The Brave New World of Carbon Trading

by

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Abstract

Human induced climate change has become a prominent political issue, at both national and international levels, leading to the search for regulatory 'solutions'. Emission trading has risen in popularity to become the most broadly favoured government strategy. Carbon permits have then quickly been developed as a serious financial instrument in markets turning over billions of dollars a year. In this paper, I show how the reality of permit market operation is far removed from the assumptions of economic theory and the promise of saving resources by efficiently allocating emission reductions. The pervasiveness of Greenhouse Gas emissions, strong uncertainty and complexity combine to prevent economists from substantiating their theoretical claims of cost effectiveness. Corporate power is shown to be a major force affecting emissions market operation and design. The potential for manipulation to achieve financial gain, while showing little regard for environmental or social consequences, is evident as markets have extended internationally and via trading offsets. At the individual level, there is the potential for emissions trading to have undesirable ethical and psychological impacts and to crowd out voluntary actions. I conclude that the focus on such markets is creating a distraction from the need for changing human behaviour, institutions and infrastructure.

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1. Introduction

The Kyoto Protocol is best regarded as a rather small first step towards controlling the enhanced Greenhouse Effect and preventing human induced climate change. As such the targets have been extremely minimal compared to the 80 percent emissions reductions on 1990 levels stated as needed by 2050 to stabilise atmospheric concentrations in order to stand a chance of avoiding temperature rises above 2ºC (Parry et al., 2008). The agreement, ratified in 2001, requires an average 5 percent reduction in carbon dioxide (CO_2)-equivalent emissions from 1990 levels by 2008-2012, for a limited range of industrialised countries. Various options and variable targets mean even high per capita emitters need not actually reduce their emissions. For example, Australia, as the highest per capita source of carbon dioxide emission,[1] is actually committed by Kyoto to increasing emissions by 8 percent over 1990 levels.[2] Interestingly then much attention has been focussed upon the efficient means of control for minimal reductions, rather than effective means for meeting a set of targets necessary to minimise human enhancement of the Greenhouse Effect. As will be shown, Kyoto's targets have been framed as part of an economic discourse where priority is given to creating gains from trade, extending the role of markets and protecting the profits of potentially vulnerable polluters.

In this debate economic efficiency has been used as an argument favouring the trading of pollution permits. The rhetoric of textbook theory has then been adopted as the grounds for creating new multi-billion dollar international carbon markets. The divorce between the assumptions of economic theory and complex reality has been neglected. Controlling Greenhouse Gas (GHG) emissions involves, amongst other things, understanding the science and its limits, regulating powerful vested interest groups, and addressing the psychological and ethical motives for human motivation. In contrast to orthodox economics, this paper explores these issues and explains regulatory instrument choice, design and implementation as integrally entwined with issues of power. Indeed the importance of addressing the topic from a political economy and public policy perspective is clear from the history behind the development of carbon markets.

During the 1990s direct regulation and taxation were the favoured instruments to achieve GHG emissions targets, especially in Europe. The European Commission (EC) had recommended a carbon tax. In the European Union (EU), as a financial measure, a tax has to be adopted unanimously in the Council of Financial Ministers. Strong opposition from industry and key Member States blocked this approach throughout the 1990s and the original proposal was withdrawn in 2001 (Christiansen and Wettestad, 2003: 6). Between 1997 and 2001 the Kyoto Protocol developed into a trading mechanism.

The United States (US) of America favoured market based instruments and pushed increasingly for carbon trading. Some have argued that corporations pulled governments towards a US styled trading scheme designed to gain themselves maximum benefit with minimum likelihood of needing to control GHGs (Lohmann, 2006b). Certainly there was intense industrial lobbying in Europe against a carbon tax and several major oil companies (e.g. British Petroleum, Shell) supported an emissions trading scheme (ETS) on the basis of experience with internal company schemes (Wettestad, 2005: 8, 10). Yet, not all corporations did support the approach. For example, in Germany permit trading was opposed by politically dominant industrial associations e.g. the Federation of German Industries (BDI) and the Chemical Industry Association (VCI). German industry seemed content with the national voluntary agreements already established which gave it the balance of power over GHGs relative to government (Skjærseth and Wettestad, 2008: 282). However, when the US withdrew from the Kyoto Protocol, in 2001, the power vacuum was quickly filled after a U-turn by the EC which saw Europe adopt US policy in place of its own failed tax initiative (Wettestad, 2005).

Employing US policy advisors the EU then brought in its own ETS which started operation in 2005. Constituting 80% of global turnover in carbon allowances and credits, the EU ETS had an estimated worth of $US51 billion in 2007 (European Commission, 2008: 21) and $US80 billion in 2008 (Kantner, 2008). The EU scheme is being taken as a major pioneering example of the way forward on GHG control. Mainstream economists have advocated global carbon trading as an attractive option for industrial and financial sectors (Stern, 2006). This call appears to have been taken-up by politicians in a range of nations including the two largest per capita polluters. In 2008 the Australian Government (2008a) published a White Paper on its proposed ETS called a "Carbon Pollution Reduction Scheme" (CPRS), and in 2009, newly elected US President Obama pledged to reduce carbon pollution through a 'market-based cap'.[3]

A contention of this paper is that the serious problems posed by human induced climatic change soon become lost amongst concerns for designing complex exchange mechanisms to handle the large scale transfer and management of financial assets. Indicative of the complex design the Australian ETS White Paper extends to 820 pages in two volumes including justifications and explanations for specific policy positions. The Australian Senate had tabled 210 amendments to the scheme in November 2009 before it was voted down for the second time. Wettestad (2005: 14) has argued that the complex nature of the EU ETS, its sub-issues and design dimensions, meant that, despite numerous suggestions and 80 proposed amendments, the Members of the European Parliament were unable to find focal points for concern, their positions lacked coherence and direction, and so relative few changes were actually implemented. Complexity means lack of public transparency and considerable room for manipulation of the process by powerful vested interests, while unintended incentives and consequences are likely and little GHG reduction may be achieved. Certainly the EU experience is far from encouraging. The amount of CO_2 emitted by participating European plants and factories actually increased: 0.4 percent in 2006 and 0.7 percent in 2007 (Kantner, 2008). Meanwhile emissions have been growing rapidly in the transportation and commercial sectors (Grubb, Azar and Persson, 2005).[4]

This paper does not question the urgent need for action on human induced climate change, but addresses the currently most popular economic regulatory approach, carbon emissions trading, and aims to point out some of the pitfalls which seem too often brushed aside. In section 2 a brief summary of the theoretical reasoning behind permit trading is presented including the commonly stated advantages. Section 3 explores how both physical and institutional aspects of the enhanced Greenhouse Effect actually violate the assumed conditions of the theoretical model, which ignores important aspects of physical and social reality. This includes showing how specific vested interest groups gain from and therefore support ETS implementation. Section 4 then looks at some key features of actual ETS design and the problems that have arisen due to asymmetric information, strong uncertainty, national protectionism and corporate power. Specific attention is paid to emissions budgets, permit allocation and emissions offsets. Section 5 turns to the role of individual voluntary actions and the potential for unintended negative consequences of an ETS, covering psychology, ethics and crowding out of desired behaviours. As will be shown, GHG trading schemes may actually increase the problem they are supposed to reduce, while also creating new problems. This supports alternative, simpler and more easily controlled and less easily captured regulatory devices (i.e. legislation and taxation) and direct action (e.g. changing infrastructure and institutions).

2. Idealised Pollution Control in Economic Theory

Pollution is conceptualised in economic theory as a limited aberration on an otherwise perfectly functioning market system. There are many competing firms none of which has power within the system or can influence prices. A pollutant is typically described as relating to a stationary point source, isolated from other pollutants, and easily controlled at a known cost.

Pollution control in economics is based upon efficiency analysis. The optimal quantity of a pollutant is determined by the associated pollution control costs and the benefits of control. The textbook approach assumes the existence of complete, continuous and known marginal cost and benefit functions. All damages are assumed to be known and expressible in monetary terms. Such a complete damage function means each (marginal) unit of pollution has an associated benefit when reduced, i.e. the damages avoided. This means a change in the output of pollution at any level can be described in terms of the net social costs. Where pollution has been unregulated the optimal reductions are determined by moving to the point at which further reductions cost more to control per unit than they benefit society in terms of avoided damages.

In this idealised setting an economic planner could chose to either set regulations to meet the optimum quantity of pollution or institute a tax to do the same. Of course a central planner could set a standard on a different basis from economic efficiency e.g., a politically acceptable standard or one set to meet a variety of other competing goals (e.g. health, precaution, fairness, equity, industrial competitiveness, rare species protection). In these circumstances economic arguments revert to debates over the most cost-effective approach for pollution control, i.e. concentrate upon control costs and ignore direct benefits from damage reduction.

Pollution taxes can, in theory, be set so as to reflect social damages and impose a cost per unit of pollution on the producer. This would make polluters pay for emissions they continue to release plus the cost of any pollution control to meet the standard. Variable rate taxes may then be set to match exactly the marginal social benefit function or a uniform tax rate may be set at the level where marginal pollution control costs equal marginal benefits of control. Taxes may then be used to raise government revenue in a way which is consistent with economic efficiency (i.e. taxing a bad) and this can be used to replace non-efficient taxes (e.g. on labour). In contrast to such a tax, a legislated standard (i.e. direct regulation) allows polluters to avoid paying for the social damages of pollution they continue to emit below the standard and restricts their liability to the control costs of reducing pollution to the standard. Standards have then tended to be preferred over environmental taxes by polluters and their political allies. Hence, neo-liberal governments typically avoid taxes on polluting firms and prefer voluntary agreements and technical fixes.

Tradable permits offer something of a hybrid between direct regulation and taxation, the two traditional economic textbook approaches. The idea is to set a standard which is regulated by issuing permissions to pollute. Permissions, or permits, are defined in appropriate units (e.g. tonnes of carbon) per period of time (e.g., per year). Polluters must then have enough permissions for the amount of pollution they produce in a given period. This has no economic efficiency aspect but merely places a cap on pollution. A central planning authority handing-out permissions is no different from one setting and enforcing a legislated standard.

The economic efficiency aspect arises from making the permissions tradable. This means rather than a polluter having no choice but to reduce pollution in line with their existing permissions they can alternatively seek to obtain more permissions on the open market. In textbook design a perfectly functioning market operates so that polluters with high control costs buy permits from those with low costs, and via arbitrage social gains occur. In brief, the expectation is that difficult to control sources of pollution will buy permits to continue polluting, while easy to control sources reduce emissions and sell their unused permits for a profit. The basic model assumes polluters know the costs of controlling their emissions, there are no transaction or information costs in finding and trading with other permit holders, and all parties have equal power in price negotiations. Economists have of course developed variations on the basic model (e.g. multiple pollutants, non-point sources, transaction costs), but the underlying theory remains as sketched here. Indeed, the contention of the following sections is that the problems arising from moving out of the textbook and into reality have been inadequately addressed.

3. From Theory to Practice

There are two broad sets of concerns over applying economic pollution control theory to the problem of human enhancement of the Greenhouse Effect. First, a simple pollutant model assuming localised known impacts proves inadequate for capturing the essential characteristics of the problem. The standard economic discourse on minimising control costs is then highly misleading. Second, a lack of realism in terms of market structure, and a total absence of anything in the economic model relating to power in society, mean implicitly adopting the existing political economy without awareness as to the consequences for public policy. These problems have implications for the choice of regulatory approach and what should realistically be expected from an ETS, which is being primarily advocated on grounds of economic efficiency.

Oversimplifying a Complex World

Although much literature and public debate discuses only CO_2, and the EU ETS is limited to this one gas, the enhancement of the Greenhouse Effect involves multiple pollutants often interdependent and simultaneously released, e.g. CO_2 and nitrous oxide (N_2O) from fossil fuel combustion. Indeed CO_2 is only responsible for approximately half of human induced climate forcing and the other half has been attributed mainly to N_2O at 6%, methane (CH_4) at

15%, and chlorofluorocarbons (CFCs) at 17%.[5] The six GHGs covered by the Kyoto Protocol are CO_2, CH_4, N_2O, sulphur hexafluoride (SF_6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs).[6] Problems have arisen in trying to compare the role of different GHGs by converting their concentration—accounting for different radiative properties and residence times in the atmosphere—into a single carbon metric, i.e., CO_2-equivalent. Such calculations risk assuming away the uncertainty involved in measuring, comparing, and aggregating, but seem appealing to those trained on the single pollutant model. The tendency is then to regard CO_2 as the only gas of concern which has led to incorrect conclusions in economic assessments (Spash, 2002 Chapter 6).

Source emissions are also hard to characterise. The key human activities contributing to GHG emissions varies tremendously between countries due to their industrial development and role in basic resource supply as opposed to manufacturing. In the EU (15 member states) sources of GHGs were estimated in 2006 as: 33% energy production, 21% industry, 19% transport, 15% households, 9% agriculture, 3% other (European Commission, 2008: 15). In Australia GHG sources have been estimated as: 50% stationary energy production, 16% agriculture, 14% transport (90% road transport), 7% net land use change (deforestation 11% minus reforestation), 6% oil and gas extraction, 5% industry, 3% other (Australian Government, 2008a: Chapter 6).[7] Thus, while energy production and consumption dominates as a source in both regions, 27% of gross human induced GHG emissions for Australia are attributed to agriculture and land clearance. Imposing a comprehensive ETS, as recommended by economic theory to achieve efficiency gains, will have highly variable impacts depending upon the mix of sectors involved. Clearly many sectors fail to match the typical theoretical characterisation of a polluter as a stationary smoke stack industrial manufacturer with easily identifiable emissions.

GHGs are widely spread throughout the economic structure of the modern economy and, due to embodied energy, relate to all products and processes. They are all pervasive in the economic system. The simple economic model assumes changing the price of a pollutant will have a limited impact which relates to a specific isolated product from a single sector. Thus, control of the pollutant has limited knock-on effects and can be analysed in a partial equilibrium framework. Due to the all pervasive character of GHGs changing their price affects all the prices in the economy and is highly unpredictable in consequence. This mitigates against any simple claims of economic efficiency in regulatory tool selection and policy design. Consider a few issues this raises.

There is path dependency. For example, placing permits on electricity generating sources first will have different outcomes compared to placing them on transport sectors first. ETS schemes are implemented in partial ways on some sectors, and selected GHGs, while excluding others. Which gas is controlled from which source and in what order will then influence future costs, but the implications are unknown even at a single point in time let alone for entire cost functions over time and across sectors. Economic analysis proves lacking. Static equilibrium models fail to capture such dynamics while the social indeterminacy of control costs is ignored completely.

There is interdependence and endogenous determination of prices and costs. The costs of controlling pervasive pollution are a function of any price placed on the pollutants. For example, carbon pricing changes relative energy source prices and energy versus labour cost, both of which affect the cost of different types of products and processes including methods of emissions abatement. So under an ETS there is a fundamental but unpredictable interdependence between permit price and control costs. Abatement costs are meant to be technically determined and independent of ETS allocations (Rose et al., 1998). However, as Vira (2002) has argued, the initial allocation of permits can influence incentives to search for low-cost abatement options and so the pollution control function, e.g. due to affecting the size of the market and so technological innovation and change. Endowment effects also predispose people to stick with their initial allocation rather than actively trading (Thaler, 1980). This means equity and efficiency are linked so violating another basic assumption of mainstream analysis.

As pervasive value concepts GHG control costs are complex and contested. Pollution control costs are typically assumed to be straightforward market prices, as if going out to buy, say, a filter to purify your water. They are therefore normally regarded as easy to calculate compared with the benefits of control, which relate to damages. This is because damages involve issues, such as loss of life, which have proven highly contentious when monetised (Spash, 2002: 188-191), and refusals to trade-off aspects of the environment for money, e.g., as evident in contingent valuation studies (Spash, 2000a; 2006). That such issues are assumed irrelevant to control cost estimates is plainly false. Control costs themselves can involve all the same aspects that typically fall under benefit assessment. First, determining nomenclature as cost or benefit is a matter of the adopted status quo from which pollutants are to be adjusted (Spash, 1997; 2002: 172-173). For example, assuming emissions pre-exist and must be reduced is different from assuming no emissions and an activity (e.g. new plant) will add them afresh. In the former case avoided damages are a benefit and lost firm output a cost, while in the latter damages are a cost and firm output a benefit. Second, within control cost calculations contentious value categories may arise. For example, a statistically recognisable number of people may die in the process of implementing control strategies (e.g. in the construction industry or a production process) with some control methods far riskier than others. Third, where negative costs arise this is just another approach to assessing (secondary) benefits. For example, planting trees to absorb carbon may have positive impacts on wildlife and biodiversity, provide recreational opportunities and protect watersheds. Carbon pricing of petrol may reduce road use and save lives. Under economic efficiency criteria, all such beneficial outcomes should be taken into account as reducing the social costs of any project aimed at GHG reduction. So, claims of social efficiency, by regulators or polluters, require calculating the GHG marginal abatement cost function which is far from straightforward, known or even knowable.

Mainstream economics focuses exclusively on efficiency analysis and recommends ETS on the basis that it can reduce a known set of technically determined abatement control costs. All the problems outlined here mean claims of efficiency gains for any regulatory instrument are far from clear or determinate. Transferring textbook predictions will lead to exaggerated and unrealistic expectations, and ignore complex interactions. Claims for an ETS being the most efficient policy instrument cannot then be substantiated. This means mainstream economists' main argument for policy choice is inoperable. Economists pursue efficiency as a narrow, professionally defined, technical matter, which then becomes the dominant form of discourse, negating other concerns. The assumption is that other goals can be dealt with as totally separate matters, in an unspecified political process, without impacting on the economics. As most people recognise, efficiency is but one goal and its pursuit a societal choice. Other goals may be adopted as more easily substantiated and more important (e.g. precaution, effectiveness, equity), and be achieved more easily using policy measures which treat them as primary rather than secondary concerns.

Markets, Power and Vested Interests

Economic assumptions are also challenged by the reality of market structure. In basic economic theory firms are price takers with no market power. In practice most markets involve mixed structures, often with considerable concentrations of power amongst some large corporations and multi-nationals, e.g. the energy sector. This has a variety of implications.

Rather than being price takers and setting prices according to marginal production costs the powerful firm is able to engage in such practices as mark-up pricing, price discrimination and monopsony. The potential for price manipulation and variation due to market structure means the standard assumptions of marginal costs rising under an ETS, and price signalling working to indicate social costs of pollution, no longer hold. In a study of imperfect competition in the energy market, with an empirical application in Italy, Chernyaus'ka and Gulli (2008) found the impact of an ETS on pricing was indeterminate a priori—even for the direction of change—being dependent upon the specifics of market structure and various institutional aspects.

Market power also means more than just the ability to manipulate prices, collude or use mark-ups. Galbraith (2007 [1967]) explained the modern industrial economy as consisting of two sectors: one in which producers are small, lack power and subject to competition, and the other in which producers are large, have considerable power and run by professional managers (the technostructure). The problem which Galbraith then exposed was the close relationship the technostructure develops with politicians and regulators. This is particularly relevant to climate change because the energy and transportation sectors are dominated by large national and international corporations able to access considerable resources and lobby politicians to achieve institutional arrangements suited to their own ends.

A few examples suffice to show the Galbraithian analysis is worthy of closer attention in the context of human induced climatic change. US business has been cited as spending up to $US100 million in the late 1990s to fight the Kyoto Protocol (Grubb, Vrolijk and Brack, 1999: 112). Supposedly objective economic studies emphasising control costs and downplaying the damages have been funded by vested interests, e.g. US electric power generators (Chapman and Khanna, 2000; Spash, 2002: 160). Climate sceptics have been organised and funded by polluting corporations (Lohmann, 2006b: 41). Yet not all such vested interests are opposed to carbon trading.

Powerful vested interest groups support permit trading for good self-interested reasons. Polluting industries see the potential for massive financial rewards in return for their participation. For example, under the EU ETS, Europe's largest emitter, the German power company RWE, is estimated to have received a windfall of $US6.4 billion in the first three years of the system (Kantner, 2008), and made €1.8 billion in one year by charging customers for permits it received for free (Lohmann, 2006a: 91). The Australian Government (2008a) ETS has proposed reducing petrol taxes to protect road transport against price rises, and giving free permits to trade exposed large point sources, such as aluminium smelters. The scheme, covering 1000 firms, has also shown Galbraithian characteristics in proposing large polluters be 'compensated' with free permits while the smaller more numerous competitive fringe face buying theirs at auction. Such 'compensation' to polluters on the basis of emissions intensity means that the worst (brown coal-fired power stations) gain the most. In the first 5 yrs of the proposed scheme the electricity generating industry has been estimated to be in line for over 130 million free permits worth $AUS3.9 billion in nominal terms (Macquarie Capital Group Ltd., 2009: 8).

A clear aim has been to implement emissions control without impairing industrial competitiveness and in this regard carbon trading has been seen as most favourable (European Commission, 2001: 5). Specific industrial sectors or industries have argued for protection, from price effects due to carbon pricing, and particularly exporters (e.g. aluminium). However, such large wealth transfers as have been occurring under the EU ETS now look like illegal hidden subsidies (Grubb and Neuhoff, 2006). Where cost price rises occur in one country, due to carbon pricing, but not in another, the case is made for an unfair advantage of the latter over the former. The relative difference might be avoided if all competing sectors were facing similar GHG control measures in all countries. However, if European experience is typical, excessive free permit allocation in some countries and to specific sectors is likely to create competitive distortion between different countries. Governments seem to fear the political consequences of 'underallocation' to specific sectors more than those of collective 'overallocation' (Grubb, Azar and Persson, 2005: 130).

Banking and finance is another powerful sector aiming to profit from ETS and related sequestration projects. Financial speculators and bankers see permits as financial instruments which provide money making opportunities. Professional financial intermediaries, advisors and investment banks have identified a new advisory role and potential for commission and brokerage fees. Already many have established climate change and emissions trading specialist groups. A clear attraction of ETS schemes for countries with established international finance and banking sectors is to establish superiority in the new financial markets trading carbon. As the Australian Government (2008a: 1-7) has stated:

> "One of Australia's major opportunities lies in being well placed to provide the necessary financial services to support developing carbon markets in the Asia–Pacific region. Australia has significant competitive advantages as a potential hub for emissions trading and related financial services in our region."

This is an aim undoubtedly shared by other countries for their financial centres such as London, with the potential noted in the UK Government's Stern report, and New York in the event of Obama's ETS. The transaction costs inherent in an ETS appear to be viewed by some as a source of economic growth, rather than a deadweight loss.

Typical amongst economic advocates of ETS in this regard is the much publicised report by Stern (2006) and colleagues. They regard GHG control as a "pro-growth strategy" (Stern, 2006: iii) which should offer positive financial returns for investors and stimulate new technologies. The report emphasises the great opportunities for banks and the financial sector in funding pollution reduction (i.e. defensive expenditures) and partaking in carbon trading (Stern, 2006: 270). The fact is that, while necessary due to past mistakes or systems failures, defensive expenditures add nothing to, or even detract from, human welfare because they are countering a societal problem, and should be distinguished as such in GDP measures (Spash, 2007: 711). Being forced to make expenditures to protect yourself against increasing threats of harm (e.g. pollution, crime, violence, war, floods and fires) is not a sign of societal progress, improved welfare or raised living standards.

What should be clear is that regulatory instruments are not neutral either politically or ideologically. They play to specific groups within society. The grounds upon which the ETS approach is then promoted, as a gain for public welfare, diverges from the reality of who actually advocates the scheme due to the potential for private gain by their social group or organisation. This becomes even clearer once actual ETS design is considered.

4. Designing Emissions Trading Schemes

While many recognise emissions trading has problems there is a general belief that these can be designed away. Thus, the EU ETS Phase I (2005-2008) has been regarded by advocates as a trial or test run showing the faults which Phase II should correct. Yet, the design of carbon trading schemes has involved several controversial aspects which undermine the effectiveness of hoped for pollution control. This section contends such problems cannot be simply designed away, and three interrelated issues are explored. The first is the calculation of and accounting for the amounts of gases being released and absorbed in the global system (e.g. carbon budgets); the second, the allocation of allowances; the third, permitted actions meant to offset the impacts of GHG pollution after its release. Each issue will be shown to involve complexity leading to unrecognised strong uncertainty. The role of vested interests, discussed in section 3, recurs and their power is seen as aimed at achieving ends which have little to do with GHG control.

Greenhouse Gas Accounting

Achieving national emissions reduction under any regulatory approach requires knowing the responsibility of different sources for emissions and being able to monitor or otherwise estimate their compliance. Identifying and regulating key contributors would be the aim to achieve effective control. The difference under an ETS is the attempt to make GHGs themselves a valuable item of exchange which then implies having a comprehensive accounting system to achieve the claimed efficient outcome. This assumes a level of certainty about sources and sinks which is unattainable.

For example take the carbon cycle. In theory understanding all the various elements which globally produce and absorb CO_2 is a matter for objective science to conduct physical calculation of a carbon budget. To this end CO_2 has been the subject of serious study and monitoring since the 1950s (e.g., Revelle and Suess, 1957). Yet source emissions are calculated to far outweigh known sinks. The global carbon budget has persistently involved a large amount of CO_2 unaccounted for by atmospheric uptake alone, suggesting other major sinks e.g., the oceans. Debate has persisted as to where this CO_2 might be going and in earlier literature it was referred to as 'missing'. While knowledge of carbon sources and sinks has improved over time, the margins of error remain large leaving the status unclear as to whether some parts of the cycle are net sources or sinks (Stephens et al., 2007). The response of natural systems to climatic change is a further source of uncertainty due to feedback loops (e.g. ocean uptake as climate warms, tree growth impacted by fires and pest infestations). In practice the carbon budget is surrounded by unknowns, ignorance and social indeterminacy (see Spash, 2002 Chapter 5). Rather than accepting such strong uncertainty, and developing social and institutional mechanism whereby it might be addressed, the pretence remains that perfect knowledge can be obtained by more research and idealised carbon accounting can be achieved.

In reality baseline GHG (e.g., carbon) levels, necessary for ETS source permissions and sink credits, have become matters for political negotiation. Thus, during the attempts to get Kyoto ratified in 2001 Russia and Japan refused to sign until they received additional carbon credits for their domestic forests (Lohmann, 2006b: 53). They succeeded and so effectively increased their carbon sinks on paper. Famously, under Kyoto, Russia and the Ukraine were awarded excess carbon allowances due to baseline projections calculated for the economic structure of the former USSR. These permissions became known as "hot air" due to being meaningless in terms of actual carbon. That is, rather than giving permits relating to an existing pollution source they related to historically existing sources no longer operational. No actual existing pollution is then reduced by the sale of the permits. In the late 1990s environmental NGOs were particularly concerned about the ability of polluters to buy Russian hot air and so avoid controlling their own emissions (Wettestad, 2005: 10). Purchasing these cheap hot air credits was seen by the US as a means of avoiding control and used as such in the Kyoto Protocol bargaining negotiations (Lohmann, 2006b: 52). Avoiding real emissions reductions by using such purchases remains an issue in light of the expected failure of countries to meet Kyoto targets (Grubb, Azar and Persson, 2005: 131).

International agreement as to country emissions caps requires a negotiation process.[8] The EU ETS took the Kyoto target of an 8% reduction over 1990 levels as a bubble for the Member States and then set differential targets allowing some countries to substantially increase emissions over 1990 levels (e.g., Portugal 27%, Greece 25%, Spain 15%, Ireland 13%) while others are meant to cut back (e.g. Luxembourg 28%, Germany 21%, Denmark

21%, Austria 13%, UK 12.5%). Such international caps are highly contested and under Phase II of the EU ETS some countries have taken legal action against the EC.[9]

Permit Allocation

Allocating permits is equivalent to attributing polluters a property right. Much is sometimes made of the temporary aspect of permits (e.g. only being valid for a year) and that they are not a transfer of property rights. Experience shows otherwise, e.g. water permits in Australia. Once permits systems are established, and permits have been allocated, a Government has created property rights for pollution which the courts may well protect. Subsequent attempts to reduce the numbers of permits (i.e. tighten the cap) could then require the Government buying back permission initially given away for free. Countries subject to a carbon cap and wishing to establish an ETS, must therefore decide how to distribute permits knowing the potential for a shift in property rights.

Permits could be auctioned with the revenues going to the public purse which would allow reduction of discretionary taxes (e.g. on labour and savings) or targeting at infrastructure change for GHG reduction. However, the political preference has been for giving away permits to existing polluters.[10] Typically this involves reference to historical emissions—termed grandfathering. An alternative is to choose a 'benchmark' or standardised level of pollutant related to an input or output for a given type of technology and production process.

Allocation under grandfathering tends to use a 'business as usual' baseline. In economic textbooks actual emissions would be the reference, assuming perfect knowledge. In practice data are unavailable, costly to obtain and uncertain. Phase I of the EU ETS saw member states rely on companies self-reported emissions estimates. These estimates are susceptible to self-interested framing and manipulation or simple over optimism. The 'business as usual' baseline requires forecasting economic growth and other factors influencing output and so becomes influenced by numerous assumptions reflecting the primary concerns of those producing the estimates. Government growth promotion and protection of industrial exports leads to high baseline estimates. As Grubb, Azar and Persson (2005: 132) note:

> "Government-industry negotiations contingent upon industry forecasts exacerbate the natural tendency of industry (and governments) to be optimistic about growth prospects, by rewarding those that exaggerate the most. Since industry has all the real data, and governments are likely to be risk-averse, the negotiations are inherently one-sided. It is a poor approach to adopt in the face of genuine uncertainty and incomplete (and asymmetric) information.
>
> Even worse, the prospect of future allowance distribution being contingent upon recent emissions ('updating') gives a direct incentive to industries to inflate actual emissions."

These authors state that, this approach over-allocates permits risking a collapse of the trading system and little or no abatement. This is exactly the situation arising under Phase I of the EU ETS, which within a year had run into problems, having created too many permits, freely given to major polluters. This drove the trade price from €30 to €12 from April to May 2006 and eventually it reached a low of €0.1 (Skjærseth and Wettestad, 2008: 276, 280). European industry "played a major role in weakening Phase I allocations to a point that may undermine the credibility of emissions trading as an effective instrument" (Grubb, Azar and Persson, 2005: 135).

In using an ETS as a means of gaining industrial polluters' cooperation a positive incentive is created for exaggerating emissions. Yet, some analysts seem unaware of the potential for industry to have a considerable information advantage over government and to use this for their own ends. For example, commenting on the proposed Australian ETS, a senior economist, now with Australia's Department of Climate Change, stated:

> "With very few exceptions, nobody is actually going to be measuring carbon emissions. It's not a matter of putting a gizmo in a smoke stack and measuring carbon as it goes past, it is really about getting the accounting systems in place." (Hatfield-Dodds quoted in ECOS, 2008: 23)

Exactly how verification of source emissions and their control is then meant to be effective (let alone efficient) is unclear.

Australia also has some prior experience in this area from which to learn. The New South Wales (NSW) Greenhouse Gas Abatement Scheme (GGAS)[11] commenced in January 2003 as a pioneering carbon ETS. This involved no actual emissions measurements, but rather 'business as usual' scenarios (MacGill, Outhred and Nolles, 2006; Passey, MacGill and Outhred, 2008). The liable entities were retailers and some large industrial electricity users. For electricity generators the scheme was a potential source of revenue as they could generate permits if their emission intensity was below baseline. Using high average historical baselines meant even brown coal fired power stations obtained permits. The majority of initial permits were emissions reductions attributed to existing or already commissioned electricity generating plants (Passey, MacGill and Outhred, 2008), i.e., were likely to have occurred anyway. Most controversially, the scheme included permits for reducing electricity consumption. Commercial providers (or 'eco-entrepreneurs') claimed permits for 'residential projects', which consisted of handing-out (mostly in shopping centres) free low-energy light-bulbs and water-efficient showerheads. A subsequent audit found that fewer than half of these devices were actually installed, leading to tightening of the regulations, but not before the commercial providers had been allocated millions of permits (Crossley, 2008). Permits created from demand side abatement jumped from 1.5m in 2005 (15% of the total) to 8.9m in

2006 (45%) (IPART, 2008). Unsurprisingly, permit prices fell dramatically from A$14 in mid-2006 to $A6 in late 2007. During the scheme, projects offering genuine new emissions reductions over business as usual are likely to have been priced out of the market.

Large price fluctuations also point to the potential instability of an ETS. A frequently stated aim of ETS is to provide certainty to industry, yet, even without the design problems noted above, there is no reason why carbon prices should be any less volatile than for other commodities. Carbon price volatility is subject to the "vagaries of near-term economic and emissions growth trends and related variables such as weather and gas-coal price relationships" (Grubb, Azar and Persson, 2005: 135). It can be exacerbated by speculators using the market purely to gain trading profits (e.g., selling high and buying low), which has nothing to do with pollution control. Firms may seek to reduce their exposure to price volatility through the use of forward contracts and hedging; however, such deals can usually only be made a few years in advance (due to counterparty risk). There is also the significant matter of uncertainty surrounding changes in government rules and regulation which are liable to be greater in a regulatory ETS than in most other markets.

Emissions trading in itself cannot therefore provide polluting firms with certainty about future carbon prices (despite the confident predictions of economic modellers). Its attraction is more likely to relate to the potential windfall gains of free permits. Indeed overallocation, market power, profiteering and speculation can actually increase investment in polluting technologies. For example, Lohman (2006a: 91) cites the case of Czech electricity giant CEZ being allocated a third of the country's allowances, selling them in 2005 when the price was high, being able to buy them back after the price collapsed and then using the trading profit to invest in coal energy production.

Emissions Offsets

The concept of “offsets” was created under the Kyoto Protocol to refer to emissions reductions not covered by the cap in an ETS. A standard permit system requires a seller to have controlled their source emissions to be able to sell a permit. Offsets are based upon projects which are disassociated from the polluting source and either reduce GHG emissions elsewhere or increase the capacity of a sink (e.g. forests, soils) to absorb GHG pollution (e.g. carbon), beyond ‘business as usual’. Offsets are also now widely traded outside the Kyoto-compliance market, including by individuals and firms voluntarily aiming to offset their GHG emissions (as discussed in Section 5).

Under Kyoto offset projects fall under either the Clean Development Mechanism (CDM) or Joint Implementation (JI) and create credits called certified emission reduction (CER) and emission reduction unit (ERU) respectively. Currently CDM projects are the major source of Kyoto offsets and occur in industrially developing countries falling outside any Kyoto emissions limits. JI refers to projects based in industrialised countries, typically Eastern Europe. Kyoto offsets were intended to provide industrialised countries with greater flexibility in meeting their caps whilst supporting sustainable development, and are also referred to as “flexibility mechanisms”.

Despite the “emission reduction” *nom de plume* these offsets do not require a polluting source to reduce emissions, but instead allow them to increase emissions and then aim to offset them elsewhere. They could just as sensibly be called certified “emission increase” units. While net global emissions reductions should occur for source offset, where sink offsets are involved the total scale of systemic GHG cycling will be expanded (e.g., via more sources justified by more sinks). Such a process seriously risks further enhancing the Greenhouse Effect. Offsets also suffer from a range of other problems.

The purely physical carbon accounting aspect of equivalence between source and sink is technically fraught with problems. For example, the amount of added uptake in trees and soils is highly variable on the basis of local environmental conditions, skills of foresters, management practices and enforcement of regulations. Forestry can also cause disturbance, erode soils and release carbon.

Offsets assume physical equivalence for diverse points in a GHG's cycle where serious non-equivalence prevails. For example, strong uncertainty surrounds the permanence of different carbon offsets. "A tonne of carbon in wood is not going to be 'sequestered' from the atmosphere as safely, or as long, as a tonne of carbon in an unmined underground coal deposit." (Lohmann, 2006a: 155). During negotiations in Bonn prior to the 2009 Copenhagen summit on new Kyoto targets the case was put forward by Australia for excluding natural disasters, which basically means if, say, forests planted as offsets burnt down they would be treated as still existing.[12] Human intervention, pest infestation, fires, climatic change and so on all affect forestry, and then it has a natural rotation cycle in which carbon is released.

The inability of sinks to compensate economically for increased sources adds further complexity. For example, afforestation and soil management are supposed means of compensation, but economic compensation means an equivalent welfare change. That is the source-related harms must equate to the sink-created goods. This means assessing the damages and social problems created by forestry schemes e.g. peasant dislocation and resistance, privatisation of common lands, acidification of soils, excessive water use, inappropriate plantings for environmental conditions. Thus, Lohmann (2006b: 38) claims the IPCC report on "Land Use, Land Use Change and Forestry" which backed equivalence and "trading trees", as he puts it, failed to address such complexities and assumed them away. The reason appears to be national self-interest, as he states:

> "Over half of the authors and editors of the chapter examining the technical possibility of countries' claiming carbon credit from 'additional land and forest activities' within

their borders were from US, Canada or Australia—the three countries most active in demanding credit for wooded land." (Lohmann, 2006b: 38)

Interestingly then the EU ETS has so far excluded credits generated from land use, land-use change and forestry activities (European Commission, 2008: 23).[13]

Despite such problems, there is a major potential for Kyoto offsets to take over the functioning of any ETS. In June 2009 there were 1,600 registered CDM projects creating 300 million CERs, and by 2012 around 2,900 million CERs are expected.[14] A CER is equal to one metric tonne of CO_2-equivalent. Offsets are therefore a growth industry for supplying GHG credits for sale to polluters on the open market. As the EC (2008: 24) notes:

> "The strong demand for emission credits has led major European banks and other financial institutions in both the private and public sectors to become active in providing finance for prospective emission reduction projects. In addition, many international carbon funds have been set up."

European countries already know they will fail to meet their Kyoto targets and so a number of governments plan to buy offset credits totalling around 550 million tonnes of CO_2 to help meet their Kyoto obligations, and have budgeted some €2.9 billion for these purchases. In addition, businesses in the EU ETS are expected to purchase 1.4 billion tonnes of CO_2 offsets from 2008-2012 (European Commission, 2008: 24).

The Kyoto Protocol specifies offsets be supplementary to domestic action. This "supplementarity principle" is referred to in Article 6(1)(d), Article 12(3)(b), and Article 17, but all three Articles leave the exact meaning vague. The Marrakesh Accords,[15] which elaborate on the rules for offsets, state that: "use of the mechanisms shall be supplemental to domestic action and that domestic action shall thus constitute a significant element of the effort made by each party included in Annex I to meet its quantified emission limitation and reduction commitments". Exactly what constitutes "a significant element" is open to interpretation.

Under Phase II of the European scheme the EC has been referred to as envisaging up to 8 percent of allowances being imported from CDM and JI projects (Grubb and Neuhoff, 2006: 19). However, this remains unconfirmed. The proposed Australian scheme set no target levels defining 'significance' and allowed unlimited import of international Kyoto compliant emissions offsets. This runs the risk of violating the Kyoto supplementarity principle, although the Government stated confidence that there would be domestic reductions (Australian Government, 2008a: 11-8) and these would be significant (Australian Government, 2008b: C-23). Unlimited import means most abatement would occur outside of Australia with the price of CDM and JI credits setting the price of domestic permits (assuming they are not over allocated in the first place). The justifications given for international linkage were the desire for a market based least–cost solution and the support of industry e.g. BP and the International Emissions Trading Association (IETA)[16] (Australian Government, 2008a: 11-3). Support for unlimited CDM and JI credits to be traded also came from the industrial sector with the IETA and Australian Industry Greenhouse Network both quoted as backing the position (Australian Government, 2008a: 11-8). The extent to which international offset mechanism are permitted clearly has a great impact on whether domestic emissions are actually reduced.

Australian ETS design proposals have included not only unlimited CDM and JI credit imports but also unlimited Australian forestry offsets (Australian Government, 2008a: 6-50). This excluded developing country forestry because the related credits under Kyoto are temporary, creating an undesired renewal liability (Australian Government, 2008a: 11-12 to 11-13). However, the Government gave clear indication that developing country offsets from reduced deforestation and forest degradation might be acceptable in future (Policy Position

11.9), and this was enough for an investment bank to state it was targeting development of six commercial projects over 3 years on the basis of expected future compliance recognition (Macquarie Capital Group Ltd., 2009: 11).

The potential for exporting emissions control also raises serious concerns over the credibility of offsets. Foremost is the issue of determining what would have been undertaken in any case, i.e., baseline scenarios. This means credits for sink offsets should relate to additional GHG absorption beyond that which would have occurred in any case e.g. excluding all forests planted anyway for other reasons such as conservation or commercial forestry. Source offsets should be real changes in emissions which would have actually occurred otherwise not just changes in arbitrary or manipulated paper projections. So the same problems arise as under permit allocation, namely vested interests making projections as bleak as possible in terms of GHG emissions in order to gain as many marketable emission credits as possible. For example, projecting two new coal fired plants would be built when only one was ever intended and then claiming the fictional plants emissions have been reduced. The inclusion of offsets within ETS is argued to reduce overall compliance costs, but seems to actually risk compromising the integrity of any emissions reductions.

Verification, enforcement and monitoring become major concerns both because of the potential abuse of 'business as usual' projections and the neglect of social and environmental impacts. Lohman (2006c) has documented a series of case studies exposing problems with projects claiming, or trying to claim, carbon offset credits.[17] Amongst the numerous problems, heavy polluting industries are given a new source of funding which may perversely increase local health and environmental damages, while making globally harmful pollutants (such as HFCs) positively valuable by-products.[18] What becomes clear from across Lohman's case studies is a disregard for local communities and their concerns. Those implementing such offset schemes seem to lack the skills to understand and address the problems of people in some of the poorest areas of the world. For example, inappropriate exotic species and monocultures used for forestry have resulted in communities trying to maintain trees which die due to poor soil conditions, are lost due to fires and drought and which displace more sustainable practices and take away people's livelihoods. This is more damming because of the aforementioned claim of offsets to support sustainable development.

One response to the problems with CDMs has been the "Gold Standard" offset, which began as an attempt by the World Wide Fund for Nature to evaluate additionality and address concerns over neglected environmental and social impacts. Projects gaining Gold Standard certification can claim a price premium, but if carried out effectively will cost considerably more. The problem then is that in a competitive market bad drives out good as long as cheap credits can be obtained and treated as equivalent to those of a higher standard. The Australian Government (2008a: 11-12) has, for example, stated that it "does not consider it necessary to accept only those CERs that meet additional criteria, such as the Gold Standard … neither does it consider that it should assess the broader environmental and social impacts of CERs". Justifications offered are that this would increase costs, there are too few of such certified projects and Kyoto standards are the international group norm which is good enough. That CDM projects may be positively harmful both socially and environmentally is apparently compensated by obtaining a plentiful supply of cheap permits.

5. Promoting Behavioural Change and Individual Action

Many individuals undertake voluntary actions to reduce GHG emissions beyond any statutory requirements.[19] Individuals may be expressing environmental and social concerns, ethical beliefs and/or self-interest (e.g. 'warm glow'). As well as reducing their own emissions by direct action they may seek to purchase offsets from the 'voluntary market'. The growing voluntary carbon credit sector raises the same issues of verification and credibility as found for statutory schemes, but also raises other issues relating to motivation, ethical behaviour, and social psychology.

Psychology of voluntary offsets

Heterogeneity amongst consumers explains the marketing of voluntary offsets offered by some companies as an optional extra (e.g. airlines) because it allows price discrimination. Carbon offsets extract rent from the environmentally concerned because the deep Green avoid flights and the 'don't care' members of the public will not purchase offsets. The availability of offsets allows the moderately environmentally concerned consumer to purchase flights rather than avoiding them. If airlines were genuinely concerned about the impact of their emissions they would add the social cost associated with their emissions to all their tickets and seek to pay the income to those who suffer the consequences. This would of course increase the cost for all customers, including those who 'don't care', and assumes the social costs and to whom they accrue are knowable.

Where individuals are solely motivated by 'warm glow' giving they will have no concern for the actual consequences of their expenditure (Andreoni, 1989). Indeed firms selling such credits may play on the 'feel good factor' of warm glow by selling credits as assuaging guilt rather than abating GHGs. That is, all the utility gained is derived from the act of giving rather than what that giving achieves. Those concerned to promote their self-image as 'Green' may pay little attention to the outcome of their actions as long as they are regarded as trying to 'do the right thing', e.g. the band Coldplay funding carbon offset trees which never actually grew (Lohmann, 2006c: 269-270).

Offset providers motivated by profit maximisation have the incentive to underfund GHG emissions abatement. As noted in the last section, low quality offsets will be the most price competitive in a market in which standards are hard to monitor and enforce. Where offset providers are motivated by other goals (e.g. biodiversity conservation, poverty alleviation) emissions reduction becomes a means to an end rather than the primary motive and may then be treated as such with resulting lack of knowledge, care and attention.

Carbon markets differ from normal goods because there is no direct process of transfer of a tangible good or service, there is no consumption by the purchaser. Even if individuals are concerned about the outcome, the structure of the international offset market makes difficult obtaining and verifying information on the consequences of voluntary credit purchases (Murray and Dey, 2009). There is a principal-agent problem, in that the purchaser (principal) usually cannot directly observe the actions of the offset provider (the agent). While there are a growing number of accreditation schemes, the quality of offsets remains highly variable. Credits may be sold and resold so they represent no real GHG offsetting at all. As the purchaser never sees the results, poor performance can go unnoticed, particularly given the scientific uncertainties which surround abatement and sequestration.

Buyers may actually prefer to avoid the costs of questioning the credibility of GHG credit providers and especially so after they have made their purchase. Given conflicting information people are more likely to believe that which supports their existing actions and opinions (Lord, Ross and Lepper, 1979). Cognitive dissonance can allow buyers to maintain the belief that their offsets are beneficial, even in the face of evidence to the contrary.

The availability of carbon offsets may also prompt some individuals to actually increase undesirable behaviour causing emissions because it isolates and individualises the issues while reducing or removing psychological controls (e.g. negative associations).[20] This effect has been noted elsewhere. Healthy food products may offer real health benefits but fail when people simply increase their personal consumption levels (Mialon and Mialon, 2005). Enhanced safety features, such as seatbelts and antilock brakes, can lead to greater individual risk taking and more rather than fewer accidents (Hause, 2006; Traynor, 2003). Technical fixes are not devoid of behavioural requirements, self control and social norms in order to be effective and the appropriate responses must be seen as embedded within an institutional and social frame.

Human behaviour in standard economic models assumes perfect information and utility maximisation with people having accurate mental accounts. In practice writing down financial accounts, and updating them immediately, is necessary to keep track of spending (Soman, 2001). Mental accounts of actions may suffer due to a desire for promoting a positive self-image (Benabou and Tirole, 2002). People are likely to systematically underestimate their emissions and overestimate their offset purchases. Purchase of the requisite number of GHG offsets is then unlikely as a voluntary action. Addressing behavioural change requires supportive institutions, changing norms, promoting self-discipline and awareness. In the absence of such measures various psychological problems arise: misrepresentation of emissions and offsets, mental commitments left unfulfilled, good intentions failing to match implemented actions. So voluntary offsets become a morning-after pill which many may neglect to take.

At a societal level, self deception may result in the passage of symbolic environmental legislation, which has no real impact on the issue at hand but does allow people to feel that it is being addressed (Newig, 2007). This is a real and present danger with human induced climate change where public concern is often high but genuine substantive emission reduction absent. The prospect of future technological solutions provides an excuse for deferring unpalatable actions. Meanwhile official rhetoric offers reassurance that all is under control, economic growth can continue as usual and trading permits is the solution (Spash, 2007). Supporting effective individual and collective direct action on preventing human induced climate change remains rather neglected or left to NGOs.

Ethics of voluntary offsets

Goodin (1994) has likened pollution permits to indulgences sold by the medieval Catholic Church. These medieval moral sin offsets created a market whereby the rich could pay professional pilgrims, prayers and penitents. This allowed relief of the rich person's conscience and less time in purgatory, without the need to personally undertake arduous tasks or indeed stop sinning. The system replaced personal action to address wrongdoing with a monetary transaction allowing immoral actions to be justified. Sin would perversely increase because, for the wealthy, indulgences provide a lower cost alternative to lengthy penances (Ekelund, Hebert and Tollison, 1992). The analogy has also been applied to carbon offsets (e.g., Monbiot, 2006; The Economist, 2006). If regarded in the same way as indulgences then GHG permits are a means of paying to undertake a wrongful act. Just as God was the ultimate arbiter in the next life so the validity and effectiveness of GHG credits is left for future generations to determine when they confront the impacts of climate change and the originators of the harm have long since passed away.

If we assume that offsets are genuine and of a high standard (socially and environmentally) and perfectly physically equivalent to emissions reduction (all of which has been questioned and contested) then why should there be any objections? There appear two main concerns. First is whether GHG emissions should be regarded as wrongful in a moral sense like sin. On aggregate and at current levels they can, for example, certainly be regarded as harmful of the innocent, but at low levels could be benign. So releasing GHGs is not in itself wrong, but rather wilfully risking harm of the innocent is the wrong. The problem for economics is then its failure to distinguish between undertaking harm and creating good, i.e. incommensurability (Spash, 1994; 2002). Creating harm is not always offset by doing something good; the dead cannot be brought back to life. Second is the basic problem that, like indulgences, providing offsets means rather than reducing their own pollution people can maintain their GHG (energy and material) intensive lifestyles. The rich North and South can continue unchanged by placing the burden of emissions control on the poor South. The poor sell cheaply, as Martinez-Alier (2002) has noted, and are easily exploited by the powerful for their own ends when the dollars start flowing. Disputation can then be expected between those who regard this as unjust, unfair, inequitable and passing the problem on, and those who regard it as economically efficient, a supply of funds to the poor and aiding 'development'. This raises the ethical basis upon which such decisions are judged.

Under a cost-benefit calculus or cost-effectiveness analysis, current income distribution is taken as a given, the poor provide services more cheaply and should therefore do so, saving the rich extra expenditure (an orthodox economic 'win-win' scenario). However, there is a fundamental difference between weighing-up the consequences in this economic approach based upon preference utilitarianism and doing the right thing (deontology) or trying to live a worthwhile life (virtue ethics). Here the values implicit in the commercial world conflict with alternative ways of valuing the world and judging right and wrong actions. Good actions are not those which simply make the most profit or cost the least.

Crowding out environmental motivations

People who carry out an activity because they consider it inherently worthwhile, rather than for any reward, are in psychological terms intrinsically motivated. Intrinsic motivations can be considered analogous to the impartial spectator described by Adam Smith (1982 [1759]) as a motivator driving a virtue based ethics of behaviour. Smith saw utilitarianism as a lower form of ethical decision-making which lacked moral authority and failed to promote self-control. Empirical evidence supports the prevalence of alternatives to the economists' consequential preference utilitarianism (Spash, 2000b; c; Spash and Hanley, 1995). Direct public interviews have shown the prevalence of non-economic motivations for valuing the environment (e.g. Butler and Acott, 2007; Spash, 2006). Numerous economic experiments have shown the importance of non-monetary motivations in decision making, particularly around social dilemmas and public goods (Fehr and Fischbacher, 2002).

Ignoring plurality in value systems can lead economists to crowd-out desired behaviours. A naïve expectation is that adding extrinsic market incentives to an activity for which people are intrinsically motivated should further enhance it. However, a growing body of theoretical and empirical studies demonstrate that extrinsic incentives can crowd-out the intrinsic motivations which underlie voluntary actions (Frey, 1997; Frey and OberholzerGee, 1997). If the incentives are small, they may be sufficient to crowd out intrinsic motivations without providing sufficient extrinsic motivation for positive action—in such a case the overall level of a desired activity may decrease (Frey, 2001). This means that the introduction of an ETS may result in individuals ceasing their existing voluntary efforts. If the incentives and overall reduction targets of the ETS are weak (as most are likely to be, at least initially), it may cause some individuals to increase their net emissions.

Crowding out of pro-social behaviour is not unique to an ETS and similar issues arise with other formal economic institutions such as taxes or sanctioning mechanisms. By prompting people to calculate the costs and benefits of alternative actions, formal economic sanctioning systems change the way in which some participants frame the situation (Claro, 2007). The introduction of any form of statutory scheme can remove reputational benefits of emissions reductions, as people are now seen to act for compliance or profit rather than as a good deed (Benabou and Tirole, 2006).[21] However, the market basis of an ETS carries with it characteristicis which may make it more prone to crowding-out effects.

Crowding-out can occur if extrinsic incentives imply distrust, suggest that self-interested behaviour is appropriate, or are perceived to reduce a person's sense of autonomy (Bowles, 2008). By contrast, incentives which promote trust, autonomy and social preferences can have the opposite effect, crowding-in intrinsic motivations (Frey, 1997). The move towards statutory carbon markets therefore has considerable potential to crowd-out existing intrinsically motivated voluntary emissions control and abatement. Public policies should be designed and implemented in ways that crowd-in, rather than crowd-out, intrinsic motivations (Bowles and Hwang, 2008; Frey, 1997). The appropriate institutional setting is then not the market but one of shared social responsibility.

Crowding-out appears likely to be particularly intense for an ETS. Markets tend to promote competitive interactions, but fail to provide a good forum for the expression of social values (Bowles, 1998). Efforts by some governments to facilitate the voluntary purchase of ETS permits by concerned individuals are therefore unlikely to be successful (particularly if those individuals have to purchase the permits from the polluters to whom they were originally grandfathered). Voluntary activity will need to be clearly delineated from any formal scheme, whether a tax or an ETS. The potential should be maintained for parallel voluntary schemes which provide recognition for contributors. This implies the need for institutions promoting social norms and aiding collective direct action.

6. Conclusions

Trading permits as a means of pollution control has moved from the environmental economics textbook to the political and policy agendas. The textbook approach is embedded in a simplified neoclassical economic model of the world where individuals are self-centred utility maximisers, firms perfectly competitive profit seekers, both have perfect information and neither have any power to influence the system. In this world view interactions between government and corporations are absent. Thus, markets are regarded as simple uniform structures for trading, rather than complex institutions the design of which requires regulation and restriction and the form of which determines gainers and losers. That the standard economic model fails to reflect reality becomes highly important when economists start recommending textbook approaches with the expectation that these will achieve the outcomes predicted from their highly abstract theories. Some may retort that theory now allows for many extensions of the basic model. However, simple perturbations of the idealised economic model fail to address a whole range of issues including strong uncertainty and complexity of social, human, and environmental systems and their interactions. Orthodox economics maintains an outdated characterisation of human psychology, a lack of open debate of ethics and avoids discussing the connections between economic and political power. The result is a reluctance to address the inadequacy of basing human well-being on ever faster material throughput from a fossil fuel driven economic structure, let alone the problems it creates.

While carbon trading and offset schemes seem set to spread, they so far appear ineffective in terms of actually reducing GHGs. Despite this apparent failure, ETS remain politically popular amongst the industrialised polluters. The public appearance is that action is being undertaken. The reality is that GHGs are increasing and society is avoiding the need for substantive proposals to address the problem of behavioural and structural change.

Currently many individuals, households and firms make costly voluntary efforts to avoid, reduce or offset their GHG emissions. Yet those voluntarily purchasing carbon credits seem almost wilfully oblivious to the potential for abuse and misdirection of their good intentions. Government regulation is necessary to ensure standards, but also needs to address the type of institutions appropriate for needed behavioural change and to encourage group norms appropriate to a restructured economic system which avoids GHG emissions.

Consideration of the motivations involved suggests care is needed to avoid voluntary activity being negatively impacted.

Perhaps the most worrying aspect of the ETS debate is the way in which an economic model bearing little relationship to political reality is being used to justify the creation of complicated new financial instruments and a major new commodity market. In 2008 the financial sector was in a global crisis having manipulated bad debts and mismanaged its own finances to the point of requiring international banks to seek government bailouts. Yet ETS proposals place a new multi-billion dollar market in the hands of the same people and organisations. Recent experience illustrates how market players continually seek new ways to profit from adapting institutional rules, and regulators struggle to keep-up.

There is also something incongruous in governments proposing to host financial markets in their own countries for competitive advantage on the basis that their institutions are well regulated, secure, trustworthy, have good labour and environmental standards, and so on. The incongruity is because they then wish to buy products (i.e., offsets) from countries which clearly fail to meet the same standards. The justification that this is cheaper, least-cost or economically efficient can only be supported if standards are the same across countries. Basic environmental and social standards clearly do matter more than price across all traded commodities, otherwise we might as well, for example, buy shoes made cheaply using unpaid child labour. Non-equivalence is more than a matter of an accounting system to equate units of some physical product (even if this were possible). Such matters are far from irrelevant to how ETS is designed and operated.

A key weakness of an ETS compared to alternative policies—taxes or direct regulation—is that an excessive baseline or regulatory loophole in any one nation or sector eliminates the need for genuine reductions elsewhere. The more complex the scheme and the greater its scope, the greater the potential for a weak link. National carbon markets allow poorly regulated sectors to gain, just as international carbon markets are susceptible to rewarding countries with lax regulations and poor enforcement.

An ETS can in theory provide a similar incentive as under a tax by pricing of all units of pollution. This is meant to encourage development of pollution control technology so as to reduce abatement costs. However, the major difference from a tax is that the revenue stream need not go to government, depending upon how the scheme is established and run. For example, if the government gives all existing polluters permits for free then the public purse gains no revenue; instead polluters can sell the permits on the open market and so avail themselves of a windfall. This adds an incentive for polluting parties to form lobby groups in order to influence policy design to avail themselves of such gains.

The billions of dollars now being generated in trading carbon and offsets has created a powerful institutional structure which has many vested interests whose opportunities for making money rely on maintaining GHG emissions, not reducing them. The transaction costs inherent in these markets are actually being seen as a source of economic growth rather than a deadweight loss to society. Once created, how politicians will cut the market by 80 percent—even within the 40 years they are allowing themselves—is hard to imagine. After all, the reason for emissions trading is that corporations and the technostructure proved too powerful for the political process to establish a tax or direct regulation in the first place.

The framing of the whole issue of human induced climate change is highly important to how it is addressed. There seem two opposing characterisations. On the one hand, financiers, bankers and major polluters argue we must bravely face the new opportunity for markets to innovatively show how the most intangible of objects can be bought and sold, reaping vast financial gains and stimulating economic growth. On the other hand, society can realise that ever increasing material throughput based upon fossil fuels has led to serious environmental problems, and failed to address social inequity, so that a change in economic structure, institutions and behaviour is now necessary. Clearly the former is dominant and perhaps we must await a financial emissions trading crisis and increasing environmental disasters to reverse that situation.

In Aldous Huxley's *Brave New World*, the drug 'soma' offered inhabitants of a future Earth the means to distract themselves from addressing life's problems while supporting the established social and economic order in the promotion of happiness through hedonic pleasures. Today emissions trading promises a painless way to avoid human induced climate change which will leave the growth economy unaffected in its pursuit of happiness through materialism. The reader is left to judge illusion from reality and the desirability of the society created.

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Acknowledgements

I wish to pay tribute to my former colleagues at the CSIRO for their support in my efforts to get this paper published without alterations. I also note the contribution towards achieving this made by Senators of the Australian Parliament and in particular Senator Milne. Thanks to Andrew F. Reeson for discussions, reflections and input, especially on section 5. I remain solely responsible for the contents.

Notes

[1] In 2009, Australia overtook the US as highest per capita carbon dioxide emitter (see http://www.abc.net.au/news/stories/2009/11/18/2745751.htm). Amongst OECD countries Australia is the highest per capita emitter of all GHGs combined (see http://www.garnautreview.org.au/chp7.htm).

[2] Australia only ratified the treaty in 2008 after a change of national government.

[3] http://www.whitehouse.gov/issues/energy_and_environment/

[4] The EU ETS covers only major energy and industrial producers and so fails to cover the important transport and aviation sectors; the latter are hoped to be introduced after 2012 (European Commission, 2008: 13).

[5] See Spash, 2002: for a review, summarised p.53.

[6] CFCs were the primary concern prior to the Montreal Protocol which attempted their regulation Since then unregulated substitutes have also arisen and creating further problems e.g. HFCs. Hydrochloroflurocarbons (HCFCs) are covered by Montreal but not Kyoto.

[7] Adds to 101% due to rounding-up errors.

[8] Of course countries or regions could take independent action and skip international negotiation. In the US, for example, some states have adopted their own targets and schemes in the absence of leadership at the federal government level.

[9] In September 2009, the European Court of First Instance found in favour of Poland and Estonia, who had challenged the EC over their EU ETS caps for Phase II. Six other countries have launched appeals against national allocation plan decisions: Hungary, Czech Republic, Bulgaria, Romania, Latvia and Lithuania. See http://www.carbon-financeonline.com/index.cfm?section=lead&action=view&id=12416. Accessed 9/12/09.

[10] That countries are prepared to freely allocate pollution rights, while taxing labour and savings, suggests that economic efficiency is not actually a prime consideration.

[11] See www.greenhousegas.nsw.gov.au

[12] http://business.theage.com.au/business/australia-demands-bushfire-exemption-in-carbon-treaty-20090613-c6h4.html. Accessed 15/06/2009.

[13] Nuclear power is excluded under Kyoto and so from both the EU and Australian schemes.

[14] http://cdm.unfccc.int/Statistics/index.html. Accessed 16/6/2009.

[15] The Marrakesh Accords are the aggregate Decisions (2/CP.7 through to 24/CP.7) of the Conference of the Parties to the UNFCCC set down in its seventh session, held at Marrakesh, Morocco from 29 October to 10 November 2001. Those decisions were adopted in Montreal in November 2005.

[16] IETA is a coalition of private companies including AES, Barclays Capital, Chevron Texaco, Conoco Phillips, DuPont, Ecosecurities, Gaz de France, Goldman Sachs, Gujarat

Flurochemicals, J-Power, KPMG, Lafarge, Lahmayer, RWE, Shell, Total, Toyota, TransAlta, and Vattenfall (Lohmann, 2006a: 146).

[17] These include: agro-forestry in Guatemala and Ecuador for coal fired plants in the US and The Netherlands; tree farms in Uganda and Tanzania for gas-fired plants in Norway; monoculture forestry in Costa Rica; in India refrigeration plant HFC gas destruction, iron production, and failed mango plantings; rural solar replacing kerosene lamps in Sri-Lanka to justify a gas-fired plant in Oregon; biomass and gas-fired plants in Thailand supporting coal burning in Japan; landfill methane combustion and natural gas pipelines in South Africa; and pig-iron, plantations and charcoal production in Brazil.

[18] The change from the Montreal Protocol is stark, as there the aim was to ban synthetic gases (such as fluorocarbons) capable of severe environmental harm.

[19] Firms may also undertake voluntary GHG emissions reductions e.g., motivated by corporate social responsibility or a desired 'Green' image.

[20] Lohmann (2006a: 191-192) gives an example reported in the London *Daily Telegraph*. An executive learned from the Carbon Neutral Company that their carbon 'footprint' was 24 tonnes of CO_2. Initial shock was replaced by relief that all she need do was to pay £156 to Carbon Neutral, which she stated was nothing compared to her expenditure on lipstick and magazines. The sales pitch was to relieve guilt over pollution relating to all those aspects of lifestyle and work which seem 'essential'. Such marketing avoids the underlying issues, prevents more serious debate and reduces direct behavioural change.

[21] This can of course apply equally to firms.