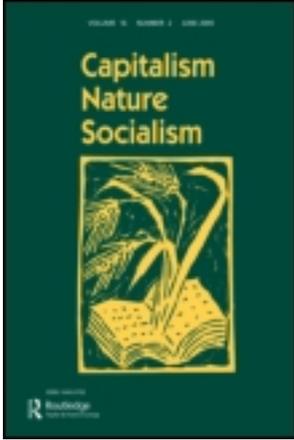


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Larry Lohmann

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The Endless Algebra of Climate Markets

*Larry Lohmann**

[T]he forms of social practice that gave rise to the new kinds of calculability, and that calculation attempted to format, also continually rendered the world more mobile, uncertain, and incalculable.

—Timothy Mitchell (2002, 118)

Carbon . . . will be unambiguously the largest commodity in the world.

—Richard Sandor (2010)

When Sir Nicholas Stern, climate change adviser to Tony Blair's government, famously said in 2007 that global warming was "the greatest market failure the world has ever seen," the implication was that, given the proper price signals, addressing it could be a great market success. With appropriate information, property rights, regulation and taxes, together with new markets for greenhouse gas pollution, the task of prying apart fossil fuels from economic life and thus "decarbonizing" society could be largely internalized into everyday market activity (Stern 2009, 11). Predictably, Stern, a former World Bank economist and vice-president, became a climate businessman himself, and today serves as an adviser to IDEACarbon, a company whose ambition is to provide "ratings, research, and strategic advice" on carbon commodities and finance to "buyers, sellers, and hedgers" (IDEACarbon 2011).

Who built the hundred-billion-dollar carbon markets that Stern and so many others have heralded, and why? International climate trading—one of many neoliberal environmental innovations of recent times—began to be planned and developed in earnest not long after the institution of the U.S. sulfur dioxide market in the 1990s. Background conditions included—in addition to the ever-growing influence of neoliberalism—increasing financialization, the imperative for surplus capital to find new outlets at a time of declining profits, and the continuing global political dominance of the U.S. But, as is always the case, there were also more specific and idiosyncratic drivers; and those drivers, and the materials they interact

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with, have changed over time. Carbon trading has had not one progenitor, but many; not one history, but many. Insular (even clubby) as the expert elite responsible for the first stages of its development is, it has always straddled a number of conventional divides, drawing participation from, among others, the financial sector, NGOs, think tanks, university economics departments, government lawmakers, certain business sectors, law and consultancy firms, and the United Nations system.

A few examples will suggest the extent of this diversity. Richard Sandor, a wealthy Chicago trader and economist who was one of the originators of interest rate derivatives in the 1970s; helped develop the idea of pollution markets in the 1980s; collaborated on a UN Conference on Trade and Development (UNCTAD) initiative entitled “Building a Global CO₂ Emissions Trading System” in the early 1990s; and in the 2000s, with philanthropic support, set up the Chicago Climate Exchange, of which he sold off his shares in 2010 for US\$606 million (Carr & Lomax 2010). At UNCTAD, Sandor worked under Frank Joshua, who later became global director for emissions trading services at Arthur Andersen before joining NatSource, a big carbon commodity trader. Also at UNCTAD was Alice LeBlanc, at the time a staff member of the corporate-friendly Washington NGO Environmental Defense, an organization that had helped write the legislation for the U.S.’s sulfur dioxide market in the 1990s. LeBlanc later joined Sandor at the Chicago Climate Exchange before becoming head of the climate change office of the ill-fated insurance and speculation firm AIG. Figures such as Robert Stavins, a neoclassical economist at Harvard who had also played a part in the U.S. sulfur dioxide program, meanwhile provided support from academia, where the whole idea of pollution trading had been hatched in the 1960s. Across the Atlantic, Michael Grubb of the Royal Institute for International Affairs proposed that the sulfur dioxide scheme could serve as a model for a world carbon market. Ted Hanisch, a Norwegian government official, explored ways in which carbon trading could provide a way for his country to “compensate” for its oil production and industrial and shipping emissions. In the mid-1990s, Graciela Chichilnisky, a high-powered mathematician and neoclassical economist at Columbia University, pitched the idea to U.S. and UN officials, claiming the mechanism could redistribute wealth to the global South (Chichilnisky 2009).

In 1997, the Clinton regime, represented by Al Gore (who later went into the carbon business himself as a private individual), played the decisive role in ensuring that the Kyoto Protocol became a plan for a world climate market. Although the George W. Bush regime withdrew from the Kyoto agreement in 2001, much to the dismay of some U.S. trading firms such as Enron, market development continued under figures such as Ken Newcombe, who headed the World Bank’s Prototype Carbon Fund before moving on to Climate Change Capital (a boutique merchant bank founded by, among others, attorney James Cameron, who had also helped negotiate the Kyoto Protocol as an advocate of the interests of small island states), Goldman Sachs’ carbon-trading desk, and the carbon-trading firm C-Quest Capital (C-Quest Capital 2011). Such cross-sectoral lines of influence continue to be crucial to climate market development at all levels. For example, the current Executive

Secretary of the UN Framework Convention on Climate Change, Christiana Figueres, was, up until the time of her appointment in 2010, senior adviser to C-Quest Capital, principal climate change adviser to Endesa Latinoamerica, the largest private utility in Latin America, and the vice-chair of the rating committee of the Carbon Rating Agency, a private firm associated with Lord Stern's IDEACarbon (Figueres 2011). Earlier, Robert Stavins' students and colleagues had influenced carbon market development in the E.U., which, unable to get agreement on a European carbon tax, adopted the E.U. Emissions Trading Scheme (E.U. ETS) as the centerpiece of its climate policy in the 2000s, engendering what is today the world's biggest carbon market, accounting for 97 percent of world market volume (World Bank 2011).

What are Carbon Markets For?

No bell rings to mark the end of building and the beginning of functioning.

—Daniel C. Dennett (1995, 218)

Reflecting the divergent interests and bricolaged evolution suggested by such vignettes, the rationales offered for carbon markets tend to be varied, slippery, and shifting. They do have a common basis: an abstract, idealized distinction between market and non-market, between a unitary "capitalism" and what is "outside capitalism," and between "externalization" and "internalization." But the contested, incomplete, and ultimately incoherent nature of these divides precludes them from providing a basis for constructing a firm or lasting justification for the new trade. Over time, it becomes obvious that there is no single, settled explanation of what carbon markets are *for*.

One relatively lasting claim, developed in an earlier phase of the history of emissions trading during the 1970s and 1980s, has been that carbon markets are technical instruments for "saving costs" in achieving an exogenous goal of "climate change mitigation." It is admitted, of course, that setting up carbon markets in the first place is far from cheap. Governments have to spend money setting and enforcing progressively stricter overall sectoral or societal caps on emissions. They also have to take on the task of dividing up emissions quotas among the industries under their jurisdiction and setting up the legal and measurement machinery for making them tradable (Cole 2002). But, the argument goes, trading then softens the blow for the private sector, making the achievement of reductions more efficient and allocating the earth's carbon-cycling capacity to where it will be most productive. Industries for which reductions are expensive can save money by buying extra pollution rights from industries for which they are cheap; those industries in turn can make money by selling permits that they don't need.

This justification has come to be supplemented by a good half-dozen more. First, science-based policy: under emissions trading, government-mandated emissions reductions informed by climatology determine the carbon price rather than a government-mandated carbon price (via, say, a carbon tax) determining emissions reductions. This is said to be a more direct way of achieving the needed reductions than having to adjust and readjust prices constantly to see which one might yield the scientifically “correct” cuts. Second, innovation: although buyers of emissions rights can evade some of the burden of low-carbon innovation, prospective sellers seeking economic advantage eagerly take it on. Even if it cannot by itself wean industry off fossil fuels, it is said that “giving carbon a price” will thus help drive the needed energy revolution. Third, information: instead of an information-challenged state having to “choose technology winners,” an information-rich, decentralized “market” is said to do so instead, resulting in added efficiencies as well as transparency. Fourth, profit: “internalization” of the global warming “externality” makes new forms of accumulation possible, and in the process helps to create a revamped, sustainable “capitalism 2.0” (or 3.0, 4.0 or 5.0). Fifth, deregulation: with carbon markets in place, governments can avoid or roll back allegedly clumsier “command and control” types of regulation, saving money for themselves as well as for business at a time of profit crisis. They can also avoid having to subsidize climate action insofar as much of the necessary funding and revenue will be provided by the carbon markets. Sixth, political convenience: by making climate action cheaper or even profitable, carbon trading supposedly makes it more palatable for industry, government, and the public. Indeed, once the new carbon assets are in circulation, even the powerful financial sector should throw its political weight behind radical action on global warming, since it is to its advantage to speculate and act as an intermediary in the new trades (Newell and Paterson 2010). Capitalists, it is said, will rally behind carbon trading, since they always favor “market approaches” over others.

This classic neoliberal script, which has been slowly developed over decades, runs into problems when the materials and *dramatis personae* out of which it is fashioned find themselves enacting a series of contradictory narratives as well, while additional actors, all with their own agendas, also join the show. For example, once carbon pollution rights become an asset, a stubbornly fossil fuel-dependent industrial sector becomes as enthusiastic about securing maximum free allocations from governments as it ever was in urging lower taxes or curbs on conventional regulation. The distinction between the design of a market mechanism and the profit-seeking activities that it enables quickly goes by the board. With it goes any pretense of governments being able to set emissions caps according to scientific criteria. Influenced by the need to make concessions to owners of many fossil-fuelled infrastructure as well as a host of other factors, carbon prices oscillate around a derisory level, powerless to incentivize a transition away from fossil fuel use. Indeed, many fossil-fuelled industries use the generous handouts of pollution rights they have been given to entrench carbon-intensive business-as-usual even more firmly. Market defenders then divide. Idealists dig in their theoretical heels, decrying the rent-seeking activities of polluting companies as illegitimately “non-market” while urging

governments on to heroic feats of cap-setting that they show little sign of wanting to perform (e.g., Sandbag 2011). Cynics meanwhile shift their ground, falling back to the position that government's role is to provide just enough scarcity to keep a market going while making long-range provisions for carbon price ceilings to forestall disruption among industries with huge sunk costs in fossil-fuelled plants and few alternatives. "Well, at least carbon has a price," market advocates shrug—although when prices of what has been called the world's "worst performing commodity" (Wynn and Chestney 2011) threaten to dip to zero, even that assertion can come into question. What with all the political capital invested, the E.U. Emissions Trading Scheme moves "from being a means to a carbon end, to being more of an end in itself" (Helm 2010, 189).

Still more slippage ensues when even the weak emissions caps to be imposed on industrialized nations prove too much to bear for fossil-fuelled industry. Search parties are sent out for cheap substitutes for emissions cuts. Enter carbon offsets, which allow Northern industries and nations to evade caps by buying pollution rights from projects outside the caps that are certified to result in less greenhouse gas emissions than would otherwise have been the case. Soon more ingenuity is being poured into offset manufacture abroad than ever went into low-carbon innovation at home. Cue the reassurance that offsets are merely a stopgap while industry finds its feet in the new regulatory environment and prepares for the steep cuts of the future. Then, as it becomes clear that offsets are, in fact, central to the market, there comes a renewed insistence that these "substitute" emissions reductions are just as good as the real thing, only cheaper. When the climatic ineffectiveness of offsets is subsequently exposed through a series of scandals and accounting controversies (e.g., see *CDM & JI Monitor* 2011; Parekh 2011), yet another rationale is wheeled out: that offsets have a redistributive or "Third World development" purpose rather than a climatic one (e.g., see Gronewold 2011). Finally, when disgruntled host communities call attention to the fact that they do not fulfill this purpose either—since offset finance is being captured by corporate bad hats and large landowners rather than ordinary people—market defenders unveil programs for "participatory reforms" (e.g., UNFCCC 2011).

These are not the only ways in which the evolving carbon market organism constantly slips the surly bonds of its early, clichéd neoliberal portrayals. In yet another twist, no sooner are various carbon commodities mooted than they attract the excited attention of Wall Street and the City of London, who target them for investment, securitization, hedging, bundling, and speculation. Soon banks and shadow banks, rather than polluting industries, are the biggest buyers of offsets. In a post-1970s era of profit crisis and financialization, networks such as the International Emissions Trading Association (IETA) understandably find themselves more preoccupied with lobbying for a large, liquid market with plenty of opportunities for intermediation and speculation than with the climate effects of the trading system. Not only prices but the structure of the commodities themselves fall under the influence of derivatives traders. The early vision of a limited, technical trading

device aimed at saving costs in achieving a sharply delineated emissions goal for a small class of big emitters is gradually overshadowed by that of a giant new engine for capital accumulation. The idea that climate action is being “internalized” into market incentives becomes curiously passé. Queried about the climate effectiveness of carbon offsets, Richard Sandor retorts impatiently that whether or not they result in less greenhouse gas going into the atmosphere is “not my business. I’m running a for-profit company” (Ball 2008). Even the penultimate default environmental justification for carbon markets—that they are “better than nothing”—loses credibility and begins to fall into disuse. The Thatcher-esque slogan that “carbon markets may be bad for the climate, but there is no alternative” rises in its place.

Also meeting an untidy end is the narrative of a lean, clever, muscular market lifting the climate action burden from the shoulders of a clumsy, wheezing, out-of-shape, overbearing state. Carbon market requirements for state measurement calculation, monitoring, enforcement, certification, registration, regulation, and creation of property rights (not to mention the constant diplomacy required to keep up confidence that international markets are on track) turn out to be enormous. Traders and financiers demanding maximum production and maximum standardization of carbon commodities—and the maximum demand required to absorb them—find themselves appealing to the same state or international agency regulators as more cautious market advocates, who, concerned about quality control, stress that increased government oversight may be necessary to convince punters that the new commodities are credible (see, e.g., IETA 2010; CAN 2010). In the U.S., Tea Party activists soon detect unseemly similarities between carbon markets and the dread “big government” approaches of carbon taxes and conventional regulation and go to work to help shoot down federal plans for cap and trade. Respected voices in economics, law, and finance fret that carbon markets are even less transparent than conventional state mechanisms: “the opportunities for graft, bribery and corruption” in the carbon offset industry are “limitless” (Buiter 2007); that an “opaque set of variable standards” creates a “tremendous incentive to create (or destroy) supply as it suits the participants in the market” (The Munden Group 2011, 17); that rather than clarifying decision-making, carbon trading “provides a layer of additional complications and occasions for dispute” (Driesen 2003, 94). Their neoliberal faith unsettled, states start contemplating more legislation subsidizing renewable energy—which, naturally, turns out to threaten to undermine carbon prices even further and so ironically comes under fire (Nicholls 2011, 4). Meanwhile, the new markets’ ability to fund global warming action turns out to be disappointing: most market growth statistics reflect trading by intermediaries, not climate change mitigation, and the bulk of the cash laid out for supposedly carbon-saving projects goes to consultancies planning and certifying projects of dubious climate relevance. On the academic front, the whole idea of an “economizable” climate goal meanwhile comes into question, given the uncertainties, scale and complexity of global warming (Weitzman 2008; Hulme 2009). In 2010, what with the financial crisis, a spate of criminal and other scandals, uncertainty about the future of UN climate treaties, an increasingly embarrassing lack of climate results (Brinkley and Less 2010), and

growing opposition from environmental justice movements, market growth stalls in spite of active trading in “paper carbon” on the financial markets. In the wake of the failure of the U.S. Congress to pass legislation mandating a nationwide carbon market, even Richard Sandor sells out his shares in the Chicago Climate Exchange (Carr and Lomax 2010), while in the usually enthusiastic precincts of the City of London and Wall Street, a new pessimism takes hold. Banks shed staff from their carbon-trading desks, and some of the hundred-odd specialized carbon funds that sprang up in the 2000s close their doors (Sills 2011). The IETA loses members, and although attempts to lay the infrastructure for commodifying the carbon-absorptive capacity of global forests continue, few observers are optimistic about the outcome of future negotiations over the UN carbon market.

The final insult to neoliberal nostrums is that much of the business community itself—particularly the parts with less experience in commodity or financial trading—turns out to be unexpectedly resistant to the new carbon markets. The essentialist neoliberal claim that since carbon trading is a “market solution,” it must be in line with “capitalism,” and that therefore capitalists ought to like it, turns out not necessarily to cut much ice with corporate actors who have always done their best to avoid market mechanisms that fail to serve their purposes while availing themselves of as many “non-market” mechanisms (violence, plunder, subsidies, corruption, enclosure of commons, patriarchy, intracorporate coordination, etc.) as are needed to turn a buck in any particular historical conjuncture (Harvey 2010; Mitchell 2002). Expert voices are heard cautioning against an indiscriminating enthusiasm for “market-based instruments,” noting that it may not be “relevant and useful” to gather them “under a single label,” much less to assume that they necessarily enhance cost-efficiency, reveal information, distribute the right incentives, or correct market failures (Broughton and Pinard 2011, 3-4). Despite these developments, a few critics of neoliberal climate policy, particularly in the North, find themselves going along with the essentialist neoliberal claim that carbon markets are a natural, almost inevitable outgrowth of an abstract “capitalism.” Concluding that it is this latter elusive chimera that must be the proper target of political mobilization, they are often drawn into an irrelevant, gaseous “policy debate” conducted by neoliberals eager to pit proponents of “necessary reform” against those of “impossible revolution.” Largely indifferent to such amusements, carbon market actors get on as best they can with the more serious business of accumulation through climate commodity exchange, with all its deleterious consequences for global warming and human welfare.

The foregoing pastiched history may appear to depict nothing more than an unusually extreme version of a standard neoliberal comedy of unintended consequences. However, the very scale of the failure of carbon markets to do what they were first advertised to do suggests that their history will provide especially clear-cut materials for problematizing the metaphors that accompany the booming trend of market environmentalism as a whole. And so it proves. In addition to exposing in particularly stark relief how the contradictions of attempts to “internalize

externalities” and institute “correct environmental pricing” can unfold, an examination of carbon market dynamics also can clarify the misfortunes that befall the notion that there exists a fixed hardware of “an economy” that can be reprogrammed with the green software of “natural capitalism” in a way that “fully incorporates nature into its system of value” (Paul Hawken, quoted in Foster 2003), or the notion that a “steady-state economy” or (alternatively) a regime of “green growth” could someday bring the history of environmental struggle to a happy end.

Making a Market from Climate Crisis: A Thought-Experiment

How do you make a market out of climate? The answer is not immediately obvious. Global warming results mainly from the transfer of carbon from a fossil pool locked underground to a separate pool circulating aboveground among the atmosphere, oceans, vegetation, soils, fresh water, and surface rocks. This transfer is irreversible over humanly relevant time scales. It follows that sustaining—or “producing”—the use-value of a livable climate requires keeping remaining fossil fuels in the ground.

To put it another way, given path dependence (Arthur 1994) and the way that fossil fuels have become “locked in” (Unruh 2000, 817) to industrialized societies’ ways of life, it calls for political mobilization behind immediate long-term investment programs in new, non-fossil energy, transport, agricultural, and consumption regimes, particularly in the North, as well as programs for shifting state subsidies from fossil fuels to existing initiatives defending or constructing low-carbon means of livelihood. Above all, it demands widespread alliance building in support of the social movements that are already directly or indirectly addressing the belowground-to-aboveground transfer of carbon. These include movements working to “keep the oil in the soil, the coal in the hole, and the tar sand in the land” in the Niger Delta, Alberta, Ecuador, South Africa, Appalachia, and elsewhere; stopping the development of dozens of coal-fired power plants in the U.S., Britain, Thailand, and other countries; fighting agrofuel projects whose effect would be to sustain a transportation infrastructure designed for oil; and working to ban banks from supporting fossil-intensive or fossil-extractive projects. Increasingly, such movements are aligning themselves with those in support of ecological and peasant agriculture, more democratic public health and energy provision, cleaner air and water, and an end to militarism, environmental racism, and extractivism.

Prima facie, carbon markets’ objective should be to support movement building of this radical kind. Yet how might it be possible to buy and sell contributions toward the long-term political shift away from fossil fuels that such movements are working toward? Yale law professor Douglas Kysar suggests that the “legal and political actions” that have “dramatic impact” on historical trends would have to be commodified. The resulting climate commodities could be sold by, for example, “indigenous groups that entirely block new exploration activities” or “forest-dwelling communities that successfully fight to stop logging” (Kysar 2010). In this delirious

vision, Lloyd Blankfein and his colleagues at Goldman Sachs, sitting down to craft products for sale to investors, would “devote themselves . . . to the identification and promotion of critical political interventions by disempowered voices for sustainability” (Kysar 2010). Accumulation would be a matter of investing in commodities that maximized radical, structural societal change over the long term.

Kysar’s tongue-in-cheek thought experiment hints at the novel and extreme ways in which the contradiction between use-value and exchange-value, between the qualitative logic of ensuring survival goods and the quantitative logic of profit, will unfold and extend itself in climate markets. To make accounting, ownership, and capital accumulation possible, Kysar’s climate market would have to turn the qualitative relations that make up movement-building and historical process into quantitative ones. For example, consumers would need to know, and producers to guarantee, what increment of historical change toward a halt to fossil fuel extraction each commodity sale represented. But who would quantify the extent to which each unit of the commodity contributed to undoing the social complexities of fossil-fuel path-dependence, and how? If different units contributed different increments of historical change depending on the particular pathway they were aggregated into, and the paths were incompatible, how would the units be commensurated? How would the historical effects of private ownership on the dialogue and movement-building comprising the “labor” producing the climate commodity be calculated? (For example, would street demonstrators wearing corporate logos on their T-shirts lose their effectiveness?) If the experts in counterfactual history called upon to help price the commodity attached a particular value to rolling back the dominance of a rampant financial sector, would Goldman Sachs still sell the associated securities? And so on. The only way of removing such difficulties for accumulation would be to demote the market to being a provider of unspecified and unquantifiable “climate services”—in which case it would lose most of its usefulness for policymakers and its appeal to other potential customers.

A More “Realistic” Model

Those combinations of theory and empiricism that conform to the arbitrary definitions of the commodity will clearly be preferred to those that stress complexity and the interrelatedness of phenomena.

—Philip Mirowski (2011, 206)

The alternative to the immediate, dizzying multiplication of paradoxes of Kysar’s whimsical proposal is to construct a market based on the enclosure and commodification of pollution sinks, whose extent the state defines in terms of limits on the quantity of molecules that can be emitted. This is what the U.S.’s sulfur dioxide trading system instituted in the 1990s did, and it is the model followed by the Kyoto Protocol’s carbon market, the E.U. Emissions Trading Scheme, and all other actually existing climate markets.

The advantages are obvious. Molecules can be counted (in many pollution markets, a ton is the unit of measurement). Molecules come “pre-standardized” in the sense that they are the same the world over. Molecules can also be owned. So, at least in principle, can the sinks that absorb them—for example, oceans, trees, or land that absorb carbon dioxide. Quantifiability and ownability make it possible to buy and sell rights to emit CO₂—essentially, rights or access to the earth’s carbon cycling capacity in the oceans, the atmosphere, soil, vegetation, and rock. And with measurement and private property come, too, the possibility of large-scale accumulation. This is why actually existing climate services markets, instead of being structured in a way that would support existing grassroots movements, are based on the equations

$$\text{a better climate} = \text{a reduction in CO}_2 \text{ emissions}$$

and

$$\text{CO}_2 \text{ reduction A} = \text{CO}_2 \text{ reduction B.}$$

But if there is to be a market in CO₂ emissions reductions, someone must “produce” them, and someone must buy them. (To put it another way, if there is to be a market in greenhouse gas pollution dumps, someone must make them scarce, someone must “own” them, and someone must “rent” them.) Setting up this apparatus can only be the job of governments, who must impose both the need for reductions (by making pollution dumps scarce) and the means of “producing” or owning them. Governments achieve the former by imposing “caps” or limits on emissions on companies or economic sectors. To accomplish the latter (that is, create a reduction commodity), governments need the additional equation:

$$\begin{aligned} &\text{forced reduction of CO}_2 \text{ emissions to level } c \text{ within time period } p \\ &= \\ &\text{tradable right to emit CO}_2 \text{ up to level } c \text{ by the end of period } p. \end{aligned}$$

Carbon dioxide reductions (and by inference climate action) can accordingly be achieved by production of tradable pollution rights, whose scarcity or otherwise is determined by government fiat. *Progressive* carbon dioxide reductions can in turn be achieved by relying on the equation:

$$\begin{aligned} &\text{reducing CO}_2 \text{ emissions progressively} \\ &= \\ &\text{issuing fewer tradable rights to emit CO}_2 \text{ in period } p + 1 \text{ than were issued in} \\ &\quad \text{period } p. \end{aligned}$$

The producers or owners of these rights are, in the first instance, governments themselves. European Union Allowances, for example, are “produced” in a preset amount by the pens or keystrokes of politicians and bureaucrats under the European

Union Emissions Trading Scheme (E.U. ETS). They are then sold or, more usually, given away free to large private-sector polluters (a dramatic rise in rent charged for natural resources, after all, has always been one of the most feared barriers to capital accumulation). Assigned Amount Units (AAUs), one of the climate commodities of the Kyoto Protocol carbon market, are meanwhile “produced” by conferences of the parties to the UN Framework Convention on Climate Change before being distributed, again free of charge, to the national governments of industrialized countries.

Polluters subject to a government cap (or funds, banks, or other private or public enterprises) can then also finance carbon-saving projects outside the caps and use the resulting extra pollution rights offsets either in lieu of emissions reduction obligations, or to sell on to third parties, or to speculate with. Thus:

$$\text{CO}_2 \text{ reduction under a cap} = \text{offset outside the cap.}$$

For example, European Union Allowances (EUAs), the emissions permits traded under the E.U. cap, are exchangeable with Certified Emissions Reductions (CERs), which are Kyoto Protocol carbon offsets generated in Southern countries outside the European cap:

$$\text{EUA} = \text{CER.}$$

Mass Production

Such equations help market actors mass-produce uniform, tradable, ownable units of CO_2 reduction (or pollution rights) at the lowest cost for the maximum profit. For example, because carbon dioxide molecules are the same everywhere, it follows that

$$\text{CO}_2 \text{ reduction in place A} = \text{CO}_2 \text{ reduction in place B.}$$

Carbon businesses under competitive pressure are thus free to choose the cheapest sites for “reduction production.” Offsets also make possible abstraction from place:

$$\text{CO}_2 \text{ reduction in place A} = \text{offset in place C.}$$

That is, they take what David Harvey might call the “spatial fix” of cap and trade (which moves pollution around the “capped” landscape to wherever it is cheapest to abate) one step further, to territories not covered by caps—notably the global South—where carbon cleanup is even cheaper (Bond 2010). A market in molecular

movements also permits indifference to technology type as long as the technologies in question emit the same number of CO₂ molecules:

$$\text{CO}_2 \text{ reduction through technology A} = \text{CO}_2 \text{ reduction through technology B.}$$

Because CO₂ molecules are the same regardless of whether they originate from the burning or decomposition of vegetation or the burning of unearthed fossil fuels, investors can also make use of the equation

$$\text{CO}_2 \text{ of fossil origin} = \text{CO}_2 \text{ of biotic origin}$$

in order to benefit from the cost differential between investing in technologies that use less fossil fuels and investing in, say, forest conservation.

Nor need we stop with CO₂. The focus on molecules opens up the cost-saving possibility of using other greenhouse gases as well in the climate commodity. Here market construction has benefited from the work of the Intergovernmental Panel on Climate Change (IPCC), which, prompted by the UN's need for national greenhouse gas accounts, has commensurated CO₂ with a range of other greenhouse gases including methane, nitrous oxide and various chlorofluorocarbons including the industrial by-product HFC-23 (IPCC 1996). Of course, this requires a lot of fudging. Each gas behaves qualitatively differently in the atmosphere and over different time spans, and the control of each has a different effect on fossil fuel use. Even the IPCC finds itself revising its calculations of the CO₂-calibrated "Global Warming Potential" (GWP) of various gases every few years, and insists on giving gases different GWPs over 20-year, 100-year and 500-year time horizons. But even such token caveats cannot be accommodated by a market that requires a single, stable number in order to make exchange possible. The UN carbon market, for example, disregards its own IPCC's recent revisions in GWP figures, discards 20-year and 500-year figures, and ignores the often enormous "error bands" specified by the IPCC (in the case of HFC-23, plus or minus 5000 CO₂-equivalents). What remain are the neat equations

$$\text{CH}_4 = 21 \times \text{CO}_2$$

$$\text{N}_2\text{O} = 310 \times \text{CO}_2$$

and

$$\text{HFC-23} = 11,700 \times \text{CO}_2.$$

In other words, the markets, having abstracted from the climate crisis to CO₂ molecules, now abstract from CO₂ and other gases to a highly simplified "carbon dioxide equivalent," or CO₂e, which becomes a new fetish. It becomes even easier to run together, in a seemingly "apolitical" and "self-evident" way, activities with

different effects on climate history. Thus ex-World Bank executive Robert Goodland (Goodland and Anhang 2010), noting that “domesticated animals cause 32 billion tons of carbon dioxide equivalent, more than the combined impact of industry and energy,” effortlessly draws the conclusion that “replacing livestock products with better alternatives would...have far more rapid effects on greenhouse gas emissions...than actions to replace fossil fuels with renewable energy.”

The cost savings achieved by substituting new molecular “raw materials” for carbon dioxide are considerable, greatly enhancing opportunities for accumulation. For example, burning off just one ton of CH_4 can generate saleable rights to release 21 tons of CO_2 in Europe. Thus more than two dozen giant hog farms operated by Granjas Carroll de Mexico, a subsidiary of the U.S.-based Smithfield Farms, are earning extra revenue by capturing the methane given off by the huge volumes of pig excrement they produce and burning it, and then selling the resulting carbon credits to Cargill International and EcoSecurities (UNEP Risoe Center 2010). Merely by destroying a few thousand tons of HFC-23, similarly, the Mexican chemical manufacturer Quimobasicos is set to sell over 30 million tons of carbon dioxide pollution rights to Goldman Sachs, EcoSecurities, and the Japanese electricity generator J-Power (UNEP Risoe Center 2010). Assuming that destruction of HFC-23 can be carried out for US\$0.25 per ton of CO_2e , and that a ton of CO_2 offset pollution rights can command \$19.50 on the E.U. ETS spot market (May 2011 prices), both the company and the financial sector intermediaries it sells to can realize super-profits. Industrial buyers of the permits can in turn save \$128.50 a ton by using the rights in lieu of paying fines for not meeting their legal emissions requirements, while industrialists and speculators alike can turn to advantage the \$6 price differential between cheap Kyoto Protocol offsets (known as Certified Emissions Reductions, or CERs) and more expensive European Union Allowances (or EUAs). Such “industrial gas” offsets—generated at a handful of industrial installations in China, India, Korea, Mexico, and a few other countries—still account for the bulk of Kyoto Protocol carbon credits, helping to keep carbon pollution rights so cheap that they approach the status of a second “free allocation” of pollution rights to fossil-intensive European industry. Just as the creation of an “abstract,” deskilled labor that could be measured in units of time opened up, for factory owners from the 18th and 19th centuries onward, the fruitful challenge of how to squeeze the most labor time out of the worker (“moments are the elements of profit,” Marx quotes a 19th century British factory inspector saying), so the creation of an “abstract” climate commodity out of the quantities and movements of CO_2 and other molecules makes possible, for today’s climate businesses, a dynamic through which ingenuity and social engineering can be repeatedly exercised to get the most profit out of an assembly line of “ CO_2e reductions.”

Offworld Commodity Production

A particularly productive element in the cloud of equivalences that make offsets possible is the equation

CO_{2e} reduction under a cap = “avoided” CO_{2e} emission outside the cap

This equivalence allows offset projects that emit greenhouse gases (and most do) to license the emissions of still more greenhouse gases elsewhere—as long as they emit less than “would have been released” in the absence of carbon finance. For instance, capped polluters or carbon traders in Europe can purchase carbon pollution rights from coal-mining projects in China, provided that the projects burn off some of the methane that seeps out of the mines, on the grounds that by converting methane into carbon dioxide, the projects do less damage to the atmosphere than would have been the case otherwise. Another variant of the equation would allow the forest conservation projects known as REDD (Reducing Emissions from Deforestation and Forest Degradation) to generate carbon credits even if they allowed an *increase* in deforestation, as long as the increase was “less than would have happened otherwise” (see, e.g., American Carbon Registry 2011). Thus offset investors make money by, in effect, cleaning up nonexistent extrapolated pollution and taking credit (literally) for it not having become reality. The dirtier that experts can convince regulators that such nonexistent extrapolated pollution scenarios are, the more capital can be accumulated, both from pollution rights sales and, on the buyers’ side, from delays in investment in no-carbon infrastructure. In fact, through this logic, governments are incentivized to make these imaginary scenarios real by not enforcing or promulgating environmental legislation, since it is by being as dirty as possible that a country creates the most money-making opportunities from carbon markets (see, e.g., Lang 2011). As elsewhere within neoliberal policymaking, the distinction between legal sanctions and market incentives tends to be eroded. The equation of real and imaginary reductions also requires that “what would have happened” in the absence of carbon credit sales be determinate and quantifiable in the same way that CO_{2e} reductions under a cap are determinate and quantifiable. Counterfactual history, that is, must be given the same epistemic status as actual history and political debate about alternative futures recast as disputes about the correctness of technical predictions.

In a culminating phase of commodity construction, the carbon commodity that has been built up in this way is in turn commensurated with more conventional commodities. It is bundled together with oil and wheat in index funds; deployed as a hedge; used as collateral for international loans (Suppan 2010; Sullivan 2010); and embedded in businesses’ long-term investment and profit strategies with regard to energy futures, currency holdings, and so forth.

Exchange, Equations, Contradictions

“The exchange of commodities,” Marx wrote in 1867, “implies contradictory and mutually exclusive conditions. The further development of the commodity does not abolish these contradictions, but rather provides the form within which they have room to move” (Marx 1990, 198). Nowhere is Marx’s insight better exemplified

today than in the unfolding of the contradictions between use-value and exchange-value traceable in the endlessly proliferating algebra of carbon markets.

The foundational equation “a better climate = a reduction in CO₂ emissions” starts off the process by eliding the multiple differences between reducing emissions and tackling the climate crisis. The equation obscures, for example, the difference between stepwise molecule reductions over the short or medium term and actions that integrate into a program that results in fossil fuels being left in the ground permanently. The industrial slowdown resulting from the financial crisis of 2008, for instance, resulted in more CO₂ emission reductions than all the world’s climate markets put together had achieved (Chaffin 2010), yet has not changed structural dependence on fossil fuels. It also ignores the nonlinearity or unverifiability of the relationship—a consequence of the physically “chaotic,” flip-flop nature of the atmospheric system—between any given increment of reduction on the one hand and, on the other, any given increment of climate benefit. Also left by the wayside is the difference between approaches that focus on molecular movements regardless of their status as “survival” or “luxury” emissions (Agrawal and Narain 1991) and approaches that distinguish the two (a choice that has climatic as well as class-struggle consequences, since “survival” emissions tend to have different causes, dynamics, and historical accompaniments than “luxury” emissions).

Equating reductions with saleable property rights takes another step away from the climate issue. As fossil fuel use becomes more deeply entrenched through a “polluter earns” system, the obsession with price discovery draws emphasis away from the long-term structural change demanded by global warming. All things being equal, corporations will choose cheaper alternatives, but if long-term structural alternatives have not been made available, not even the highest prices can compel anyone to choose them; on the contrary, they are likely to incite revolts against the trading system’s design. Nor have low prices ever historically been drivers of the kind of structural change that global warming demands. The E.U. ETS has not incentivized investment away from fossil fuels even in the one sector, electricity generation, that has been consistently short of emissions rights (see, e.g. Deutsche Bank 2009).

Similarly, equating reductions in place A with place B obscures a number of geographically specific factors that make a difference to energy transitions, including the greater influence on technology development a reduction in emissions from a particular industrial process might have in a high-income country, where it is more expensive, than in a low-income country (Alfredsson 2009; Jacobson 2009). By abstracting from the tendency for pollution to be concentrated in what in the U.S. are called “poorer communities of color,” the equation also bases capital accumulation on historical patterns of class and racial discrimination, resulting in opposition from networks of underprivileged communities ranging from the California Environmental Justice Movement (California Environmental Justice Network 2010) to India’s National Forum of Forest Peoples and Forest Workers

(*Mausam* 2008, 2009). Just as the creation and quantification of the working day was a major site and instrument of class struggle in early capitalism, so the assemblage of equations that go into the creation of a climate commodity are major sites and instruments of class struggle in today's nascent carbon markets.

Equating CO₂e reductions that result from different technologies, meanwhile, makes it possible, indeed necessary, to make climatically wrong choices in the name of molecule prices—for example, to use routine, cheap efficiency improvements to delay long-term non-fossil investment, or to build destructive hydroelectric dams that do nothing to displace coal and oil. It also conceals the land-intensive (and thus socially discriminatory) nature of many attempts to “replace” fossil fuels. Among these are agrofuel schemes in countries such as Brazil and Indonesia, as well as wind power projects such as those in Oaxaca's Tehuantepec isthmus, where many indigenous communities have cheaply signed over land to private wind farm developers from Spain and Mexico who profit not only from electricity sales but also from using or selling pollution rights in Europe. The equation

$$\text{CO}_2 \text{ of fossil origin} = \text{CO}_2 \text{ of biotic origin,}$$

in addition to weakening the effect of emissions caps by ignoring the difference between the two carbons in terms of climate history, intensifies climate class struggle in the same way, providing “scientific” and economic sanction for extensive land grabs from the poor (Dyer and Counsell 2010; Gregersen et al. 2010), who are likely to be displaced at high human cost (not included in the calculations) and see their store of knowledge of low-carbon subsistence livelihoods depleted as a result (also not included in the calculations). The influential “cost curves” that the equation makes possible also tend to abstract from the difference between forest clearing for commercial agriculture on the one hand and, on the other, rotational forest farming that involves subsequent re-growth of forests and storage of carbon. This abstraction, again, helps pave the way for the deskilling of forest dwellers. As Nathaniel Dyer and Simon Counsell (2010) comment, the “argument that we need a new economic model to account for [climate change] externalities and to put our economies on a sustainable path” has ironically led to cost-curves which, with their “hidden costs and partial analysis,” are “similar to the narrow economic approach that contributed to the problem that we are now attempting to solve.” Thus Aritana Yawalapiti, an indigenous leader in the upper Xingu region of Brazil, reported in November 2010 that REDD carbon forestry promoters visiting his territory had told his community that they would have to reduce forest burning if they were to be paid for producing carbon pollution licenses. But, Aritana objected,

we always burn at a place where we fish, hunt or open a small farmland area . . . we open a space to farm, we plant, we collect manioc, after some years everything recuperates again . . . the forest grows back, while we plant at another place (Sommer 2010).

As banners carried by Karen indigenous people from Thailand during a demonstration outside the Bangkok climate negotiations in 2009 explained, “people who live with the forest don’t want REDD . . . we conserve forests because forests are life, not a commodity.” Here as elsewhere, accumulation in the carbon markets takes place not through “decarbonization” but through dispossession.

The crucial “offset” equation

$$\text{actual CO}_2\text{e reduction} = \text{counterfactual CO}_2\text{e reduction}$$

conceals and engenders yet other forms of the contradiction between use-value and exchange-value. By making accumulation dependent not only on finding or postulating, but also if possible on creating as much greenhouse gas as possible so that it can then be “avoided,” applications of the equation continually generate perverse consequences. This phenomenon is most visible with respect to HFC-23 and N₂O, manufacturing byproducts whose cleanup now often generates more profit for their manufacturers than the primary products of the processes in question (Pearce 2010); but the phenomenon is general. As corporations are given incentives not to obey environmental laws and governments are given incentives not to promulgate or enforce them, opposition grows from environmental protection movements in countries such as the Philippines, South Africa, and Nigeria, where oil companies gain extra profit for supposedly avoiding gas flaring activities that are illegal and unconstitutional anyway (Osuoka 2009; Docena 2010). Also provoking resistance is the carbon market’s general methodological imperative of isolating a single counterfactual story-line as a baseline for offset “savings”: in treating history deterministically with the exception of the activities of carbon financiers and offset project managers, this technical requirement for a market “eliminates” the ability of workers and farmers to create their own history (FASE 2003; Gilbertson and Reyes 2009). Here, too, the internalization of the global warming “externality” in carbon prices gives rise to fresh externalities, as the contradiction between use-value and exchange-value is re-activated at each step and calculative technologies continually undermine their own efficacy (compare Soros 2008). As with the market in complex financial derivatives, the more extensive and liquid the commodity trade in question becomes, the less successful it is in meeting its ostensible “objective” (Lohmann 2009b). Climate change no less than price uncertainties has proved to be a singularly recalcitrant subject for the headlong, overconfident efforts at commodification characteristic of the neoliberal era.

Regulation and Decommodification

Over the last decade-and-a-half, the overwhelming contradictions of climate markets, while shape-shifting continually, have only grown more intense as new equations proliferate and market actors, regulators, biogeochemical systems, forests,

technological complexes, and grassroots resistance networks each make their plays. The strategic question in the face of this dynamic is how to build the most effective possible movements to address the climate threat that is now posed by carbon markets themselves.

This cannot be done through any type of regulation (or, to use the preferred neoliberal term, “governance”) that does not contribute to movements for decommodification of the earth’s carbon-cycling capacity. For example, no additional equivalences, surveillance procedures, or technical criteria for determining when a carbon offset project goes beyond “business as usual” could ever relieve the contradictions built into the equation

$$\text{actual CO}_2\text{e reduction} = \text{counterfactual CO}_2\text{e reduction.}$$

Current attempts to do so are merely giving underlying contradictions described in this article more “room to move.” The effect has been to reinforce the supply-side dominance in the offset markets of large polluting corporations in the global South—Sasol, Mondi, Rhodia, Tata, Birla, Jindal, and the like (UNEP Risoe Center 2010)—who are better able than others to devote resources to navigating the growing regulatory and planning mazes in the service of gleaning new revenues for activities that reinforce fossil fuel use. To take another example, the regulatory principle according to which development projects must obtain the free prior informed consent of affected communities becomes virtually useless once “climate mitigation” has been globalized through carbon offset projects. A forestry project in Australia selling pollution licenses to ConocoPhillips, for example, would have to obtain the consent not only of the affected community in Australia, but also of communities affected by Conoco operations in Oklahoma, Libya, Peru, Viet Nam, Kazakhstan, Greenland, and other parts of the world—clearly an impractical requirement. In this context, to interpret the analysis of the equations sketched in this paper as a demand for them to be “fixed” and “elaborated” would be delusional. Carbon market regulation that relies on “more and better” internalization merely creates dangerous new externalities, making climate policy even more counterproductive than it already is.

Only those regulations that limit or reduce commodification have much of a chance of limiting the damage carbon markets do, or of playing a (small) part in the longer-term project of forcing policymakers to phase out carbon trading. As is suggested by the taxonomy of equations discussed in this article, commodification and decommodification have many forms and degrees, and even governments that work within a carbon-trading framework are sometimes induced to undertake actions with modest decommodification effects. For example, the E.U. has recently decided to stop applying the equation

$$\text{HFC-23} = 11,700 \times \text{CO}_2$$

by banning HFC-23 credits from sale as of 2013. The reasons for this move are complex, involving not only recent scandals over the issuance of a flood of blatantly bogus pollution rights from industrial gas projects (EIA 2010), but also fears that European industries in the sector in question may relocate to the global South to take advantage of offset revenues, a desire to reduce transaction costs in the manufacture of carbon offsets by sourcing them from entire sectors rather than individual projects, and worries that an oversupply of carbon credits will undermine market operations. Nevertheless, the curb does demonstrate the possibility of rolling back commodification rather than extending it, as do environmentalist campaigns to abolish offsets and “deactivate” equations such as

$$\text{EUA} = \text{CER} = \text{AAU}.$$

More generally, regulators sometimes come under pressures that result in their taking *ad hoc* actions that have a temporary decommodification effect, for example, by restricting

- *Who* can sell or buy carbon commodities and for what reason—for instance, moves to restrict access of speculators to the markets;
- *What* traders can sell or buy—for instance, moves to get rid of N₂O or coal-project credits, restrict the exchangeability of allowances, or limit securitization;
- *Where* they can sell or buy the commodity—for instance, restrictions on over-the-counter trading or on trading technology;
- *When* they can sell or buy—for instance, limits on banking and borrowing; and
- *How* traders can sell or buy—for instance, restrictions on the velocity of trading.

However, moves that reduce carbon markets’ liquidity and factitious “efficiency” as well as the opportunities they provide for the financial sector are bound to continue to rouse the opposition of many powerful actors in the carbon markets as well as some market architects. Discussions are under way at the UN, moreover, to scale up commodification by allowing whole sectors to produce carbon credits by performing “better than they would otherwise.” In the end, there can be no substitute for strategic popular movements around decommodification of climate benefit in alliance with related movements against commodification of water, electricity, health services, and fossil fuels and in support of land rights, labor, tax reform, alternative energy, alternative transport, food sovereignty, and public control of the financial sector. Such alliances are already contributing to a shift in the center of gravity of climate change activism away from the technocratic programs advocated by governments, corporations, and large environmental NGOs, which have always been organized around molecule flows, temperature targets, and market mechanisms.

Some of the most powerful voices for radical climate action and against carbon markets to emerge recently include the international peasant movement *La Via Campesina*; movements against fossil fuel extraction in countries such as Nigeria, Canada, and Ecuador; various Indigenous Peoples' networks; environmental justice movements among the poor in cities such as Los Angeles and Durban; labor unions in countries such as Mexico; and so forth.

As such connections suggest, the class and race dimensions of the struggle over the equations analyzed in this article are bound to remain central. During the last days of the December 2010 climate summit in Cancún, UN security ordered non-governmental delegates who were displaying anti-REDD stickers to remove them and temporarily suspended the accreditation of Tom Goldtooth, a prominent Indigenous opponent of REDD (*Democracy Now!* 2010), as well as that of representatives of low-income communities of color in California who were also critical of carbon trading. "I came to [the summit] representing the public health concerns of low-income communities of color living in Los Angeles being impacted by toxic emissions," said Sunyoung Yang of the Los Angeles Bus Riders Union. "Throughout the past two weeks I have seen how the . . . meeting has systematically limited and suppressed voices of dissent to programs being promoted through the UN such as REDD which will only increase the poisoning of the communities I represent back home" (Global Grassroots Justice Alliance et al. 2010). Left unharrassed, by contrast, were demonstrators and delegates from the network 350.org, who had staged larger and noisier protests demanding a target of 1.5 degrees Celsius of warming as well as a limitation of atmospheric concentrations of CO₂ to 350 parts per million, but who have refrained from critiquing market approaches and have embraced the CO₂ fetish (indeed, the name of their organization embodies it). As the Indian activist Soumya Dutta noted following the conference, "Only questions and protests which were clear in their political message against present-day big-money interest were pro-actively silenced" (Dutta 2010).

Conclusion: Internalization as Externalization

Carbon markets are a particularly disastrous example of what can happen when the cluster of processes commonly associated with neoliberalism is let loose on environmental crises. But the lessons are more general. Commodity solutions always reinterpret and transform the social and environmental challenges that they confront. Their goals are never exogenous but are incessantly reshaped by the very process of addressing them. Hence the "internalization of environmental externalities" associated with market environmentalism is better conceived not as a (successful or failed) attempt at "environmental problem-solving" but rather as a continuous changing of the subject. In order to be "internalized," environmental harms of any complexity must be simplified, reformatted, made abstract, quantifiable, and transferrable in a process that obscures many of their characteristics while introducing fresh problems. For instance, turning biodiversity into a commodity

means transforming it into measurable units, inevitably divorcing it from the human and nonhuman context in which it has evolved while abstracting from habitat, species, genus, or the like. By the same token, making bankable “wetlands credits” capable of expanding opportunities for the circulation of capital involves “ignoring a great deal of ecological information” (Robertson 2004), setting off conflicts among bankers, regulators, and scientists alike.

In the process of developing skills at internalization, moreover, internalizers set aside, lose, or destroy other skills, theirs and others’ (Lohmann 2009a; compare Mirowski 2011). In order to be priced low enough to be traded, “environmental service” commodities also unavoidably conceal the human labor, study, and other activities that go into creating, maintaining, and restoring ecosystems. Competition among “environmental service” businesses only increases pressures to disaggregate and decontextualize in the service of cost reductions. The harms associated with the simplified and restructured socionatures that result—for instance, landscapes in which regions of accelerated degradation are interspersed with areas specializing in the production of a few technician-selected aspects of “nature”—must then also be “internalized,” whether through the creation of still further commodities or through another layer of expert “governance.” And so on.

Any process of internalization, in short, creates its own externalities. Internalization itself is externalization (Callon 1998). The question is not whether but when a new internalization will be required or enabled; each act of internalization gives rise to a need or a possibility for yet further internalizations. Neither a coherent strategy for “making capitalism sustainable” nor mere opportunistic “greenwash” for supposedly more fundamental processes, internalization is merely one more example of a long-familiar process through which business treats the crises it helps to throw up as a basis for further accumulation.

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