

**Constructing the US experience: Investigating the emblematic role of
early pollution trading in climate governance**

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Abstract

This paper lays out what is hoped is seen as a convincing case for the further investigation of the role played by the early environmental Skeptics in the development of precisely what they were arguing against - environmental action as undertaken in a marketised form through the development of emissions trading systems. The analysis suggested here views the actions of the Skeptics not simply in terms of their power and access with and to the U.S. government, as this reliance on power as an explananda is seen as missing the technopolitical means through which this change was effected. The use of Cost Benefit Analyses (CBA) by the Skeptics as a means to subject potential environmental regulation to the rigours of a 'naturalised' economics, is hypothesised to play an important role in reconciling environment and economics, with the latter subsuming the former under the rubric of efficiency, in the development of 'liberal environmentalism' (Bernstein 2001). This hypothesis for further investigation is generated through an attempt to identify weaknesses in the technopolitical account of emissions market construction undertaken by Donald MacKenzie (2009), namely its failure to adequately contextualise the initial turn to an economic rationality with respect to environmental regulation and governance. The paper attempts to address this weakness by effecting a technopolitical 'contextualisation' of the construction of the early U.S. experience with emissions trading markets.

Introduction

The 2009 climate change negotiations in Copenhagen can be seen, as has been argued by [Bernstein et al 2010] as a 'Tale of two Copenhagens'. Whilst the Bella Center was host for two weeks to the roiling mass of bodies that muddied the international waters of climate change mitigation and adaptation, the atmosphere one Metro stop South in the Crowne Plaza Hotel was as clear as the offset consciences of the participants to the International Emissions Trading Association (IETA) hosted side events. Subsequently the one hundred and five panels scheduled over a ten day period proceeded calmly and, well, efficiently. IETA was formed in 1999 to advance and promote the global development of emissions markets, and its side events during the Copenhagen negotiations enabled the conglomeration of the human elements of this very contemporary form of environmental governance. In spite of the scant four decade history of emissions trading, and indeed a little over a decade with specific respect to carbon, these markets have been highly successful in generating an associated 'service sector' (Voß 2007:4), constituting a 'powerful constituency that benefits from climate change policy' (Newell & Paterson 2010:10).

The participants to these side events comprised bankers, representatives of government ministries, consultants, brokers, risk managers, project developers, and market news and research providers. This mix was also studded with the somewhat out of place looking figure of the gently rumpled academic, student or NGO member. Whilst arguments in the Bella Center raged over the production of the leaked draft proposal, and discussions fractured along numerous economic, geopolitical and Kyoto Annex lines, presentations and discussions at the Crowne Plaza Hotel were more tightly focused on the potential expansion of the markets and much discussion was prefaced upon the notion of market efficiency.

During the event, IETA representatives announced that the association would shortly be releasing a guide to what they referred as the 'basic economic concepts' underpinning emissions trading and the drive to expand this form of contemporary environmental governance. The conference participants were as aware as market critics however, that in the wilds of national, regional and global political economies, emissions trading does not function exactly in line with the theory first domesticated on paper by Ronald Coase (Coase 1960), with its neo-classical economic presumptions of self-maximising economic rationality and perfect market knowledge. Therefore, alongside the oft-mentioned economic proof of efficiency, a second form of evidence was also frequently motivated during discussions, the evidence of history. The early US experience with emissions trading mechanisms, and most predominantly sulphur dioxide (SO₂) trading under the Acid Rain Program (ARP) instituted under Title IV of the Clean Air Act Amendments (CAAA) of 1990 was, and is, cited as a regulatory or governance proof of concept for emissions trading. The apparent efficiency of the early US pollution trading markets that developed in the 1970s, '80s and '90s was given as evidence by several carbon market participants for the necessity of expanding the breadth, number and linkage of contemporary carbon trading markets to maximise Greenhouse Gas (GHG) mitigation at least cost. It also underlay arguments resisting the then congressional moves to regulate Over The Counter (OTC) trading within the House Regulatory Reform Bill with respect to any future US federal carbon trading system.

Two hypothetical responses to these observations can be immediately brought to bear. The first corresponds to what might be seen as a broadly neo-classical economic position, namely that these arguments and claims simply reflect the linear or mechanical translation and transportation of emissions trading techniques from the US to the international/EU levels. That is, the early markets do indeed stand as a simple proof of concept, and in this sense the fact that these claims were brought to bear in this forum is entirely uninteresting. The second

response maintains that arguments about the efficiency of the early US experience represent a purely rhetorical cover to an expansive drive to commodify the environment following a neoliberal political economic rationality. This position could be seen as that of certain critics of emissions trading, both academic and activist, and similar to the above, sees the claim of the efficiency of the early markets as essentially a trivial one, hiding an underlying market rationality.

In contrasting these hypothetical responses, the broader project from which this paper derives draws from the insight that there is no simple relation between the techniques and technologies (Lovell & Liverman 2010) employed in early emissions markets and the evaluation and propagation of their perceived efficiency. Market design and implementation is seen here as a political matter, and we need therefore to engage in an analysis of the technicalities of this process and not simply ‘with the overall virtues and demerits of markets.’ (MacKenzie, 2009:33). It is indeed necessary then to identify the specific construction of both the early US emissions trading systems, and concurrently the ideology or emblematic idea of the efficiency of these systems in order to adequately grasp the agencies and governance forms that have developed in relation to the construction of emissions trading markets.

However, as this project is only at the very early stages, the purpose of this paper is the limited one of laying out a convincing case as to why this history of the early US emissions trading experience warrants further research. This is done through the elucidation of a set of new questions that are opened up, representing a trail of indicative analytical breadcrumbs. I do not present these, nor can they be taken as, convincing arguments or answers to identified problems or issues. However, following Voltaire’s claim that you should ‘Judge a man by his questions rather than by his answers.’ I hope to portray these as interesting and as a trail that is worth following.

This paper begins by outlining the technopolitical approach to the analysis of emissions trading markets, as formally espoused by MacKenzie (2009). Following this introduction to the theory and application of technopolitics to the early emissions markets, I will briefly present critical responses to this general approach and indicate that as presented here, Mackenzie's formulation, in drawing heavily from an account of economic performativity, raises the question of the missing role of context. I will then outline a possible means of approaching context with this framework, and a substantive hypothesis for further research suggested by a ‘contextualised’ technopolitical account of the development of the early

emissions markets – namely the potential role of the ‘Merchants of Doubt’ (Oreskes & Conway) in constructing the importance of efficiency in environmental regulation and thereby providing the ‘ground’ upon which emissions trading markets as environmental governance have developed.

A technopolitical approach to emissions trading development

The conceptual perspective afforded by technopolitics or ‘material sociology’ as Mackenzie also refers to it, derives from the ecological (Murdoch, 2001) Actor-Network Theory (ANT) first developed as a tool for social science research in the 1980s in and through the ‘Science and Technology Studies’ of Bruno Latour, Michel Callon and John Law¹ and from the specific application of this as ‘performativity’² with respect to the development of financial markets. I will focus here on the clearest and perhaps most direct application of a technopolitical analysis to emissions trading, namely that undertaken by Donald MacKenzie³. In his 2009 book ‘Material Markets’, MacKenzie lays out what he refers to as ‘ten precepts’ (pp.8-36) of technopolitics, where these outline ‘an approach to the study of markets, especially of financial markets, that is inspired by the social studies of science and technology’ (MacKenzie 2009:8). These precepts are used as the general basis for conceptualising the development of the emissions markets in the current project and can be loosely grouped into five separable categories. The first of these refers to the production of knowledge. The second incorporates a Barnesian account of finitism into the otherwise ANT derived methodology. The third to the principles of agency distributed across human and non-human actor-networks or agencement. The fourth elucidates the technopolitical approach to politics and power. Finally, and most importantly for the current analysis, the fifth espouses the programme of economic performativity developed by Michel Callon.

The production of knowledge is outlined in the punning precept ‘Facts matter’. Facticity is understood as produced, and the questions of interest here with respect to facts are how they are produced and what secures this facticity, not the truthfulness of any given fact. It is therefore necessary to investigate the history of the production of facts, which becomes increasingly obscured by their ‘social’ acceptance, that is, the history of their production tends to vanish as facts become increasingly accepted as such. It is also important to note here that following actor-network precepts, facts are not simply socially produced, and this point should not be taken to indicate a belief in the worst depredations of social constructivist or

¹ e.g. Callon, 1986; Callon & Latour, 1981; Latour, 1988, 1993, 1999, 2004; Law, 1986; Law, 1992)

² (see e.g. Callon 1998, 1999, 2007, 2008; MacKenzie & Mollo, 2003; MacKenzie 2006, 2008, 2009)

³ e.g. MacKenzie (2007, 2008, 2009)

post-modern thought. Facts are produced yes, but by the full range of human and non-human actors.

Finitism is given in the precept 'Classification and rule following are finitist processes'. Finitism is taken here from Barry Barnes critique of extensional semantics, and refers to the fact that once the meaning of an item [A] is chosen, this does not mean that all instances to which [A] applies are then fixed. Instead, every application of a term to an instance requires a decision. MacKenzie argues that utilising a finitist understanding of this flexible account of classification and rule following in the development of markets has the advantage of directing attention to the factors - social, material and technical, that constrain these classifications.

Agency distributed across human and non-human actor-networks is conceptually rendered in the precepts that: 'actors are embodied', 'equipment matters', 'cognition and calculation are distributed and material' and 'actors are agencements'. Collectively these precepts maintain that markets are combinations of human beings and physical objects - therefore the corporeality - the physical limitations of these objects, is crucial to market function. Similarly, equipment, be it in the form of physical tools or non-physical concepts change the nature of the economic agent. MacKenzie states there is a need for 'systematic ways' (MacKenzie 2009:13) to reduce complication in the markets to a level that is 'mentally' tractable. In relation to this, conceptual equipment matters in spite of it not necessarily being understood, it has agency beyond and independently of application by a subjective human actor. Cognition and calculation are also understood as physical processes, where the creation of cognition occurs through the creation of environments within which powers are exercised. These lead to the notion of agencement, where technopolitics assumes a form of indiscriminate ontological monism, with human and non-human agents being treated similarly, and an a priori agnosticism to the human, non-human or blended nature of any particular agency. MacKenzie uses the term agencement here, drawn originally from, as:

The notion of agencement thus has a virtue that is not amongst those standardly claimed for actor-network theory. Tracing the agencement making up an economic actor, rather than focusing exclusively on what one might call action's glamorous agential peaks, broadens the field of view of the social science investigation of finance, not just towards things but towards less high-status human beings. (MacKenzie 2009:22)

The technopolitical approach to politics and power involves the precepts that: 'innovation Isn't linear', 'market design is a political matter' and 'scales aren't stable'. MacKenzie claims that performativity is misread if perceived in terms of a linear progression analogous to a view of linear technological progression. Related to this concept of non-linearity, he argues

that:

If the process by which technologies or markets develop were as a linear model posits, the politics of technology (or the politics of markets) would be reduced to a simple but unattractive set of choices: to embrace innovation indiscriminately; to acquiesce passively; or to resist innovation. However, because linear views of innovation are false, a more discriminating and nuanced politics of technology, seeking actively to shape the innovation process and its outcomes, is possible, and the same is surely true of the politics of the markets' (MacKenzie 2009:32-33)

MacKenzie also maintains that the tendency to differentiate into 'big' and 'small' scale phenomena impedes the development of a politics of the market, where only the latter are considered as political. Mackenzie highlights changes of scale - from small to large, where seemingly small technical considerations can have large outcomes and effects.

Most importantly for the arguments developed in this paper is economic performativity, where 'economics does things'. Economics is not merely descriptive or analytical, but performs itself. This refers then to what might be taken as the central claim of performative analyses within SSF, namely that the markets are not to be seen as embedded in society, but in economics. Where '[e]conomics does not describe an existing external "economy" but brings that economy into being: economics performs the economy, creating the phenomena it describes.' (MacKenzie & Millo, 2003, p. 108). The metaphor of framing is used here, where quoting Larry Lohmann:

Instead of focusing on imagined pre-existing or intrinsic properties of environmental objects or agents, it focuses on what produces and sustains the objects and agents. Rather than picturing essentialized objects moving across sharply-delineated boundaries between what is internal and external to an economy, the framing metaphor sees objects constantly being made and remade, and boundaries as fluid or poorly-defined. (Lohmann, 2008:5)

Framing can lead to 'black-boxing' in relatively stable, 'cool' situations, when interests and identities are clear and known and contestation is minimised. These 'black-boxes' are never completely secure however, and the entangled socio-natural contents can overflow and become disruptive. Use of this metaphor indicates then that we cannot retain a singular and monolithic understanding of the market-economy and that it must be constantly reformed and built (Callon, 1999, p. 266) – there is no inertia in the construction of socio-natural structures, they crumble in the absence of constant energetic input. Obversely, this metaphor 'also casts doubt on the idea that there are things that are by their nature resistant to such imaginary monoliths' (Lohmann, 2008, p. 5). Therefore, as Lohmann succinctly puts it:

According to the new metaphor, it may not be fruitful to analyze environmental protection as a matter of either integration into, or isolation from, market economies. Rather, it suggests that closer attention be paid to specific contexts and nets of practices. (Lohmann, 2008, p. 5)

With respect to emissions markets, Mackenzie argues that they represent a clear example of economic performativity, where ‘economics has done something: its role has not been to analyse an already existing market, but to help bring about a new market into existence (MacKenzie 2009:139). In this case, a market prefaced upon the development of tradable pollution permits.

The theory of emissions trading is based theoretically in the work of economist and Nobel laureate Ronald Coase (1960), who argued initially that pollution levels could be ‘optimized’ by the inclusion of emissions, previously understood as a negative externality, as a ‘factor of production’. Coase’ position was framed in opposition to two other means to address negative externalities, namely command and control measures and taxation. Coase argued that instituting a market for emissions would, under optimized conditions; result in the distribution of emissions amongst the market actors such that the overall amount of wealth, and thereby social good can be extracted from them. Following this rationale, Thomas D. Crocker (1966) analysed the problem of atmospheric pollution as what he refers to as a clear case of ‘market failure’ (Crocker 1996:61) requiring a more effective means of allocating air resources, one that he argued could be provided through the development of economically based atmospheric pollution control systems.

Neither Coase nor Crocker directly inspired the idea of tradeable permits however, and this innovation is typically traced to John H. Dales (1968). Dales more formerly outlined a process of ‘cap and trade’ emissions trading, whereby the state is responsible for setting the overall emissions levels. Trading emissions rights then enables businesses to find the most efficient, qua cost effective, way to reduce their individual emissions, such that the overall emissions do not exceed the centrally set cap. Businesses that can reduce pollution costs cheaply can sell unused emissions right to those businesses for which making emissions reductions are more costly. In this way both sellers and buyers are rewarded (their individual costs of meeting the cap are minimised) and reductions are made where they are cheapest to do so. Further advocates of cap and trade systems such as Montgomery (1972), who provided the formal mathematical proof of the efficiency of emissions trading; and Tietenberg (1980), established this approach firmly within the broader field of environmental economics (see e.g. Anderson & Leal, 1991), and subsequently mainstream environment policy thinking (Gorman & Soloman, 2002).

MacKenzie locates the economic theory of emissions markets as the initial inspiration for early market developments in the 1970s and '80s, although these are then dismissed as 'limited and often clumsily implemented' (MacKenzie 2009: 143) and are covered in a single brief paragraph in this text. More significant for MacKenzie in terms of economic performativity is the development of the sulphur-dioxide market in the 1990s. Not only did economic theory underpin this market construction, but economists such as Robert Stavins of Harvard and former economist for the influential pro-business environment NGO the Environmental Defence Fund; Richard Schmalensee who was a member of president George H.W. Bush's Council of Economic Advisors; and Robert Hahn - a member of the Council of Economic Advisors professional staff; were active political advocates of a sulphur-dioxide emissions market under the CAAA ARP. Important here is the role of 'Project 88', a bipartisan project chaired by republican senators John Heinz and democrat Timothy Wirth, and chaired by Robert Stavins aimed at bridging the gap between environment and economy 'by applying economic incentives to the work of environmental protection' (Project 88, 1988:9). Project 88's first report was driven by economic comparisons of the projected costs of a market-based approach to acid reduction versus an approach relying on the broad brush application of mandated technological standards. This comparison indicated that a regulatory mechanism relying on tradable permits could save \$3 billion a year.

Between technopolitical theory and technopolitical analysis - where's the context?

Mackenzie clearly identifies the role of economics and economists in the early markets, but this account is arguably unsatisfactory in the sense that it fails to relate the development of the emissions markets to the broader political economic context. What MacKenzie leaves unproblematised in this account is how and why the theory of emissions trading gained prominence as a form of environmental regulation. It was shown to be theoretically the most economically efficient means of undertaking pollution reduction, but why was *economic efficiency* and the need to implement environmental regulation at least cost emphasised as the overriding goal of environmental governance? (Paterson 2009)⁴ MacKenzie's apparent failure to contextualise his analysis in this way is quite understandable given his close focus on the

⁴ For further critical analysis of the underpinning Callonian performativity see e.g. Fine (2003) where he argues that this approach fails as an adequate historical analysis as it does not consider the structural impact of capital in the motivated turn to 'rational choice' theorising in sociology, and that: 'In short, whatever his intent in disposing of economics and its experts, Callon might reasonably be situated somewhere between complicity with or conformity to the new phase of economics imperialism' (Fine, 2003, p. 483). For a rejoinder to this form of critical political economy on the grounds of a problematic epistemological focus on economics see Muniesa (2010).

development of the emissions trading markets - not the broader environmental governance forms that they are part of. It is fairly unproblematic here to claim this as a quite legitimate focus given the evident importance of economic rationality and impact of market developments in shaping the contemporary world.

However, in ignoring this question of 'why efficiency?' MacKenzie's account has developed around two empirical lacunae. First, he ignores the pre- ARP market developments, characterising these simply as clumsy and partial implementations of the economic theory of tradable pollution permits, in a sense merely as a comparatively uninteresting initial failure of performativity. However, given the number and extent of these emissions trading programmes, which included the EPA Emissions Trading Program (1974–), Leaded Gasoline Phasedown (1979–87), Effluent Trading in Watersheds (1983–) and Transfers Among Parties to Montreal Protocol (1989–95) it doesn't appear at all clear to me that they can be so quickly dismissed.

Early ex-post assessments of the pre-SO₂ markets also did not provide uniform evidence of least cost in the actually implemented very early markets (Voß 2008, Coelho 2009). How was the drive towards economically efficient regulation maintained then in the face of this lack empirical evidence? How was the idea of efficiency as the fundamental ground underlying environmental governance further 'cooled' and framed. During the Reagan administration years in the '80s, several new regulatory proposals to extend acid rain legislation that were accompanied by the various flexibility and burden sharing mechanisms that had already been instantiated in the early EPA emissions trading scheme (bubbles and trading) were blocked by industrial and regional interests through their influence in the House, Senate and Reagan administration. Further use and extension of emissions trading markets evidently did not remain uncontested, should we then look to further factors that may share some responsibility for the ongoing construction of the emissions trading markets?

One response to this question is to return to Mackenzie's understanding of agencement, where this implies investigation of 'less-high status human beings'. It would appear that curiously, this understanding fits rather well with an argument made recently by Matthew Paterson (2009a; and Newell & Paterson, 2010) regarding the importance of analysing the resistance to market development. Paterson maintains that:

The specific contribution here is to emphasise the role played by specific political strategies of resistance in constructing markets, a point which tends to be neglected by authors like MacKenzie or Callon, or relegated to an after-the-fact protest by eco-Marxist writers like those in the Mansfield or Heynen et al

books.(Paterson 2010: 252)

This idea of resistance can seemingly be applied more broadly in this case, not to the markets that have developed per se, but to environmental regulation broadly conceived, and from the kind of anti-market critics such as Carbon Trade Watch and the Durban group, to what have been referred to as the 'Merchants of doubt' (Oreskes & Conway 2010), the 'Skeptics' critical of the need for environmental regulation. It is to this question that I will turn in the following section.

First however, there is a need to clarify what contextualisation means in this instance. If the claim here is that the technopolitical account developed by Mackenzie is problematic to the extent that it fails to adequately contextualise the early market developments, then the question naturally arises here, how should this contextualisation be done? One obvious way given the above arguments might seem to be to combine a technopolitical and political economic analysis in some particular admixture. For examples of this with respect to emissions trading see e.g. Lohmann (2008, 2009, 2009a, 2009b, 2009c) and in the field of political ecology see Castree (2003 and Gareau 2005). This would seem to also be problematic however, on two grounds. On the one hand, these two approaches embody such significantly different and arguably irreconcilable epistemological, ontological and indeed metaphysical commitments as to make their combination (Holifield 2009, Muniesa 2010) untenable within a consistent research programme. On the other hand, there is an arguable tendency for context to overdetermine a finer-grained technopolitical analysis when they are combined. This problem with political-economy/technopolitical accounts is seen very clearly in some of Larry Lohmann's research - with the tendency towards rejection of emissions markets along Polanyian lines, although his technopolitical analysis is not entirely capable of supporting this staunch market rejectionism. Neoliberalism is problematic if taken as a monolithic programme (Barnett 2005) and should arguably be rejected as a causal determinant of action in favour of a closer, relational, actor-network account of agency.⁵

What does, or should, contextualisation refer to in a technopolitical account then? How can it be undertaken? How does it seek to address the two lacunae in Mackenzie's analysis identified above? Fortunately, we don't need to look very far, and can motivate Mackenzie's own claims (2009:171-174) over the shifting context of the EU ETS when comparing the processes of NAP (National Allocation Plan) assessment between phases I and II of the

⁵ This sweeping claim cannot, of course stand as is however, and a fuller exposition of this argument is quite evidently beyond the scope of this paper. It is hoped however, that the position espoused as a positive hypothesis in what follows can be taken as supportive of this position.

market. In this way, it seems possible to drive a wedge between the explicitly given programme of technopolitics, as presented by MacKenzie in his ten precepts, and aspects of his actually undertaken historical/empirical analysis of the development of the early emissions trading markets⁶. Here the argument is that the creation of the emissions trading markets developed under tight political constraints, but that the existence of the markets is beginning to shift these constraints. That is, the boundaries of the political are determined by the construction of 'objective' technical processes such as the use of PRIMES models *precisely because these are removed from political contestation*.

Efficiency is given here not as an ideology, or as a discourse, but similarly to the emissions markets themselves, as involving the development of a heterogeneous agencement. This is understood as reliant upon material, corporeal, technical, and discursive techniques and technologies to proscribe and maintain the abstract conception of economic efficiency and enable its transportation and translation from one setting to the next. In this case, into the early forms of atmospheric pollution regulation and environmental politics in the U.S.

The hypothesis developed here is that the work and action of the early 'skeptics' laid the very ground for the development of precisely what they were arguing against - environmental action, albeit implemented in a marketised, ostensibly least-cost form through the development of emissions trading systems. This is due to their focus on, and foregrounding of, the perceived necessity of economic efficiency, and the specific technopolitical means - the use of Cost Benefit Analyses (CBA) with which this was transported into environmental policy making.⁷ There is a shift in the focus of what is considered natural; the *natural* object becomes an economic one, *not* an environmental one per se. Any environmental regulation must be economically efficient; otherwise it should 'naturally' be rejected. This can be seen then as a potentially important process within the development of the turn to 'liberal environmentalism' (Bernstein 2001) from the late 1970s onwards. This seals the breach between economy and environment opened up through prior environmental arguments e.g. Rachel Carson's 'Silent Spring' (Carson 1962; and the anti-growth sentiments espoused in the

⁶ In this way, I hope to avoid the charge that I am simply trying to be more 'catholic than the pope' and presenting the problem of MacKenzie's technopolitics as if it is simply not *technopolitical enough*.

⁷ This argument is driven by a limited number of sources, and foremost amongst them, the recent text by Naomi Oreskes and Erik Conway (Oreskes & Conway 2010) entitled 'Merchants of Doubt'. This text details the actions and impact of a handful of influential science policymakers in the US to deny or skeptically challenge the developing scientific knowledges around the effects of smoking, the impact of the Strategic Defence Initiative, SO₂ emissions on acid rain formation, CFCs and ozone depletion and most recently and perhaps infamously the skeptical rejection of Anthropogenic Global Warming (AGW).

Club of Rome's 'Limits to growth report' (Meadows et al. 1972), and subsumes the environment under economy as nature 'red in tooth and claw' (Latour, 2004)

Did 'Skeptics' help create the ground for early emissions trading?

Who then, were these 'Skeptics'? In discussing the backlash against global warming, Lahsen (2008) emphasises the role of the physicist founders and leaders of the George C. Marshall Institute - Frederick Seitz, Robert Jastrow and William Nierenberg.⁸ Similarly, Oreskes and Conway (2010) highlight the impact of this small cadre of scientists, with the inclusion of S. Fred Singer. These men all became influential scientific policymakers in and orbiting around US administrations through the 1970s, '80s and '90s. Frederick Seitz was a solid-state physicist whose initial prominence resulted from his contribution to the building of the atomic bomb during World War II. Seitz would later become president of the US National Academy of Sciences. Seitz is notable in his role, from 1979 to 1985, as the director of a programme for the R.J. Reynolds Tobacco Company that distributed \$45 million to scientists to undertake research that could be used in a legal domain to defend tobacco from claims of its carcinogenic impact. Robert Jastrow was trained as an astrophysicist, was a successful popular author and had a long involvement with the U.S. space programme, not least as director of the Goddard Institute for Space Studies. Through the George C. Marshall Institute, Seitz, along with Jastrow and William Nierenberg would develop and circulate papers and literature denying AGW, one notable 'white paper' further developed and propagated the argument that any global warming was due to increased solar activity.

William Nierenberg, also a physicist by training, was a director of the Scripps Institution of Oceanography and served the Reagan Administrations Transitions Team in identifying and suggesting scientists for appointment to prominent administrative positions. Nierenberg was a lead author of the 1983 report of the National Academy of Sciences on the impact of CO₂ on the climate, 'arguably the first comprehensive scientific assessment of the subject' (Oreskes & Conway 2010:79). This report was the first to challenge the developing consensus of AGW and launched the climate change "debate" (Oreskes et al 2008). Beginning in 1982 (and continuing to 1984), Nierenberg also chaired the Acid Rain Peer Review Panel, with responsibility for appointing the nine members of the panel who had been tasked with

⁸ Lahsen emphasises the importance of this trio's very modern faith in technoscience, their attempts to maintain their own prestige, their generally hawkish political outlook and dislike of environmentalists and environmentalism as driving forces behind their skeptical actions. Whilst interesting in discussing personal motivations, from a technopolitical perspective, the more urgent question is how their enrolment of, and within, specific technical agencies influenced and enabled the emphasis on economic efficiency as an overriding goal of environmental policy.

reviewing the output of technical discussions undertaken as part of the U.S.-Canadian Memorandum of Intent on transboundary air pollution, signed by President Carter in 1979. Lastly, S. Fred Singer was literally a rocket scientist, becoming a leading figure in the development of earth observation satellites and the Reagan administration's chief scientist at the Department of Transport. He was also one of the panel members of the Acid Rain Peer Review. In his solely authored Appendix 5 to the 1984 Panel's report, Singer concluded by arguing that 'In the absence of even order-of-magnitude estimates of economic damage attributable to acid deposition, and with emission control costs certainly in the multibillion dollar range, one must question whether we are attacking a million-dollar problem with a billion-dollar solution' (A5-10). Nevertheless, he explicitly suggested a least-cost approach to the regulatory problem of reducing acid rain through application of a bubble on a regional basis and the application of transferable emissions rights (pp.A5-7-8). He explicitly juxtaposes this to the imposition of performance standards, which are described as 'extremely costly and wasteful to society' (p. A5-8)

Oreskes and Conway refer to the 'skeptical' practices of these men as the 'Tobacco Strategy' (Oreskes & Conway 2010:6). In a way, this strategy implicitly claims that facts matter, that knowledge is produced and that scientific consensus can be undermined by highlighting uncertainty. This uncertainty is a clear issue in terms of environmental pollutant and particularly climate change models that develop future scenarios. That is, potential or indicative future histories. Drawing upon Callonian terminology (Callon 2008), framing or producing facts can be seen to require 'cool situations' where facticity is settled and not politically contested. In contrast, the Tobacco Strategy develops and maintains 'hot situations'. In 'hot situations' the development of facticity is impeded due to ongoing political contestation of terms, concepts, and what constitutes evidence. Oreskes and Conway argue that the Tobacco Strategy is applied across a wide number of cases by the skeptics, highlighting the uncertainty inherent in future scenario modelling and therefore the political contestability of, in this instance, the air pollution models underpinning the drive for environmental regulation.

What underpins Oreskes and Conway's analysis are questions of access and funding by politically and economically motivated corporations and pressure groups. In short questions of power. 'Merchants of Doubt' argues that debate was significantly influenced by this small number of powerful scientific policymakers, ideologically opposed to health and environmental regulation, and backed by the significant resources of the tobacco, coal and oil industries. This argument is both important and powerful, but it is not complete. Crucially,

what Oreskes and Conway overlook, and what is raised through a technopolitical analysis, is the way that the creation and maintenance of these 'hot situations', this political contestability, is dependent upon a concurrent construction of other facts or natural objects. That is, the creation of uncertainty is reliant upon the creation of certainty elsewhere - the scientific consensus around the impact of smoking, SO₂ and GHG emissions were characterised and contested as 'bad science' (Oreskes & Conway 2010:6) only through juxtaposition with 'good' science. In the case of the skeptical Tobacco Strategy as applied to the environment, this is undertaken by the widespread adoption of Cost Benefit Analysis (CBA) and the shift in focus to economic efficiency and efficient allocation of resources as 'natural' goals.

CBA as an economic tool came to prominence in the US before the Second World War, as a means for the US Army corps of engineers to deal 'objectively' with the large scale water developments being pioneered after the depression and in the wake of the great Mississippi flood of 1927. (Lohmann 2009:18). The use of CBA techniques and economic technologies by skeptics was designed to delay action, to indicate that it was not cost effective to undertake environmental action at the present time, given the manifest uncertainty in potential environmental outcomes. The skeptics translated scientific uncertainty, in the prosaic sense (related to the development and use of climate models that indicated an uncertain range of potential impacts over a large period of future history), by the use of CBA and the use of heavy future discounting (Oreskes and Conway 2010) allowing long-term risks to be written off. The Flood Control Act of 1936 expanded this usage by emphasising that CBA accounting techniques could be used to check perceived excessive 'pork-barrel' governmental spending by requiring that federal participation only take place "if the benefits to whomsoever they may accrue are in excess of the estimated costs" (Hammond, 1960, p. 5; cited in Lohmann 2009:18). Part of the role of the 'skeptics' is indicated here in the further work of S. Fred Singer. He made early use of CBA as a means to think about environmental pollution and evaluate its regulation in a paper produced and widely distributed in 1977 for the Mitre Corporation. (Singer 1977). The next four years would see the eventual institutionalisation of CBA as central to government regulatory programmes, made definitive through President Reagan's executive order 1229 in 1981. This order required a 'regulatory impact analysis' to be applied to all potential 'major' rule changes, and advised against the adoption of any that did not prove to be economically effective (Lohmann 2009).

In an attempt to fend off, and indefinitely delay environmental regulation, the cost-benefit analyses utilised by a small number of Skeptical scientific policymakers helped to provide

precisely the ground on which environmental regulation could be justified by organisations like EDF and other environmental groups, EPA economists etc. themselves drawing upon a different set of economic technologies that were considered as providing this economic efficiency - the economic theory of pollution permits. Arguably then, the role of the early 'skeptics' through the application of a specific set of CBA tools warrants further investigation regarding the developing emphasis on efficiency in the U.S. environmental regulation from the late 1970s onwards.

Conclusion

This paper has attempted to lay out what could be seen as a convincing case for the further investigation of the role played by the early environmental Skeptics in the development of precisely what they were arguing against - environmental action as undertaken in a marketised form through the development of emissions trading systems. The analysis suggested here views the actions of the Skeptics not simply in terms of their power and access with and to the U.S. government, as this reliance on power as an explananda is seen as missing the technopolitical means through which this change was effected. The use of Cost Benefit Analyses (CBA) by the Skeptics as a means to subject potential environmental regulation to the rigours of a 'naturalised' economics, is hypothesised to play an important role in reconciling environment and economics, with the latter subsuming the former under the rubric of efficiency, in the development of 'liberal environmentalism' (Bernstein 2001).

What does this question bring to the analysis of the construction of the carbon markets? This analysis can be considered a tentative first step in the further investigation of the ways that economic techniques and technologies and the notion of historic efficiency are transported and translated into an international context within the UNFCCC negotiations on the flexible mechanisms of the Kyoto protocol, and into the EU as its region-wide Emissions trading System (EU ETS) as means of interrogating the global political economy of carbon trading as a dominant and yet highly contested form of climate governance. It highlights that, at the least, investigation of the high profile actions of contemporary climate Skeptics might perhaps be profitably investigated as not existing purely outside, that is external to the construction and governance of the markets - but as embroiled in ongoing market construction and governance debates.

This question of the role of the early Skeptics with respect to the construction of the early U.S. emissions trading markets was generated through an attempt to identify weaknesses in

the technopolitical account of emissions market construction undertaken by Donald MacKenzie (2009), namely its failure to adequately contextualise the initial turn to an economic rationality with respect to environmental regulation and governance. The paper attempted to address this weakness by effecting a technopolitical 'contextualisation' of the construction of the early U.S. experience with emissions trading markets. The term technopolitics is used here to indicate the importance of seemingly merely 'technical matters' where these are considered here as 'central to whether over-allocation can be avoided, and thus to whether an emissions market achieves its environmental goals.' (MacKenzie:176) MacKenzie is at pains to indicate that these issues (as highlighted under a performativity approach (see his ten precepts) are elided within much of the literature on emissions trading markets but are crucial in undertaking a 'politics of market design' (MacKenzie:176).

For example, the recent book 'Climate Capitalism' by Peter Newell and Matthew Paterson (2010) contained five points on what 'effective governance' of the markets would require. First, strong targets (caps) are needed to create scarcity in the market 'it needs to government to set strong targets' (Newell & Paterson 2010:160), increase the carbon price and create incentives for development and implementation of low emissions and renewables technologies. Second, rigorous Measuring, Reporting, and Verification (MRV) rules must be put in place. Third, Attempts to relax additionality rules in offsetting projects must be strongly resisted. Fourth, carbon markets need to be structured to incentivise global technological flows - beyond the limited North-South cooperate projects (with China and India hosting by far the majority of CDM projects). Fifth, markets need to be oriented towards adaptation as well as their current focus on mitigation.

A technopolitical approach is instructive in indicating potential problems with the first and perhaps most important of these points. MacKenzie notes that 'A tendency to over-allocation is therefore, a predictable feature of what might be called the 'technopolitics' of constructing emissions markets, and an over-allocated market is useless' (MacKenzie 2009:175). This is due to the political exigencies of getting a market established - concessions to emissions producers, and rent seeking. This would seem to indicate the political difficulty or even impossibility of governments to set strong targets. However, this tendency is counterbalanced in some sense through the ratchet (a technopolitical response to the over allocation) in SO₂ markets and its equivalent in the EU ETS - the commissions use of the NAP formula, 2005 emissions data and the PRIMES model in moving from phase 1 to phase 2. The point here is that the ratchet and NAP formula remove an element of direct political control and therefore political contestation from the cap setting process by the reliance upon object economic and

statistical technologies. The technopolitical agencement involved in the construction of emissions markets hereby changes its own context. Aldous Huxley, author of 'brave new World' once stated that:

“Man is being subjected to his own inventions, that he is now the victim of his own technology and the victim of his own applied science... This is perhaps one of the major problems of our time, we have to start thinking about this problem very seriously, and seeing how we can reestablish control over our own inventions” (quote from Aldous Huxley in conversation with John Morgan for the BBC, date unknown).

Technopolitics puts a particular spin on our understanding of this reestablishment of control - it crucially does not rest in political regulation or reregulation as traditionally understood, but through a grasping of our technopolitical agencements and the reestablishment of control through the very process of subjecting ourselves to our own inventions.

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