commission 2016). Once allocated or auctioned, carbon allowances can be traded between operators of installations. This allows operators of individual installations to comply with the emissions cap by purchasing additional allowances from the operators of other installations with excess allowances, rather than reducing their own emissions.

The link established between the EU ETS and the Kyoto mechanisms, agreed to in 2004 and commencing in practice in 2008, gave European installations another source of carbon commodities and underpinned the expansion of the CDM and JI. From phase two of the EU ETS, carbon credits from the CDM and JI, with certain quantitative and qualitative restrictions, could be surrendered by EU ETS installations in lieu of carbon allowances. The link with the CDM and JI therefore allowed the overall EU ETS cap to be exceeded on the basis that an equivalent quantity of emissions was reduced by offset projects outside the cap. With the establishment of this link, over half of global demand for CERs and ERUs came from the EU ETS between 2008 and 2012 (World Bank 2012 p. 68). This supported the rapid growth of the Kyoto markets over this period. The rate of registration for CDM projects peaked at 953 new projects in December 2012, bringing the total number of projects to 7,248. The rate of CER issuance peaked three months later, at 63 million CERs in March 2013, bringing the total number of issued CERs to 1.27 billion. From then, the CDM project pipeline mostly dried up, reaching 7,792 projects at the end of 2017, which had been issued with 1.89 billion CERs (UNEP DTU 2018a). The trajectory of JI followed a similar pattern, though on a smaller scale, and with a more abrupt decline, with no projects having been registered or credits being issued since 2014. In total, 574 projects were issued 863.5 million ERUs (UNEP DTU 2018b).

The implementation and expansion of the EU ETS and Kyoto mechanisms generated economic activity for actors beyond the operators of installations and offset projects. What can be called the carbon trading industry comprises carbon brokers, exchange platforms, emissions auditors, offset project developers, news services and law firms, among many other actors. These businesses developed largely from the EU ETS and the CDM/JI to grow the transaction value of global carbon markets from less than US$1 billion in 2004, the year before the EU ETS commenced, to a high of US$176 billion in 2011. Almost all of this trading was associated with the EU ETS and Kyoto mechanisms: 84 per cent of this came from trading

EUAs and 15 per cent came from trading CERs and ERUs (World Bank 2012 p. 10). A crash in carbon prices saw the rise in the transaction value of the global carbon market come to a halt. In 2014, the transaction value of global carbon trading hit its lowest point since its 2011 high at US$30 billion, and only marginally recovered in the years that followed (World Bank 2014 p. 15).

Outside of the EU ETS and Kyoto mechanisms, the development of carbon markets has been uneven. The most significant setback for carbon markets globally came with the failure of US legislators in 2009–10 to pass a proposed national cap and trade system, upon which predictions that carbon would be a US$2 trillion market by 2020 were based (Hoffman & Twining 2009; Meckling 2011 pp. 61–2). The roll-out of carbon markets internationally was also partially reversed with the repeal of Australia's carbon pricing mechanism in 2014, which was set be linked to the EU ETS, although a weaker offsetting mechanism was subsequently developed in its place (Pearse 2017b). Despite these problems, at the beginning of 2018, 36 national level and 25 subnational carbon trading schemes had been implemented or scheduled. This brought the total share of global greenhouse gas emissions covered by carbon pricing (including carbon taxation) to just over 20 per cent (World Bank 2017 pp. 12–13).

This history of carbon markets points towards a disjuncture between the promise and experience of the market-based approach, which helps explain the paradox on display in Paris. The promise of carbon markets is summed up in the way the European Commission, which oversees the EU ETS, introduces the rationale of the scheme. The Commission lauds the socio-ecological efficacy of emissions trading in creating a low carbon economy, the way it enters into the economic calculations of, and creates value for, business, and its capacity to manage difficult climate politics by devolving decision-making to the market:

> Emissions trading systems are among the most cost-effective tools for cutting greenhouse gas emissions. In contrast to traditional 'command and control' regulation, trading harnesses market forces to find the cheapest ways to reduce emissions … By putting a price on carbon and thereby giving a financial value to each tonne of emissions saved, the EU ETS has placed climate change on the agenda of company boards across Europe. Pricing carbon also promotes investment in clean, low-carbon technologies. (European Commission 2016 p. 2)

The brief snapshot presented in this section suggests global carbon markets, centred around the EU ETS and its links with the CDM and JI, have a more chequered history. The socio-ecological results of the 'grand policy experiment' of sulphur dioxide trading, which supported the initial adoption of carbon markets, are disputed (Stavins 1998). The 'new carbon economy' that has been built around carbon markets has faltered (Boyd et al. 2011). Global climate politics remains fractious despite the Kyoto Protocol cementing carbon trading as 'the only game in town' (Jotzo 2005 p. 81). With notable exceptions, aspects of these disconnections have been reproduced in the economics, political economy and post-structuralist literature on carbon markets.

## Mainstream and Critical Approaches to Carbon Markets

### *Carbon Markets as Least Cost Emissions Reductions*

Economists have sought to evaluate the socio-ecological efficacy of the EU ETS by quantifying the impact of the instrument on greenhouse gas emission levels. This work is guided by the same economic logic that calls for the adoption of market mechanisms in the first place. The logic starts with the premise that climate change is a case of 'market failure' that can be addressed by putting a price on carbon, which 'internalises' the costs of carbon pollution as an 'externality'. Carbon markets are preferred over carbon taxation because different actors have different marginal abatement costs. In this context, the ability to trade is said to offer the most efficient way to find 'least cost' emissions reductions (Tietenberg 2006). While acknowledging problems in design and implementation, and the need for reform, economists have largely agreed that the EU ETS has reduced emissions in a cost-efficient manner.

Over the first ten years of the scheme, levels of emissions covered by the EU ETS reduced by about 20 per cent (Ellerman et al. 2016 p. 97). The task of economists operating within the dominant economic discourse is to disaggregate the effect of the EU ETS from other factors, most importantly the economic recession beginning in 2008, as well as energy prices, weather patterns and other polices. Various econometric techniques have been deployed to assess this at aggregate, sector and firm levels (e.g. Abrell et al. 2011; Anderson & Maria 2011; Egenhofer et al. 2011; Ellerman et al. 2010; Gronwald & Hintermann 2015). Summarising these studies, Martin et al. (2016 p. 143) state that 'concerning the issue of carbon emissions, the available evidence suggests that the EU ETS has had a robust negative impact on them'. This evidence, to date, is mostly focused on the first two phases of the scheme, and points towards EU ETS-induced emissions reductions of about 3 per cent per year (Martin et al. 2016 p. 143).

In a similar vein to the logic governing the issuance of carbon credits from offset projects, economists measure emissions reductions in relative rather than absolute terms. As Martin et al. (2016 p. 131) note, 'one should consider an emissions trading scheme to be effective only if it leads to emissions that are lower than would have been the case without the policy'. Thus, the socio-ecological effectiveness of climate policy is not measured against the goal of curtailing climate change as such, but against counterfactual emissions scenarios constructed by economists. The shortcoming of this method is that actions that may be relatively less polluting than 'business as usual', and thus evidence of effective policy, may not deliver a pathway to a safe climate. This can be illustrated with the case of emissions reductions achieved through 'fuel switching'.

Most of the emissions reductions found by economists in the first phase of the EU ETS were a result of switching between existing coal and natural gas power generation capacity (Delarue et al. 2008 p. 45; Ellerman et al. 2010 p. 192). At any point in time, the combination of gas and coal prices, the energy efficiency of different plants, consumer demand, load capacity, as well as other regulatory and infrastructure factors, determine what mix of fuel is used to generate and sell electricity into the grid. The introduction of a carbon price adds an additional factor to these determinations, which can bring forward the point in the 'merit order' between fuels at which gas-fired power becomes relatively more profitable than coal-fired power (Ellerman et al. 2010 p. 174). Fuel switching is said to have been the cost-efficient option in phase one of the EU ETS because it 'was the easiest to achieve and required the least lead time' (Ellerman et al. 2010 p. 192).

The central place of fuel switching in these economic accounts of the emissions reductions engendered by the EU ETS calls into question positive assessments of the socio-ecological efficacy of carbon markets. Scientific studies have found that the lower emissions created by burning gas rather than coal to generate electricity may be cancelled out by increased methane leakage in upstream sectors, which are not covered by the EU ETS (Wigley 2011). More importantly for our purposes, fuel switching is an action that works entirely within prior patterns of carbon-intensive investment, and therefore does not contribute to the necessary transformation of energy systems in a low-carbon direction (International Energy Agency 2015). What makes fuel switching the cost-efficient option for reducing emissions – the fact it did not require significant and new long-term investments – also makes it an ineffective way of addressing climate change.

The dominant economic literature is therefore limited by a preoccupation with assessing whether emissions reductions are cost efficient, not whether such actions address the causes of climate change. This leads to a focus on redesigning carbon markets in a way that more closely matches economic theory, avoiding more fundamental questions about the goal of cost efficiency itself. It is necessary to move beyond the marginal abatement cost