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Debate

Climate as Investment

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ABSTRACT

The climate crisis and the credit crisis have made the political issues surrounding investment and finance more critical than ever before. Proposals for 'Green New Deals' and the like — aimed at tackling both global warming and global recession — are streaming forth worldwide. Yet many such proposals are incoherent in that they overlook the need for an immediate start to a programme of phasing out both fossil fuels and purported fossil fuel substitutes such as nuclear power and industrial-scale agrofuels. They also tend to rely on Northern-biased conceptions of technology transfer and intellectual property that the climate crisis has helped make obsolete. To overcome these problems, future climate movements will have to focus increasingly on the democratization of research, planning and finance.

INTRODUCTION

Shadowed by simultaneous crises — financial and climatic — the world is humming with determined talk about investments that might both mitigate global warming and put business back on its feet (Ban Ki Moon and Gore, 2009; Goldenberg, 2009; Jura, 2008; Stern, 2009). The United Nations, together with various development, business and non-governmental organizations, is urging a 'Green New Deal' (Jackson, 2009; UNEP, 2009); Barack Obama has set out a US$ 787 billion tax and investment package 'to create and save three to four million jobs, jumpstart our economy, and begin the process of transforming it for the 21st century' (US House of Representatives, 2009); and coal-powered utilities and oil companies are begging for billions in public money for technologies to capture carbon dioxide from their smokestacks and bury it underground. Progressive activists are demanding that corporate tax evasion be stopped, military spending cut, and the money diverted to clean energy and community-based planning, some proposing that 'the trillions of dollars earmarked for economic recovery can be spent to fight climate change' (Khor, 2008; also George, 2008). Private investors and

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agribusiness corporations are meanwhile looking to shape a political environment in which they might benefit from ploughing hundreds of millions of dollars into commercial ventures ranging from agrofuels to wind energy to synthetic biology and nanotechnology (*Biofuels Digest*, 2009a, 2009b). An odd alliance of forest conservationists, economists, traders and investment banks is mobilizing to demand that hundreds of billions of dollars be put into ventures that protect carbon reservoirs in trees (Lang, 2008). Concerned physicists are taking to the airwaves to urge a Manhattan Project for fusion power (Cox, 2009), and a host of futuristic geo-engineering schemes involving mirrors in space, artificial trees, nanoparticle ocean films and the like is also under serious discussion (Brahic, 2009a). Many governments are meanwhile hoping that major climate investment decisions can be simply left to the new carbon markets that they are in the process of cobbling together.

To what extent are any of these proposals a good idea — simultaneously effective against the causes of global warming, safe, beneficial to livelihood and fair to all social groups? In what ways might they be combined in a coherent climate policy package? The answers are complicated. Many proposed climate investments are aimed at fostering unlimited growth in consumption, which is almost certainly incompatible with the declining material throughput required to avoid crisis (Jackson, 2009). Many investments would probably make global warming considerably worse than it is already. Some might make money for some sectors for a time but then lead to another economic crash. Others might sound good in isolation but would undercut each other. Still others would benefit only a small minority, harming many others or endangering the earth. On the other hand, promoting a workable pattern of investment capable of both addressing the climate problem and benefiting society in other ways is likely to involve political tasks that frighten many environmentalists and other elites: analysing the history of the climate crisis and the role of fossil fuels in the construction of political power and economic growth; asking different communities what their own energy solutions have been in specific contexts; building movements for structural change; and 'taking over the City' (Minns, 1982) and Wall Street to ensure more democratic control over the architecture of finance. Given the stakes and the difficulties, as well as the hazards of missteps, a rough map of at least part of this complex terrain seems essential — one that cannot be provided by economics and climate science alone. As of 2009, what is living and what is dead in the idea of climate investment?

THE DEAD

It is perhaps best to start with what is dead. Only if the corpses of deceased climate investment strategies still sprawled in plain view on Main Street are cleared out of the way and given a clean and honourable burial can public health be ensured and the ancestors properly respected. The following

strategies, having been fairly plainly dead for some time, should be swiftly stretchered off the scene so that life can go on.

Investing in more fossil fuel extraction and burning is not a viable climate strategy. On the contrary, it is the main cause of global warming. As biologist Tim Flannery puts it, 'There is so much carbon buried in the world's coal seams that, should it find its way back to the surface, it would make the planet hostile to life as we know it' (Flannery, 2005). The carbon locked away in underground coal, oil and gas is more than double the unstable carbon contained in living and dead biomass combined (Falkowski et al., 2000), and the ability of the oceans to take up carbon, while large, is limited, making it impossible to prevent carbon released from the burning of fossil fuels from building up the atmosphere. Investment now has to be directed toward keeping oil, coal and gas in the ground, not bringing them out.

That will entail reversing the energy finance policies and regulations of nearly all nations, banks and intergovernmental institutions: it is estimated that the assets of the fossil fuel businesses currently supported by the financial markets, if burned, would already push atmospheric levels of carbon dioxide beyond 500 parts per million. It will also mean eliminating indirect public investment in fossil fuels such as tax breaks for oil companies, the US$ 300 billion that goes annually to fossil fuels in straightforward subsidies (Ban Ki Moon and Gore, 2009), and the bankrolling of fossil fuel projects by international development banks such as the World Bank, which doubled its loans for fossil fuel development between 2007 and 2008 (Redman, 2008). Finally, it will mean calling a halt to the expansion of fossil fuel-related infrastructure, especially in the North, including airports, petrochemical installations, electricity generating plants, new highways, and so forth; hence the recent call of activists from Asia, Latin America and Africa to stop construction of further coal plants in the UK (Jowit, 2009) and the protest of environmentalists concerned that economic stimulus plans will lock in fossil fuel dependence for additional decades (Harvey, 2009b).

Such shifts will be welcome to those who, understanding that rates of extraction must eventually begin an inevitable, terminal decline dictated by geology and technology, have long urged the need to prepare early for 'peak oil' and 'peak coal'. They will also come not a moment too soon for groups that, long before climate became a headline issue, were battling coal extraction in Appalachia or Bangladesh, 'petro-violence' (Watts, 2001) in Ecuador or Iraq, or the consequences of a global liquid natural gas economy in Mexico or the US (Zalik, 2008). As activist Nnimmo Bassey remarks of Nigeria, decades of oil extraction 'have translated into billions of dollars that have spelt nothing but misery for the masses of the people'. Cheap petrodollars 'turned Nigerian politics into a struggle for the control of the national purse and led to a massive regime of conversion of public funds and properties into private control', polluting, destroying and dislocating 'the very basis of survival of the people in the region'. 'Nigeria should

not make any new oil block concessions', Bassey concludes: 'Leaving the oil underground does not translate to losses but saving. . . . By this simple act, Nigeria would keep the equivalent tonnes of greenhouse gases out of the atmosphere. This is a foolproof step [to curb global warming] that requires no technology transfer and does not require any international treaty or partnership' (Bassey, 2009).

Investing in carbon sequestration and storage (CCS) (IPCC, 2006; *Restructuring Today*, 2009; Socolow, 2005) is no answer to these concerns. Because it also squanders finance on transferring fossil fuels out of the ground while delaying transitions to non-fossil technologies, CCS (sometimes called geosequestration) is another strategy for which last rites should have been performed long ago. Just as agrofuels help sustain oil dependence, so CCS sustains coal dependence, making global warming worse while driving up the ultimate, unavoidable cost of switching away from fossil fuels. Or perhaps it would be more exact to say that it is the *hope* of CCS that helps sustain coal dependence: the first commercial carbon capture and storage plant could not come on stream before 2030 and would require decades of research and tens of billions of dollars before the vast infrastructure needed could be deployed (Ansolabehere et al., 2007). As Vaclav Smil points out, sequestering even a mere 10 per cent of today's global CO_2 emissions would require forcing underground every year a volume of compressed gas equal to or larger than the volume of crude oil extracted globally by a petroleum industry 'whose infrastructures and capacities have been put in place over a century of development' (Smil, 2006). To be effective, the technology would have to inject 50 cubic kilometres of corrosive liquid carbon dioxide into underground 'toxic waste dumps' every day until the coal is gone and then gamble the earth's climate on the numerous unknowns connected with being able to keep it in place for thousands of years. Along the way, over 25 per cent more coal would have to be burned just to produce the energy needed to liquefy the carbon dioxide, scrub out the sulphur dioxide and mercury and, as needed, transport the product around the landscape (Freese et al., 2008). By confusing the process through which fossil fuels are formed underground over millions of years with an untried experiment involving injecting millions of tonnes of a dangerous fluid into leaky reservoirs in the earth's crust, CCS again gets its basic science wrong (Rochon et al., 2008).

Its abandonment cannot come a moment too soon for environmental justice movements battling the expansion of fossil-fuelled industries near their communities or the transport of coal or oil through them; or those suffering from coal mining or the dumping of the toxic wastes already associated with the industry. While energy companies strategize about how to manage the expected resistance to the new liquid carbon dioxide dumps (they have already coined a new term, 'NUMBY syndrome' — 'Not Under My Back Yard'), groups bearing the immediate environmental brunt of coal-dependent infrastructure are already clear about the futility of CCS. As the US group

Coal River Mountain Watch says, 'We cannot afford to waste precious time and resources on this dead-end technology' (Coal River Mountain Watch, 2009).

Investing in agrofuels as a stand-in for oil is also a dead strategy, since it helps preserve the infrastructure of fossil fuel dependence, not replace it. The enormous industrial agrofuel investments being made today are intended to help power technologies designed to run on petroleum. They thus give those technologies — and the 'petro-violence' with which they are linked — a new lease on life at a time when they should be in the process of being replaced, and reinforce governments' determination to rely on them until the last drop of oil has been extracted. Rather than promoting energy security, in short, industrial-scale agrofuel investments promote the security of fossil-fuel infrastructure, and exacerbate the insecurity of societies that depend on it or are re-engineered in its name. They squander an opportunity to invest in a fossil-free future that needs to be grasped quickly.

In addition, because agrofuels are being forced to play the same role fossil fuels play in current transport and industrial technology, their requirements for land are immense. Reliance on fossil fuels entails burning 400 years' worth of plant growth every year (Dukes, 2003). To ask contemporary ecosystems to provide, year on year, a significant supplement to such a highly concentrated, accumulated source of energy places an insupportable burden on agricultural and forest lands and societies. In this sense, policies promoting investment in industrial agrofuels perpetuate the same confusion between below-ground and above-ground carbon pools that is exemplified in policies that assume that transfer from the one to the other can continue indefinitely. 'Sustainable industrial agrofuels' is a contradiction in terms.

Accordingly, for investors to move out of agrofuels cannot come quickly enough for those whose farmlands, forests, health and livelihoods are threatened by them in countries from Indonesia, Malaysia and Papua New Guinea to Cambodia, Cameroon, Uganda, Côte d'Ivoire and Ecuador. In Colombia, for example: 'Vast stretches of land are given over to plantations for agrofuel; tropical forests are being cleared to plant thousands of hectares of oil palm, sugar cane and other crops . . . . In many cases, palm plantations are expanding over the territories of displaced communities' (WRM, 2008). With large tracts of land 'no longer being allocated to food production', food dependency on large multinational corporations has increased. In Choco province and in dense forests along the Pacific, paramilitary gangs formerly associated with antidrug operations are seizing Afro-Colombian land to facilitate palm oil biofuel conglomerates, murdering dozens of farmers in the process (Monahan, 2008).

Investing in other land-intensive schemes for 'compensating' for fossil fuel use is another dead strategy. Such schemes come in many flavours, but they all attempt to press biotic carbon dumps or storehouses into service

to help moderate the climatic effects of extraction and burning of coal, oil and gas. Because of the quantitative and qualitative mismatch between below-ground and above-ground carbon pools, that entails investing in new forms of control over enormous tracts of land or ocean that people are already using for other purposes.

Thus elite alliances forming around the concept of REDD — 'Reducing Emissions from Deforestation and Degradation' — are proposing that billions of dollars be invested in acquiring and preserving carbon in the world's native forests. State forestry departments, conservation organizations, local authorities or indigenous peoples would be pressed into service as onsite security staff for this gargantuan biotic climate warehouse. So far, REDD advocates include ex-World Bank chief economist Nicholas Stern, who sees it, tonne by tonne, as one of the cheapest ways of keeping carbon dioxide molecules out of the atmosphere; Wall Street firms such as Merrill Lynch, which see high potential in trading such new 'carbon assets'; the UN's Food and Agriculture Organization, which welcomes it as an opportunity to expand its political role; and, often in the forefront, forest scientists, technicians and master planners occupationally predisposed to be captivated by global technical fixes.

The enormous sums of money potentially on offer have already divided various indigenous peoples' groups and local communities, some of whom see REDD as an unprecedented opportunity for advancement, whilst others see it as a potentially catastrophic enclosure movement and violation of the sacred (IEN, 2009); and environmentalists, who divide between proponents such as the US's Conservation International and The Nature Conservancy on the one hand and, on the other, groups such as FERN and the Forest Peoples Programme, who, looking to the example of the ill-fated Tropical Forest Action Plan of the 1980s and 1990s, see REDD as disempowering forest peoples in favour of acquisitive corporations and officials with little experience of or incentive to understand local issues of forest conservation (Griffiths, 2008).

Very similar, but at an earlier stage of development, are schemes to promote investment in 'biochar'. Spearheaded by scientists, technicians and startup companies, biochar seeks to scale up to a national or continental level a little-understood ancient Amazonian burning practice that sequestered carbon in a useful mineral form, hoping thereby also to produce gas and oil substitutes (Harvey, 2009a). To make a dent in the fossil fuel problem, biochar, like agrofuels, would involve altering land-use practices over millions of hectares in untried ways (Biofuelwatch, 2008). To representatives of the Kuna people of Central America, to whom the potential for conflict is obvious, biochar is 'bioshit'. While biochar would use fairly low-tech methods of cooking agricultural wastes, schemes are also afoot to use synthetic biology to produce oil out of biomass, providing means for transforming the widest possible range of biomass on the planet into fossil fuel 'equivalents' capable of serving a petroleum-using or coal-using

technology infrastructure. That could bring additional millions of hectares into service in the quest to make current fossil fuel infrastructure safe for the climate.

Plans are being made to make extensive use of the oceans in a similar way. Ocean fertilization to promote algal growth to absorb carbon dioxide is one option (ETC Group, 2009). Recently, proposals to bury land-grown biomass in the oceans have also been revived (Fountain, 2009). Again, because of the mismatch between underground and surface carbon pools, such attempts at technical fixes, if intended to compensate for continued use of fossil fuels, would entail planetary-scale tampering with the agricultural, soil and other livelihood systems relied upon by millions of peoples, as well as ocean fisheries. Just as Wall Street wizards were prevailed upon in recent decades to help commodify an unprecedented range of uncertainties in the service of an enormous expansion of credit and leverage (Lohmann, forthcoming b), so technical wizards in scientific institutions are now being prevailed upon to find ways of cultivating immense biotic fields in order to maintain fossil infrastructure in the face of climate change. Both projects benefit various elites in the short term at the cost of the accumulation of concealed toxic risks.

Investment in nuclear and thermonuclear energy is a long-dead corpse and any attempt to revive it would be a disastrous waste of money. Nuclear and thermonuclear energy are no more capable of attaining their main purpose — replacing fossil fuels — than are agrofuels, although the reasons are different. The attempt to use plant harvests to mimic petroleum fails because their energy concentration is too low. To be able to play even a small part of the role of oil, agrofuel crops would need to be planted across unfeasibly large areas of land, forcing an unsustainable simplification of human and other biological communities. The attempt to use nuclear fission or fusion as a stand-in for fossil fuels, by contrast, fails largely because the concentrations of energy involved are unmanageably high. Nuclear fuel contains at least ten million times more usable energy than any fossil fuel does, yet is used in energy generating plants for nothing more than boiling water, using the kinetic energy of highly dangerous particle and gamma radiation. As Amory Lovins pointed out long ago (Lovins, 1977: 6), that is like using a chainsaw to cut butter.

None of the classic obstacles to rejuvenating nuclear energy has ever been, or could ever be, overcome: the equipment, skills and security technology required to contain nuclear reactions; the resulting gigantic capital costs and need for huge state subsidies that drain resources from more competitive, climate-friendly options (Burke, 2008; Lovins and Sheikh, forthcoming); the long lead times; the dangers to the gene pool of radioactive contamination lasting tens of thousands of years; the hazards of mining raw materials; the impossibility of effective waste disposal and the enormous costs of any attempt to effect it; the squandering of scientific expertise on research and

development; the threat of use of nuclear materials in weapons; the insurance required to 'compensate' for the dangers; the needs for surveillance and police. The idea that thousands of massively expensive and hazardous nuclear plants should be assembled quickly in order to help maintain an archaic energy infrastructure built around fossil fuels is technologically, financially, scientifically and politically ludicrous, and would meet substantial global resistance. Fusion power, meanwhile, would have to initiate and control a process capable of converting a lump of matter with the mass of a dollar bill into energy equivalent to that released by a hydrogen bomb. The specialized high-energy technology required to trigger harnessable thermonuclear reactions, involving temperatures of millions of degrees, is not even close to being developed.

Such cases point to some of the reasons why *investment involving technology transfer as currently understood* is also a defunct strategy. North–South technology transfers facilitated by standard mechanisms of foreign aid, export subsidies, foreign direct investment and so on necessarily revolve around Northern export technologies that have been developed in the shadow of fossil fuel dominance and the search for fossil fuel replacements. Technologies that are needed to overcome fossil fuel dominance tend to be neglected or suppressed. An excellent example is the World Bank's Clean Technology Fund, advertised as dealing with climate change, which promotes coal power in the South through transfer of 'clean coal' technologies (which are defined as those that emit no more than a standard coal fired power station in the North) (Brahic, 2009b).

No less importantly, current conceptions of technology transfer slight the importance of technology exchange based on Southern innovation. South-to-North and South-to-South transactions are likely to prove increasingly key as the world warms further. In agriculture, for example, although no-till and permaculture movements in the North are important, the main reservoirs of knowledge on which to develop the non- or low-fossil fuel agriculture which is the key to future nutrition are located in the South. Yet 'technology transfer' continues to carry the connotation, as it always has, of moving Northern technology into a 'technology-deprived' area in the South. In practice, this typically plays out in the degradation, skewing or destruction of one set of technologies in favour of another (Mitchell, 2002).

The irony in an age of global warming is that it is often a green technology that is degraded by a less green one. One example of how this process is encouraged by today's international climate investment regime comes from the Bhilangana river valley in mountainous Uttaranchal, India. The low-carbon irrigation system of Sarona village uses porous rock dams to divert water gently into small canals while letting silt through. The water then flows into still smaller channels feeding terraced rice and wheat fields that then discharge any remaining water back into the river. This

well-established, low-carbon system, like many others in the region, is under threat from a 22.5 megawatt run-of-the-river hydropower system being built by Swasti Power Engineering with prospective Kyoto Protocol carbon finance (UNEP and Risoe Centre, 2009). Knock-on effects would include loss of livelihoods, migration and loss of a type of knowledge that, ironically, will be especially valuable in a greenhouse world. Sarona residents were never consulted and first learned about the project only in 2003 when construction machines arrived. Some 146 similar dam projects are proposed or underway in Uttaranchal alone (Ghosh and Kill, forthcoming).

No matter how closely a technology investment scheme hews to a mathematical notion of 'equality', it will inevitably be skewed by Northern and fossil fuel biases if it shies away from historical or political economy analysis of 'technology transfer'. One example is the 'Greenhouse Development Rights' framework, with its tacit endorsement of a long-discredited concept of 'development' that condescendingly sees 'resilience' as 'far beyond the grasp of the billions of people that are still mired in poverty' and singles out for special climate blame 'subsistence farming, fuel wood harvesting, grazing, and timber extraction' by 'poor communities' awaiting Northern tutelage in capital flows, social networking, carbon trading and methods for holding policymakers accountable (Baer et al., 2008). Similarly, thinking about climate investment by the United Nations Framework Convention on Climate Change (UNFCCC) and the European Community — which envisages a scaled-up carbon market, including a trade in REDD credits, supplemented by a modicum of public finance channelled largely through existing institutions — reveal not the slightest understanding of (nor, more importantly, any particular interest in) the extent, nature or impact of Northern and fossil fuel biases in climate change mitigation technology investment (Commission of the European Communities, 2009; UNFCCC, 2008).

None of this is to suggest that green technologies developed in the North could not contribute to a global regime of technology exchange and investment in which dispersal and appropriate local adaptation were facilitated to the greatest possible extent in the service of mitigating climate change. But that regime would be in many ways the antithesis of the one currently in effect, and of the one assumed to be inevitable in the proposals of the UN, European governments and various development organizations. Due partly to the political organizing efforts of powerful transnational corporations (Drahos, 2002; Lessig, 2004), current technology transfer is based on the premise that for innovation and creativity to be optimized, they must be commodified to the maximum extent possible. Any uncompensated benefits that one person's creativity might provide to another, it is assumed, must be 'internalized' through intellectual property laws. This entrenched neoclassical extremism, which contrasts sharply with the customary sharing of vernacular technologies (Illich, 1983) and flies in the face of abundant evidence that the more uncompensated benefits that an invention or initiative

generates, the more knock-on innovation takes place as a result,[1] strongly militates against locally-useful adaptations and assimilations of Northern technologies that could reduce or prevent dependence on fossil fuels. Instead of the needed 'commons of ideas' that would foster the maximum multiplication of benefits from climate-friendly technologies, the world of trade today is characterized, to adapt the words of innovation experts Brett Frischmann and Mark Lemley (2006), by 'too much intellectual property protection and too few spillovers'.

The political obsolescence of such neoliberal intellectual property doctrines in an age of global warming is signalled vividly in the reaction of a Chinese information technology (IT) industry employee to a recent presentation of a Chinese scholar and climate campaigner:

> If global warming is really as serious a threat to human civilization as you are saying, then where is the open source movement for the climate? I am an active participant in the free software movement. Every week I spend more than 10 hours of my free time on it, like millions of other tech guys around the world. We all understand that the free software we help to create and distribute probably hurts the profit margin of the whole IT industry. But there are more important things in life than making money at all costs. So this is what we do to make the world a bit better and more fair. Unless I see a comparable movement for the climate, I will always suspect that you guys are just another interest group, and the whole climate change thing might be some hype to sell certain kinds of proprietary technology from the West. (cited in Wen, 2009: 31)

Of course, there already are equivalent, unofficial 'open source movements for the climate' in the form of innumerable independent community and non-governmental efforts eager to share their discoveries and insights globally. But until governments learn to support such initiatives more and thwart them less, promises of climate-friendly 'technology transfer' are likely to remain hollow.

The current counterproductive regime of 'climate technology transfer' has also been heavily influenced by skewed methods of energy planning and demand forecasting developed during the age of fossil fuels and then used by national energy bureaucracies for their own purposes. A study led by Paul Craig of the University of California (Craig et al., 2002) reveals that US forecasts have historically overestimated US energy demand. The results have included overproduction, reduced prices and overconsumption of fossil fuels and their 'substitutes'. Scholars and activists such as Chuenchom Sangasri and Chris Graecen (Chuenchom and Graecen, 2004; Graecen, 2004) show how US-dominated frameworks of energy planning giving pride of place to fossil fuel use and highly-centralized generating plants have interacted destructively with political interests in other countries as well (see also Perkins, 2004).

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1. For some of this evidence, see Audretsch et al. (2005); Bernstein and Nadiri (1988); Cohen and Levinthal (1989); Gilson (1999); Griliches (1992); Harhoff (2000); Jacobs (1988); Ramello (2005).

Carbon trading is one final bloated corpse that needs to be hoisted into a hearse and whisked away quickly before it poisons genuine investment initiatives. Carbon markets, as developed in the Kyoto Protocol, the European Emissions Trading Scheme (EU ETS) and various other programmes and exchanges, were occasionally advertised by the derivatives traders and neoclassical economists who invented them (Lohmann, forthcoming b) as a means for incentivizing and providing finance for a transition to a fossil fuel-free future. In their decade of existence, however, they have done precisely the opposite, by offering the heaviest fossil fuel polluters in industrialized societies new means for delaying the steps toward structural change that need to be taken immediately, while simultaneously providing supplementary finance for fossil-intensive industrial pathways in the South.

In order to function, carbon markets translate climate change mitigation into measurable greenhouse-gas 'emissions reductions'. That is the only way to reconstruct climate benefit as tradable units: discrete, divisible, determinate, quantifiable, commensurable, additive and incremental. Universally fungible greenhouse gas pollution rights are backed by an implicit government guarantee that an optimal 'climatically safe' amount of total rights in circulation can, in principle, be specified and mandated. Governments set supply levels ('caps') that supposedly progressively approach this 'safe' level and either sell the commodity or, more usually, give it away free to large industrial polluters. Trade in the product then supposedly makes climate change mitigation maximally cost-effective. For added cost savings, a second class of quantified climate-benefit units called 'offsets' is then developed and added to the pool of commodity 'reductions'. These offsets are manufactured by special projects that are claimed to result in less greenhouse gases accumulating in the atmosphere than would be the case in the absence of carbon finance. Examples include tree plantations (which are supposed to absorb carbon dioxide emissions); fuel switches; wind farms; hydroelectric dams (which are argued to reduce or displace fossil energy); and projects to burn off methane from coal mines, waste dumps or pig farms. Proposals to use agrofuels, biochar, REDD, ocean fertilization, CCS and nuclear energy to generate greenhouse gas pollution licences for sale to rich countries or firms — proposals that would cement the links between these various technologies and the fossil fuel economy — are also being considered under various carbon trading schemes.

Abstracting from place, technology and history, carbon trading achieves its 'economies' by putting off technological change and investment in a long-term non-fossil future. It confuses 'investment' in the sense of 'short-term money-making venture' with 'investment' in the sense of 'foundation for a secure future'. Suppose, for example, a country promulgates a law that progressively scales down the electricity utility sector's emissions to a point at which it will have to invest in non-fossil generation. Carbon trading, if also introduced, lets the industry delay that investment by allowing it to buy cheap pollution rights from sectors that have overshot their own targets using

technologically easy cuts that contribute little to a historical trajectory away from fossil fuels. Or it allows generators to buy further delays by acquiring still cheaper 'offset' credits from, say, companies burning off methane from waste dumps in Brazil or coal mines in China or achieving routine efficiency improvements at sponge iron plants in India. In this way, carbon trading encourages more ingenuity in inventing measurable 'equivalences' between emissions of different types in different places, or between emissions reductions and various kinds of offsets, than in fostering targeted innovations that can initiate or sustain a historical trajectory away from fossil fuels (the effectiveness of which is less easy to measure). Indeed, once the carbon commodity has been defined, merely to weigh different long-range social and technological trajectories or evaluate and 'backcast' from distant goals is already to threaten the efficiency imperative.

A case in point are the 763 Chinese hydroelectric dams that have applied or are planning to apply to the United Nations to be allowed to sell more than 300 million tonnes of carbon dioxide pollution rights to Northern industry. By buying such rights, corporations such as Germany's RWE are able to avoid investing in less polluting electricity generation at home. A mere thirty-eight of the Chinese dams are expected to produce enough carbon credits to allow Germany to relax its emissions restrictions by more than 1 per cent by 2012. Yet the money paid for the pollution rights (and billed to German electricity customers) does nothing to reduce China's emissions, either, nor does it help in its transition to a fossil-free future: the dams do not replace fossil-fuelled generation, but merely supplement it, and were arguably going to be built anyway. Construction at Xiaoxi dam, for example, got under way in 2004, two years before the developers applied for CDM credits. The project design document notes that it would be against Chinese regulations to build an equivalent coal-fired plant on the site, yet planners claim that the project is 'saving' carbon equal to the difference between the emissions of a coal-fired installation and those of the dam (McDonald et al., 2009).

The US Government Accountability Office warned recently that such carbon projects can allow industries in the North 'to increase their emissions without a corresponding reduction in a developing country' (GAO, 2008). The project of finding 'cost-effective' ways of investing in climatic stability through carbon markets entails losing touch with what is supposedly being costed. For over ten years, the main product of carbon markets has been procrastination. Whatever small emissions cuts may have been made under the Kyoto Protocol or the EU ETS (which are unmeasurable in principle due to the system's contamination with offsets) are made through their regulatory components, not their trading components. At the same time, trading has blocked long-term progress away from fossil fuel dependence, locking in future increases in emissions.

Like the strategy of investing in agrofuels and CCS, the misguided investment strategy that would have carbon markets 'sort out' global warming

(Scott, 2008) damages more than just climatic stability. 'Nobody asked if we wanted to move', said a 38-year-old man whose family lost a small brick house to the Xiaoxi dam. 'The government just posted a notice that said, "Your home will be demolished"'. While the dam company says local surveys found overwhelming support for the project, with 97 per cent of 212 respondents saying they were satisfied with their compensation, people interviewed in Xiaoxi said they were not contacted for the surveys. The German carbon firm Tuv-Sud, which validated the project for the UN, admitted that 'the concerned villagers and their leaders were not involved in the decision process'. But it contended that the 'essence' of European guidelines on participation was fulfilled because those affected 'have improved their living environment', although many villagers did not get enough money even to buy new homes (McDonald et al., 2009).

It is not only communities fighting damaging industries in the South that sell carbon credits who bear the impacts of carbon markets. Communities on the fenceline of polluting industries in the North suffer them as well — which is why it is unsurprising that California's environmental justice movement, weaned on struggles against the disproportionate effects of industrial contamination on poorer communities of colour, 'stands with communities around the world in opposition to carbon trading' (California Communities against Toxics et al., 2008). Many indigenous peoples' organizations, meanwhile, strongly oppose the way carbon markets have enclosed, privatized and commodified the earth's carbon-cycling capacity, or ability to keep its climate stable (Goldtooth, 2009; Sommer, 2009). Various green energy developers in both South and North are concerned about the way carbon markets are blocking progress in the spread of renewables (Hankins, 2009; Solarenergie Forderverein, 2009).

THE LIVING

Respectfully clearing the dead from the streets opens a space for the living. But what kind of climate investment is it that will make possible a human future?

First, it is not enough simply to invest in non-carbon energy and non-carbon transport, sustainably-heated houses or reduced-oil agricultural techniques. Plenty of financial institutions are already doing that, while continuing or even increasing their investment in fossil fuels — the World Bank, for example. Nor will it be enough just to stop investment in fossil fuels, although that is part of the solution. Rather, successful climate investment will go into creatively building long-term, coherent historical *pathways* away from dependence on fossil fuels. That is different, and more complicated, and has far-reaching consequences. For example, it means rejecting investment in carbon trading systems as the foundation of climate policy, since such

systems do not select for a livable future history, but rather for short-term cost savings on slightly modified business-as-usual pathways.

Second, the new pathways that must be the objective of climate investment will lead industrialized societies not only away from coal, oil and gas, but also away from the search for fossil fuel substitutes. Nothing else — not agrofuels, not nuclear energy, not wind farms — can play the role that fossil fuels play in today's industrialized societies, including their political role of powering the machines that shape elites' struggles against the poor (Caffentzis, 2008), and it is futile and enormously expensive to pretend that they can. The hope that a replacement for fossil fuels can be found that will allow everything else to remain exactly as it is has to be abandoned. Assumptions about demand, energy planning, development and social control that derive from the fossil age and its politics are of little use in a greenhouse world. It is not only fossil fuels that must be left in the ground, but also the practices and institutions that have made their extraction and burning possible and even necessary. Again, it follows that carbon markets cannot be a part of intelligent climate policy, since they are designed in a way that extends the life of fossil fuel-oriented infrastructure.

Third, the future of climate investment belongs, instead, to locally-focused energy, locally-adapted agriculture and locally-appropriate transport. In agriculture, for example, the inefficiencies and simplifications that petroleum allowed now have to be set aside by a myriad of intricately-differing local practices that constitute the necessary condition for high yields without oil. As the anthropologist Richard O'Connor once pointed out, 'the environment itself is local; nature diversifies to make niches, enmeshing each locale in its own intricate web. Insofar as this holds, enduring human adaptations must also ultimately be quite local' (O'Connor, 1989). In this new, lower-energy context, more than ever before, '[t]he only frameworks that can tell you anything about the likely efficacy of a policy are those at the most local level', to cite the words of Michael Thompson and colleagues. 'What is needed is . . . an approach that places the "mere details" . . . at the very centre of the stage and relegates to the wings the alarm bell-ringers and their immaculate prescriptions' (Thompson et al., 1986: 71, 87–8). A post-fossil agriculture more attuned to local capabilities may or may not entail more drudgery. But one thing it will certainly require is a rediversification and decentralization of knowledge, a turn toward the gardening side of farming in millions of separate locales. Future trade in agricultural goods will be built on bases of increased respect for and individual attention to local particularities.

To a lesser extent, the same is true of post-fossil fuel energy generation, and indeed of post-financial crash investment generally. As another anthropologist, Stephen Gudeman, observes with respect to the financial crisis, instead of merely 'helping occupants at the top of the prestige and power scale (Wall Street or the financial realm)', emergency investment also needs to be directed toward the communal 'base' maintained by ordinary

people — an arena of 'the things and services with which we live and by which we make our relationships with others', including things and services obtained by trade for purposes of resilience rather than speculation: housing, living spaces and so forth (Gudeman, 2008). In short, climate investment must be directed more toward building and maintaining diverse baskets of concrete incommensurables than toward the indefinite processes of commensuration that serve mainly to expand liquidity, credit, capital velocity, uncertainty and trade in fictional commodities.

Fourth, this will entail a shift in the types of knowledge used in making investment decisions. Hitherto, investment planning has typically been built on, for example, abstractions regarding 'future energy demand', formulated by institutions such as the International Energy Agency, that rest on the assumptions that all remaining fossil fuels will be taken out of the ground, and that afterwards 'substitutes' for fossil fuels will be used. These claims, when acted upon, result in the accumulation of a particular kind of knowledge: how many tens of thousands of nuclear plants will have to be built; how many becquerels of radioactive waste will need to be guarded for how many thousands of years; how many millions of hectares of land will need to be taken over for gigantic solar arrays or the production of agrofuels and biochar; how all this can be done at the least cost to the corporate sector; and so forth. This accumulating knowledge finds its home in a cascade of conflicts, mishaps, technical fixes and accretions of yet further technical knowledge, as for example when 'second generation' cellulosic agrofuels emerge from the ashes of the 'first generation'. All this leads in turn to the buildup of techniques for commodifying and 'managing systemic risk' — techniques whose historical blindness and technical inadequacy have again been revealed during the current financial crisis.

In the end, this snowballing of ultimately useless climate investment knowledge tends to flatten other kinds of knowledge that will be more at a premium in a warming world — in particular, knowledge of resilient means differing communities might deploy in order to lead satisfying, mutually-acceptable lives without entailing the global threats and power differentials associated with fossil fuels or fossil fuel substitutes. What is required is a different knowledge process, one in which more assumptions (including those about energy demand) are opened for concrete questioning, and in whose creation more and different communities with different starting assumptions can be involved. One modest example from Europe is the Transition Towns movement, which is going some way toward rethinking demand with its 'Energy Descent Action Plans', even if it still lacks a political economy analysis of industrial energy use or an organizational focus on equitable energy distribution. In Indonesia, similarly, the Institute for Democratic Economics is facilitating sweeping reinvestigations and reformulations of energy and livelihood issues by dozens of communities on different islands of the archipelago, deriving conclusions and agendas that fly in the face of neoliberal orthodoxy.

None of this implies that there will be no place for expert assistance in climate finance decisions. But it will come not only from fields such as economics, finance, climate science and engineering (Lohmann, forthcoming a). Specialists in other areas as well must pitch in to help liberate the climate debate from the neoliberal straitjacket in which it has become encased. Historians, for example, can help analyse how structural change has been peacefully brought about in the past. Anthropologists and sociologists can help expose, disassemble or put in perspective destructive assumptions and practices implicated in commodification, imperialism and economic growth doctrine, as well as document existing resources for climate change solutions. Legal scholars can help highlight environmental protection instruments whose virtues have been eclipsed by neoliberal fervour (Driesen and Sinden, 2009), and so on.

All this will require, *fifth*, that state bureaucracies, research institutions, banks and other financial institutions be forced to make space for more investigation and discussion of how various communities and societies *already* support themselves without overreliance on fossil fuels; to move toward greater humility in their assessments of what is possible and not possible; and to stop shying away from acknowledging the centrality to climate investment of issues of class, colonialism, race, local geography and the politics of knowledge. It will also entail that limits be put on the overreaching, counterproductive attempts to commodify innovation enshrined in current intellectual property law (Frischman and Lemley, 2006).

Sixth, most financial, corporate and government leaders will not be able to find their own way to these realities, or to successful climate investment policies. Their place in society has been carved out and sustained by fossil fuels and fossil fuel substitutes and by the economic and political practices that most need questioning. Hence the leaders themselves will have to be led by a popular movement. It follows that activism for successful climate finance cannot be just about urging globally-agreed targets for greenhouse gas reductions, offering a checklist of acceptable technologies, constructing new commodities, and then delegating investment to traditional financial institutions and governments — however reformed and regulated — who will then try to get prices right while keeping structures of power and knowledge much as they are. It will be much more about building a political movement for broad-based, democratic, post-fossil, long-range social planning based on co-operative inquiry. Broad social change is inevitable; the unrestrained attempts of the past few decades to commodify uncertainty, innovation and carbon-cycling capacity will have to be curbed sharply. Ways must be sought to find and enforce democratic consensus about what resources must be shared where and when, for long-term collective benefit; what institutions will accordingly have to be phased out and what new institutions constructed to take their place; and how the political transition is to happen. Without this democratic process, supposed ‘Green New Deals’ are

likely to be destructive of livelihoods and climatic stability alike. As some 300 development and environment organizations recently insisted in a statement on a proposed Global Climate Fund, investment governance 'must be democratic, transparent, and accountable to all, especially the impoverished and vulnerable communities most affected by global warming. . . . Civil society groups, social movements and indigenous peoples, from developing and developed nations, must be formally represented within all governance structures' (IFG, 2008: 2).

Seventh, that can only happen through a process that involves 'taking over the City'. The historian E.P. Thompson remarked years ago that it has always been hard to understand the concept of the commons using capitalist categories (Thompson, 1990), and there is no reason to suppose that a workable, realistic pattern of climate investment can even be investigated properly, much less carried out, before there is much more shared public control over finance. That entails not just state takeover of a financial sector that has ballooned so destructively during the past few decades (Lanchester, 2009; Panitch and Konings, 2009), but also thorough democratization of financial decision-making structures, particularly those that are important in determining long-range energy and transport development. Some of the experience needed for the necessary transformations is already being built up in the course of the campaigns for change that have emerged in the wake of the financial crisis. These include campaigns to reduce the overwhelming influence of Wall Street on Washington; increase workers' and farmers' participation in management; disallow banks' claims about the value of the 'toxic' assets they hold; roll back limited corporate liability; challenge shareholder primacy; halt public handouts for CCS and nuclear development; force the World Bank to obey its review panel's recommendations to stop investing in fossil fuels; get the Royal Bank of Scotland out of oil; seek tax justice; institute a maximum wage; stop the propertizing and piracy of ideas and innovations that should be held in common; and so forth. Even US ruling elites are feeling the heat. What will be more difficult is following through on such initiatives without being distracted by predictable elite defences involving attempts to replace fossil fuels with new high-tech alternatives, pour yet more public cash into insolvent private banks, make minor technical modifications to the regulation of finance, or retool carbon markets. In climate as in other fields, the economic crash offers the opportunity to transform finance into a force for livelihood and survival, but the struggle to make that happen will be ongoing.

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