Towards good carbon governance: examining and evaluating climate change policy in the UK, EU and China[1]

Abstract

The human impacts of climate change over the next century will be sufficiently broad, and generally adverse, to threaten the rights and freedoms of many existing and future persons. These impacts will also exacerbate inequalities between rich and poor countries; and policies designed to tackle climate change will also predictably alter the distribution of benefits and burdens within all of the countries where they are adopted. This paper addresses some of the challenges facing the selection of policies to reduce the risks of dangerous climate change using data from the UK, EU and China as a point of departure.

Introduction

Global climate change poses significant risks for the health, wealth and security of existing and future generations. Although some regions will escape catastrophic climate impacts, and others may benefit from the localised effects of rising global temperature and sea-levels if they remain modest, the aggregate impact will almost certainly be adverse, with members of future generations and developing countries being worst affected (UNDP, 2007, 71-108; Parry, Canzani and Palutikof, 2007: 48-65). At the same time, a consensus has emerged on some degree of co-ordinated international response to prevent avoidable adverse climate impacts. The aim of these policies is widely held to be the stabilisation, and later reduction, of global concentrations of greenhouse gas in the atmosphere in order to prevent 'dangerous climate change.'

While there exists no straight-forward to concretise the aim of avoiding dangerous climate change, an increasing number of analysts, environmental organisations and over one hundred governments have adopted the objective of avoiding a global temperature rise of more than 2^{o}C on its pre-industrial level (UNFCCC, 2007: 2; Hepburn and Stern, 2008: 266; European Commission, 2009a). The size of the task ahead is revealed by the fact that the earth has already warmed by 0.8^{o}C since 1900 due to human activities and inertial properties of the climate system mean that an addition warming of 0.3^{o}C will occur by 2100 regardless of global efforts to reduce greenhouse emissions (Solomon et al, 2007, 36; 68).

A number of challenges face any attempt to implement a set of global policy instruments that could reasonably be expected to achieve the target of avoiding a 2^{o}C warming. We might call this the problem of 'good carbon governance' since reductions of annual flows, and total stocks, of carbon dioxide and associated greenhouse gases are the focus of all of these proposals. An extensive literature has now emerged that compares the relative merits of alternative policy instruments - as well as the 'international policy architecture' that seeks to systematise these efforts - to manage the risks posed by global climate change (Aldy and Stavins, 2008: 1). Contrary to the assumption of much of the academic literature, however, the task at hand is not merely the technical one of devising and implementing a suite of policies and instruments that scores most highly in terms of economic efficiency and environmental effectiveness. There are also fundamental questions of *ethics* and *politics* at stake in national and international responses to climate change. This paper investigates some of the ethical and political barriers to good carbon governance problem.

Understanding environmental policy

There are, broadly speaking, four types of policy instrument that can be adopted by national and international policymakers to reduce the risks of climate change (Jacobs, 1991: 134-48; Carter 2007, 323-36; Gupta et al, 2007).[2]

1. Government regulation. Government regulation involves public agencies defining the aims, specific objectives and administrative measures required to secure these aims. This involves regulatory agencies enforcing pre-determined limits of pollution within their jurisdictions and specifying penalties for firms, individuals or municipalities that fail to comply. Typical measures involve legal limits on the amount of a pollutant that firms or households are permitted to emit; prohibitions on certain highly hazardous pollutants; and mandatory adoption of energy efficient technologies in new buildings or industrial production.

Despite increasing critique of direct governmental intervention to secure environmental quality, the majority of domestic and international existing climate policy measures are regulatory in nature. 27 of the 36 policies developed under the 2006 EU Climate Change Programme involve direct regulation of firms and consumers (EC, 2006: 9-18); and the 2009 EU Climate and Energy Package specified a series of legally binding emissions targets to be met by 2020.[3]

Table 1: UK Climate Change Policy

R	• legally binding targets to cut annual CO_2^e emissions by 34% (by 2020) and 80% by 2050 (UK emissions ≈ 21% of their 1990 level in April 2009). • legally binding five-year emissions budgets specifying caps up to 2050 • legal requirement for electricity providers to source 40% of electricity from low carbon sources by 2020 • legal requirement for 15% of all energy (heat, electricity, transport) to be sourced from renewable sources by 2020
E	• £3.2 billion on household energy efficiency measures (eg subsidised Smart Meters) • >£405 million for low carbon technologies (inc. £120 million for offshore wind) • >£140m on cycling infrastructure and initiatives. • >£30 million for electric vehicle infrastructure (eg charging points).
V	• negotiated agricultural ‘action plan’ to encourage more efficient use of fertiliser, livestock, manure to reduce farming + waste emissions by 6% on 2008 levels by 2020 • extended until 2017 the use of CCAs providing discounts on applicable energy taxes to firms volunteering to meet strict energy efficiency targets.
CT	• extended Airport Passenger Duty (current rate: £20/£80 Europe/non-Europe flights) • extended Climate Change Levy on use of non-renewable energy by business and public sector organisations (inc. electricity from natural gas and coal)
ET	Full Participant in EU ETS: 950 UK installations were allocated 215 million tCO_2^e of allowances in 2008 (EU ETS total ≈ 1900m $1tCO_2^e$) ≈ 43% of UK CO_2 emissions

Source: UK DECC (2008); UKCCC (2009)

The regulatory dominates the UK Climate Change Act of 2008 (UKCCA) and 2009 Low Carbon Transition Plan that extends, and renders precise, the commitments specified in the UKCCA (see Table 1). The UK Government is now subject to a legally binding target to cut annual emissions of carbon dioxide-equivalent (CO_2^e) by 34 per cent (by 2020) (UK emissions were 21 per cent below 1990 levels in April 2009). The UKCCA also introduced legal requirements for electricity providers to source 40 per cent of electricity from low carbon sources by 2020; and for new homes to meet a 'zero carbon standard' by 2016.

The regulatory approach is also central to China's long term energy and environmental strategy, set out in the Stat Council's Eleventh Five-Year plan (2006-10) and associated 2008 White Paper on Climate Change (China National Development and Reform Commission, 2009; Information Office of the State Council, 2008). These documents introduced a range of legally binding environmental regulations and standards within China (see Table 2). Amongst the most important measures were strict energy conservation standards for firms and municipalities linked to a mandatory target of reducing energy consumption per unit of GDP by 20 per cent by 2010; stricter building codes; and national standards on energy intensive products such as air conditioners, domestic appliances and light-bulbs. Despite the increasing role of non-regulatory mechanisms, such as voluntary agreements and subsidies, government regulation is still viewed by Chinese policymakers and scholars as the most reliable method of increasing energy efficiency and environmental equality (Yu, 2010: 2161).

The advantage of a regulatory approach is that regulations, standards and rules limiting the use of greenhouse gases exploit the established legal-political relationships between regulatory authorities and the atmospheric users within their territories (*political legitimacy*); are consistent with precise and predictable environmental standards being enforced uniformly across a territory in line with an environmental goal (*reliability*); and operate within the context of transparent, and enforce, any punishments that will be applied to non-compliers (*compliance*).

Nevertheless, the disadvantages are also significant. This type of response can be cumbersome and bureaucratic, especially when applied to global or trans-boundary environmental problems. It may lead to inefficiencies arising from atmospheric users having limited control over the timing of mitigation measures and investments; and suffers from the perceived paternalism of hard regulatory mechanisms. Moreover, direct government regulation has proven unpopular amongst the business community due to their perceived inefficiency.Perhaps the clearest reason to look beyond such measures, however, concerns the situation of regulatory authorities. The problem here is that setting the aims, mechanisms and compliance structures for atmospheric pollution control imposes a large informational burden on the relevant authorities. Tietenberg usefully refers to this as the 'regulatory dilemma': while regulators posses the statutory responsibility to ensure that dangerous climate change is avoided, the information required to construct an efficacious climate response often lies beyond their reach (Tietenberg, 2006: 25-6). So long as there is such a mismatch between capability and responsibility, traditional regulation will struggle to generate effective or efficient reductions in greenhouse gases in isolation of other policy instruments.

Table 2: Chinese Climate Change Policy

R	• Strict energy conservation standards as part of 11th 5 yr plan (2006-11) including mandatory goal of reducing energy consumption per unit of GDP by 20%. Key projects: renovation of coal burning furnaces; increased use of combined heat and power; changes in building construction; oil substitution; green lighting: aim to cut national CO_2 emissions by 550 million tonnes relative to Business as Usual pathway. • Energy Consumption Law (2008): buildings regulations, energy conservation, national standards on energy intensive products • energy efficiency labelling (white goods; lighting; air con; boilers + heaters) • energy consumption standards per unit of industrial output (eg shipbuilding) • reduction, reuse, recycling of waste (Circular Economy Promotion Law, 2008)
E	• 210 billion (from 4 trillion yuan 2008- stimulus package) earmarked for energy conservation, pollution reduction, ecological restoration • 760m yuan for circular economy pilot projects since 2005 (360 local projects) • 370 billion yuan for technology renovation and less energy intensive industrial plant • Financial subsidies for purchase of energy efficient lighting and vehicles • Special funds and subsidies for renewable energy production focused on hydro electricity; wind; nuclear; solar. • Protecting price of wind-generated power

V	• Large, central government-backed, public awareness campaign on energy efficiency. Main areas of encouragement:
	  ◦ Fewer journeys by car; reduced use of (and encourage purchase of more efficient) air-condition systems and white goods
	  ◦ State encouragement for re-forestation and environmental NGOs
	  ◦ Promotion of the 'Recycling Economy'

CT	• Lowered excise tax for small cars (3% - 1% for <1l engine) • Raised excise duty for larger cars (15%-25% for >3l engine) • Tax breaks (import, export, excise) for wind power projects
ET	• No legal CO2 reduction duties under the Kyoto Protocol (no AAUs); but China is dominant in market in creation of primary CDM credits (CERs). • Projects in China issued 84% of primary CERs during 2008 (1700 projects, covering 327 million tCO2, and generating ≈ $3.6b). • City wide 'cap and trade' carbon markets planned in Tianjin, Beijing and Shanghai

Source: China National Development and Reform Commission (2009); Information Office of the State Council of The Peoples Republic of China (2008)

2. Government expenditure. Problems with regulatory instruments such as those outlined above have led analysts and policymakers to embrace policy instruments designed to preserve environmental quality without mandating specific standards, regulations or punishments (Jordan, Wurzel and Zito 2005: 482-3). One of these 'newer instruments' involves the use of government subsidies (preferential loans, tax allowances or government funding of low carbon infrastructure) in order to encourage consumers or firms to undertake environmental quality preserving activities and investments that they could not otherwise afford. One problem with such subsidies is that they cannot always be designed in order to discriminate between agents that would, or could, only undertake the desired activities when presented with the subsidy and those agents who enjoy the subsidy despite the fact that they would have performed the desired activity in any case. In this instance, the problem is that the scope of the subsidy is drawn *too widely*. But the terms of the subsidy could also be miscalculated so that its scope is drawn *too narrowly* in not taking the opportunity to change the behaviour of agents who do not quality for the scheme. Such miscalculations, which are inevitable given informational constraints and diverse user incentives, mean that subsidies are often very costly relative to the environmental benefits they deliver (Carter, 2007: 322).

Despite these drawbacks, government expenditure continues to be a major focus of national and international climate policy, with the bulk of the funding being committed to infrastructural commitments (such as bicycle or electric car facilities) and government research and development support for the development of particular emissions reduction technologies (carbon capture and storage). Over and above its commitments as a member of the European Union, for example, the UK Government is committed to spending over £3billion on household energy efficiency measures by 2020 (such as the provision of Smart Meters to every household by 2020); over £400 million for low carbon technologies (including £120 million for offshore wind); and £140m on cycling infrastructure and initiatives (DECC, 2009). The European Commission, meanwhile, has signalled its intention to fund up to 12 projects developing innovative renewable energy or carbon capture and storage projects at a cost of €4 billion; increase the research and development budget for environment, energy, transport to €8.4 billion for the period 2007-13; and invest €90m in the Global Climate Change Alliance initiative to fund projects such as reforestation (European Commission, 2009). Finally**,** 210 billion yuan has been earmarked from the ongoing 4 trillion yuan Chinese stimulus package in order to fund a range of energy conservation, pollution reduction and ecological restoration measures.

3. Voluntary agreements. A second 'newer' policy instrument growing in popularity is the environmental voluntary agreement (EVA). EVAs can be defined as 'private or public efforts to improve environmental performance beyond existing legal requirements' (Paton, 2002, 37). There are four main types of voluntary environmental agreement (OECD, 2003: 18-19; Paton, 2002, 38-40). First, 'unilateral commitments' are fully voluntary actions undertaken by firms and environmental groups designed to improve the environmental quality of their activities in absence of any kind of threat of regulation. Second, 'private codes' are voluntary agreements amongst industry associations, NGOs or standards organisations designed to improve environmental quality with no formal government involvement. Third, 'voluntary challenges' are government sponsored schemes offering recognition and rewards such as environmental logos, good publicity, tax breaks or technical assistance to firms opting into programmes that meet certain environmental quality standards. Fourth, 'negotiated environmental agreements', the most formally structured type of voluntary instrument, involve firms agreeing to explicit (and often legally binding) emission standards or targets established in negotiation with regulators on the understanding that further legislation will not be introduced so long as the agreement remains effective.

The main advantages of EVAs over government regulation or expenditure are threefold: their potentially rapid deployment with corresponding rapid improvement in environmental quality; the extra freedom and flexibility they provide for firms to reduce emissions at least cost; and their potential to reduce the monitoring and enforcement costs of environmental protection borne by regulators. Attracted by these advantages, governmental and non-governmental actors have participated in voluntary agreements, particularly of the third and fourth category, to reduce greenhouse emissions in several countries in recent years including Denmark, Netherlands, Sweden, Germany, Japan, UK and US (Torvanger and Skodvin, 2002; Gupta et al, 2007: 761). The UK Government recently outlined details of a negotiated agricultural 'action plan' designed to encourage more efficient utilisation of fertiliser, livestock and manure to reduce farming and waste emissions by 6 per cent on 2008 levels by 2020 in the absence of any legal requirements (DECC, 2009). The same legislative programme extended until 2017 the use of Climate Change Agreements (CCAs) which provide discounts on applicable energy taxes to energy intensive firms that volunteer to meet strict energy efficiency targets. Finally, the Chinese authorities are engaged in a wide ranging government-backed public awareness campaign to encourage energy efficiency amongst citizens and firms in areas of life not subject to direct legal action or subsidies.

While voluntary agreements have become popular amongst policymakers in many developed countries, the case for voluntary agreements playing more than a minor role in the climate policy mix is unclear. One problem is that, as with subsidies, regulators may do not know if the participants would have modified their behaviour in absence of the agreement. The IPCC, for example, reported in 2007 that Climate Change Agreements prevented up to 11.6 million tonnes of CO_2 being released by UK firms between 2002 and 2004 (Bernstein *et al*, 2007: 479-80) and further claimed that voluntary agreements were responsible for up to 50 per cent of the energy savings achieved by Dutch manufacturers in recent years (Gupta *et al*, 2007: 760). The problem with such claims is that the relevant baseline by which the voluntary agreement is measured is unclear. Is it a situation where no government action had been taken to encourage these firms to reduce their atmospheric footprints? Or is the baseline the emissions that regulators would have expected had a different, less efficient, policy response been adopted? A further problem is that voluntary agreements often involve targets that are easier to achieve than their regulatory rivals such that success in their own terms does not always indicate real improvements in environmental quality.

These two problems may explain why there is minimal reference to voluntary agreements in the latest European Climate and Energy Package, which instead focus overwhelming on the benefits of a mix of carbon markets and direct government regulation. Nevertheless, voluntary environmental agreements do appear to have tangible benefits when targeted effectively, particularly where they have been mixed with other forms of instrument or negotiated in the context of a credible threat of additional regulation if they fail. Given that successful voluntary agreements promise benefits beyond their role in reducing emissions such as altered attitudes to energy efficiency and waste amongst firms and consumers (as well as more cooperative relationships between regulators and firms) this form of instrument remains a useful weapon in the management of climate change.

4. Market-based instruments (MBIs). MBIs promote environmental quality by making firms and other agents internalise the full social cost of their environmental behaviour in absence of subsidies, voluntary agreements or government regulation to enforce specific emissions reduction activities. The idea is that if users face a price for the environmental resources that they consume, they will use the goods, services and energy sources that degrade these resources more efficiently and, by extension, more sparingly. There are essentially two species of MBI relevant for climate change policy: ‘price-based instruments’ (introducing taxes, charges or levies on greenhouse gas emitting activities) and ‘quantity-based instruments’ (which involve some version of pollution trading) (Weitzman, 1974; Nordhaus, 2007: 35ff; Helm, 2005: 207-16). In idealised circumstances, price-based and quantity-based instruments will converge in the social benefits they deliver relative to either policy inaction or rival policy instruments. In such circumstances, the difference between the two approaches is merely the way in which the social costs previously externalised become internalised. Regulators either (i) intervene directly to manipulate user incentives by charging a uniform levy on each unit of pollution emitted or (ii) create a market in allowances affording the right to emit whose price is set indirectly via market activity. In the real world, however, a number of factors including uncertainty about the marginal costs and benefits of mitigation; political feasibility; and problems of international harmonisation can lead to significant divergence in the environmental effectiveness and cost efficiency of pollution taxes and emissions trading schemes (Hepburn, 2006; Keohane, 2009: 47-56; Metcalf, 2009: 73-8; Nordhaus, 2007).

(4.1) Greenhouse taxes (see Table 3) involve regulators imposing a fixed charge that must be surrendered in proportion to the amount of CO_2^e emitted by ‘downstream users’ either at the point of release (‘effluent charges’) or by ‘upstream users’ at the point of production (‘input charges’) (Jacobs, 1991: 140-1). To be effective in making atmospheric users internalise the social costs of their CO_2^e emissions, the charge for each tonne of CO_2^e is modelled on the additional social costs they impose once released into the atmosphere. These costs can be surprisingly high due to the fact that greenhouse gases remain in the atmosphere, thereby affecting the climate, for long periods.

The weaknesses of greenhouse tax schemes are threefold. First, the fact that carbon taxes work best if they are internationally harmonized is problematic given the lack of support for taxes in many developed and developing countries. The political hostility to greenhouse taxes reflects the fact that this instrument is much more explicit about the cost of climate mitigation than its rivals. Second, as effectively taxes on energy consumption, greenhouse taxes will exacerbate to a certain extent the inequity that users in different income groups, or those operating in different physical environments, will bear differential burdens in both reducing their emissions and bearing the costs of the tax. The result is that the burdens of carbon taxes will not be felt evenly prior to compensatory transfers. Poorer consumers, for example, could be expected to exhaust a larger share of their disposable income on carbon taxes through higher prices for goods even if the tax is levied upstream. The consequence could easily be a magnification of existing inequalities even if the outcome of the tax is beneficial for environmental quality in general terms (Carter, 2007: 339). Third, in abandoning the direct link between government regulation and permissible levels of emissions, carbon taxes are risky in the sense that they may not bring about the desired emissions reductions in the relevant timeframes.

Table 3: National Greenhouse Tax Schemes

Country	**Activities covered**	**Headline tax per tCO_2^e**	**Annual CO_2 emissions: 1990-2007(%)**
Finland (1990-)	Heating, transport fuels	€20	+10.6
Sweden (1991-)	All fuels except biofuels (EU ETS firms exempt); 79% industry discount.	1050SEK (€102)	-9.1
Norway (1991-)	Tax on mineral products; petrol; natural gas; continental shelf emissions	180 NOK (€21)	+7.8 (2006)
Denmark (1992-)	Tax on fuel varying with carbon content	90DKK (€10)	-3.5
Switzerland (2008-)	Tax on heating fuels	CHF 12 (€8)	+0.8 (2006)
Ireland (2010-)	Tax on all emissions not covered by EU ETS	€15	+25.0

Source: OECD; IEA; Finnish Environment Ministry

Despite these problems, greenhouse taxes continue to play a significant role in the climate policy packages of several European countries. Denmark, Finland and Sweden have operated national carbon tax regimes over and above what is required of them by EU legislation for over 2 decades; and Ireland has recently begun to impose a tax of €15 per tonne of CO_2^e to be surrendered by firms without emissions responsibilities under the EU emissions trading scheme (EU ETS). The UK Government, meanwhile, recently announced it would extend both the Airport Passenger Duty (a departure tax levied on most air travel at the current rate of £20 for European flights and £80 for non-European flights) and the Climate Change Levy (a tax on the use of non-renewable energy by businesses and public sector organisations, including electricity from natural gas and coal) despite their unpopularity amongst firms and a general lack of evidence of their efficiency in reducing emissions (DECC, 2009; National Audit Office, 2007). Finally, although it has not introduced an economy wide tax on carbon emissions, the Chinese government has increased taxes on efficient cars - and reduced import, export and excise taxes for wind power projects - as part of the environmental package specified in the 11th Five Year Plan (2006-2010).

(4.2) Greenhouse emissions trading. An alternative market-based instrument, which can be viewed as an even subtler appeal to the pollution reducing incentives communicated to users by market prices, involves the creation of markets for

tradable allowances conferring the right to emit a certain quantity of CO_2^e over a specified period of time (see Table 4). The global emissions trading market is divided between the voluntary market and the compliance ('mandatory') market *Voluntary emissions markets* involve individuals and firms purchasing emissions allowances to offset their greenhouse emissions in absence of legal requirements. Roughly 54 million tonnes of CO_2^e was traded on the voluntary carbon markets in 2008 with a market value of $397 million (Capoor and Ambrosi, 2009: 1). *Mandatory emissions markets*, by contrast, which had a market capitalisation of $126 billion at the end of 2008, involve participants legally obliged to surrender allowances to match their annual emissions of CO_2^e as a result of domestic legislation or international treaties (Capoor and Ambrosi, 2009: 2).

There are two basic forms of mandatory emissions trading: 'credit-and-baseline' schemes and 'cap-and-trade' schemes (Tietenberg, 2006: 192). Credit-and-baseline schemes, such as the Kyoto Protocol's Clean Development Mechanism (CDM) and Joint Implementation (JI), enable firms or countries to earn tradable emissions allowances by financing emissions reduction projects that reduce emissions subject to the requirement that these projects would not have occurred without the intervention of the project owners. The CDM and JI, the world's largest credit-and-baseline schemes, had generated 313 and 2.8 million allowances respectively by July 2009 worth around €350 million (each allowance represents 1 tonne of CO_2^e permanently taken out of the atmosphere).

Table 4: A Snapshot of Emissions Trading Schemes in 2010

Scheme	**Unit**	**Avg price per CO_2^e (2009)**	**Size of market (€billion) in 2009**	**Size of market ($mtCO_2^e$) in 2009**
EU ETS	EUA	€13.0	73.00	5600
CDM	CER	€10.9	17.5	1600
JI	ERU	€9.1	0.40	44
ETM	AAU	€10.0	1.38	138
RGGI	RGGI	€2.4	1.80	770
Total	**n/a**	**€11.33**	**€94 billion**	**8.2 billion CO_2^e**

Source: Point Carbon (2010)

Cap-and trade-schemes, by far the most important type of mandatory scheme in terms of its significance for the good carbon governance problem, have *four* core elements (Tietenberg, 2006: 192-203). First, regulators place an overall cap on the CO_2^e emissions of participants in accordance with the general aim of avoiding dangerous climate change. Second, participants are required to apply for a permit authorising their engagement in the sorts of emissions activities covered by the scheme. The participants in existing schemes are almost exclusively countries (ETM) and energy intense firms (EU ETS) but any legal person could theoretically function as a participant.[4] Once these permits are authorised, a fixed number of authorized emissions allowances are distributed amongst the participating users (either by auction or free-of-charge) that must be surrendered for every metric tonne of CO_2 emitted during the specified commitment period. Third, once the scheme is in operation, the participants are encouraged to trade emissions allowances under their control as they see fit in order to fulfil their legal obligations under the scheme. Whether a participant is a net buyer or seller of allowances will reflect their individual circumstances. Fourth, participants who do not comply are subject to financial penalties and/or a requirement to undertake mitigation measures to make up emission allowance shortfalls in a later commitment period. Financial penalties can vary significantly, with schemes such as the EU ETS adopting a fixed penalty for each allowance a non-complier is short of €40 up to 2012 and €100 thereafter.

Incorporating both a ceiling on emissions (a regulatory device) and a market for tradable emissions rights (a market-based device) confers a number of efficiency and effectiveness benefits over rival policy instruments (Stavins, 2009: 314-17; Keohane, 2009: 44-51). First, it reduces the risk of emissions overshoots associated with carbon tax schemes, which introduce a levy on each tonne of CO_2^e that each polluter emits in absence of a ceiling on the level of collective CO_2^e emissions that are acceptable. Second, it facilitates a more efficient approach to climate mitigation than either greenhouse taxes or direct regulation since it eliminates the necessity for firm, or individual, specific emissions limits. The idea is that the cost of achieving any particular scheme-wide cap will be lower than could achieved with alternative instruments because emissions allowances issued into the system will simply flow to their highest valued use (forms who face the highest marginal abatement costs) guaranteeing that emissions reductions take place where they are least costly to implement.[5]

Although the theoretical case for emissions trading is formidable, recent experience of the European Emissions Trading Scheme (EU ETS) shows that positive environmental outcomes depend greatly on the details of each scheme. Schemes that are not underpinned by a stringent (and declining) emissions budget, or issue more allowances than is necessary to meet this budget, or fail to cover emission of all six major greenhouse gases, will fail to bring about real cuts in the annual CO_2^e emissions of participating installations. The EU ETS, which was subject to all three flaws in its first few years of operation, actually led to a rise in the CO_2 emissions of participants from 2005-2007 of 2 per cent (European Commission, 2008; Point Carbon, 2008: 12-14). While emissions in the first year of the second phase (2007-2008) fell by 3 per cent - and are projected fall by 4-5 per cent between 2008 and 2009 - the scheme’s more recent success had more to do with the economic weakness of member states following the 2007 global financial crisis than the economic incentives introduced by emissions trading.

Nevertheless, emissions trading is a key aspect of climate policy, with several new schemes operating at national and regional level being discussed. The US Waxman-Markey bill of 2009, for example, included provision for a federal cap-and-trade scheme (the US ETS) on similar lines to the EU ETS but covering a wider range of GHGs and incorporating some additional trading and price measures (US Congress, 2009). Initially covering the GHG emissions of firms responsible for annual emissions of 25,000 tCO_2^e or more, the US ETS will initially cover electric utilities, fuel refineries and other industry responsible for 66 per cent of US annual emissions (in 2010) rising to 85 per cent of emissions (in 2016). Finally, despite not having emissions reductions responsibilities under the Kyoto Protocol, several developing countries, first and foremost China, are playing a key role in the development of mandatory emissions trading as a tool of carbon governance. China is the host country for over 80 per cent of the carbon credits currently issued through the CDM (Capoor and Ambrosi, 2009: 34-5); and at least three Chinese cities are planning to commence mandatory carbon trading amongst firms operating within their jurisdiction (Bloomberg, 2009).

The climate governance mix and some relevant desiderata

While the differences in underlying philosophies and potential environmental outcomes amongst the four instrument types should not be underestimated, analysts and policymakers generally acknowledge that each will play a role in effective national and international responses to climate change (Sorrell and Sijm, 2005: 204-217; Hepburn, 2006: 230). The resulting package of policies (the ‘climate governance mix’) will take its character from the balance and weightings of instruments adopted and set limits to the environmental outcomes achieved as well as shape the way in which these outcomes are achieved. The need for policy packages reflects the fact that certain instruments are better suited to certain aspects of climate policy. Consumer behaviour, for example, seems more readily and speedily modified through subsides or voluntary measures that adjust social norms in absence of direct regulation or complex citizen-level emissions taxes or trading. Energy intense firms, by contrast, may be most efficiently targeted by economic instruments that make them bear the social costs of their emissions profiles in absence of strict emissions standards or targets for each firm. The need for policy packages also reflects that fact that there is much more interaction between instruments than is often acknowledged in the environmental policy literature, which tends to regard instruments as substitutes rather than complements. Some existing emissions trading schemes, such as the Chicago Climate Exchange (CCX), are based on voluntary agreements; and several countries currently run schemes (such as the Climate Change Agreements in the UK) that offer firms participating in voluntary agreements reduced rates of energy tax in return for energy efficiency commitments. Broader policy packages are required, then, not only to balance the use of superficially competing instruments but also to draw out potential synergies amongst them.

A comprehensive evaluation of national and international climate policy not only involves working through the strengths and weaknesses of each instrument viewed its own terms, but also the comparative evaluation of instruments and, ultimately, the comparative evaluation of the policy packages to which they belong. As such, there are five main ways in which instruments, and the policy packages in which they are systematised, can be evaluated: environmental effectiveness; economic efficiency; political feasibility; distributive equity; and procedural fairness (Jacobs, 1991, 152-62; Paton, 2002, 140-8; Page, 2007).

Environmental effectiveness concerns the extent to which an instrument, policy or policy package predictably fulfils the general aims of policymakers, as well as the specific objectives that arise form this aim, in terms of protecting environment quality. As we have seen, the fundamental aim of global climate policy was defined by the FCCC as the avoidance of 'dangerous climate change.' One problem with the effectiveness criterion is the problem of the appropriate baseline for success or failure. Should an instrument's effectiveness be established by comparing its predictable outcomes against verified environmental performance in the past (a historical standard) or against environmental performance in a hypothetically constructed scenario (a counter-factual standard)? If a counter-factual standard is used, is the appropriate standard the environmental quality delivered by environmental policy inaction (business-as-usual); by the most effective rival instrument (comparative success); or by a consideration of what the relevant atmospheric users were entitled to expect of their policymakers (a normative standard)? Put simply, is the standard of environmental effectiveness to be understood as making atmospheric users no worse off than they were; better off than they could expect to be on any alternative policy; better off than they could expect to be had no action had been taken; or at least as well off as they have a right to expect.[6] Even putting aside problems concerning the appropriate baseline for evaluating environmental effectiveness, a further problem arises in the guise of separating endogenous and exogenous variables, that is, between environmental quality improvements brought about by a given policy and improvements brought about by exogenous factors such as structural change, industrial decline or war.

Economic efficiency means quite simply that the optimal, or least cost, path is taken to achieve the valued goals that determine the basis for climate policy. The main costs to be balanced, here, are those borne by regulators and the agents (firms, individuals, municipalities) who are the primary targets of policies designed to improve environmental quality. Other things being equal, economic efficiency dictates that reductions of greenhouse emissions take place where they are least costly to implement in terms of human well-being. If efficiency was the decisive, or only, value of relevance after environmental effectiveness then environmental policy would simply seek to equalise the marginal mitigation costs of all atmospheric users. However, to reduce climate policy making to aggregate environmental quality and cost effectiveness would be to ignore the socio-political dimension of climate change.

Political feasibility concerns the extent to which an environmental instrument or policy package can realistically achieve the support amongst policymakers, firms and citizens to be implemented. Philosophers and economists tend to downplay this criterion reflecting their fundamental concern with problems of ideal-theoretic conceptions of justice or economics. Ideal-theoretic analyses seek to clarify the optimum set of instruments and policies for the resolution of environmental problems on the assumption that agents will endorse, and fully comply with, the set of instruments and policies that best meets the criteria of effectiveness and efficiency. The assumption behind these analyses is that policies that can be shown to promote environmental quality and cost effectiveness in the theoretical domain will automatically generate support amongst atmospheric users. However, to the extent to which we are concerned about the real-world application, success and failure, of environmental policies - which depends more on national and regulatory culture, politics and self-interest as much as principled argument - political feasibility becomes a valid a criterion of environmental policy in itself. Determining how much weight should be given to political feasibility considerations, however, is a delicate task not least because public (and policymaker) support is malleable.

Distributive equity concerns the equitable distribution of costs and benefits. The idea is that environmental policy objectives must not merely be pursued at least cost to aggregate human well-being but also should refrain from introducing gross inequalities in the distribution of resources or exacerbating previously existing inequalities. The problem is that it is far from obvious which pattern of distribution should be adopted to adjudicate between the various consequences of alternative policies on human well-being; there is a need to incorporate norms of responsibility into our evaluation of rival policies; and the impact of policies of mitigation and adaptation on global poverty and development must also be taken into consideration.

Finally, *procedural fairness*, a neglected dimension of climate policymaking, is the idea that a certain degree of openness and participation should inform the policy construction process; and in addition that the policies selected are implemented in a procedurally fair and impartial manner. A concern for procedural justice in climate policy making comes from the fact that citizens, or other morally relevant agents, are not merely entitled to favourable outcomes, efficiently reached, of their policymakers but also that the process bringing about these outcomes are consistent with procedural justice. That is, to be justified to the agents to whom they apply, policies must be democratically accountable and involve equal treatment for those they bind. Applying norms of procedural justice amongst the four types of climate policy means at the minimum that we ascertain whether there are any unanswerable procedural objections to one policy alternative to which other alternatives are not susceptible.

Conclusion

In the above, I have sketched four main types of climate policy and outlined some relevant desiderata that might be used to evaluate rival environmental policies - and the policy-packages though which they might be systematised - in the name of managing the threats posed by global climate change. I have focused mainly on the problem of mitigation; and I have not sought to defend one type of policy in contrast to its rivals as a general solution to the good carbon governance problem. Several obstacles remain the path of a policy-relevant, analytically sophisticated, application of these desiderata to carbon governance problem First, how should we characterise the relationship between the various desiderata? It seems fairly clear that environmental effectiveness is of pre-eminent importance and should be allocated some priority over subsequent desiderata. But how do cost efficiency, political feasibility, distributive equity, procedural fairness relate to one another? Clarifying the relationship between these, sometimes conflicting, desiderata should be made an urgent focus of research. Second, how should the desiderata be applied across political, social and cultural boundaries? It is tempting to hold that the weightings and priorities on which we settle for one jurisdiction will also be suitable for extension to other jurisdictions. But this itself threatens the acknowledgment of the values contained in some of the desiderata themselves, not least distributive equity and procedural fairness.

Policy relevant climate ethics is very much in its infancy. It is the hope of the author that the cross-disciplinary and cross-national debate with which this conference is engaged will lead to fruitful progress not just in the characterisation of the good carbon governance problem but also its eventual solution.

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[2] For the purposes of simplicity I focus here on policies of mitigation and put aside for the most part issues of adaptation, compensation and geo-engineering.

[3] The most important of these legal instruments required member countries (i) to reduce their collective annual greenhouse emissions by 20 per cent; (ii) to raise energy efficiency by 20 per cent; and (iii) source 20 per cent of final energy consumption from renewable energy sources (European Union, 2009b).

[4] The scope of cap-and-trade schemes also turns on what point in the emissions cycle is adopted as the reference point for participation: ‘upstream schemes’ isolate energy suppliers and importers, whereas ‘downstream schemes’ isolate end users of energy, as participants.

[5] As evidence for this claim, proponents of greenhouse emissions trading cite the positive experience of emissions trading in the US Acid Rain Programme (where the introduction of a market in Sulphar Dioxide emissions permits brought about a 50 per cent reduction in acid rain 1990-2000 (Tietenberg, 2006, pp. 6-14). One problem with this claim, however, is that they ignores the fact that many European states secured an even higher reduction in SO_2 over a comparable time period (-69% between 1990 and 2007) for the EEA group of 32 countries) through combination of regulation, subsidies and voluntary action.

[6] One example of the problems faced when evaluating policies according to environmental effectiveness is the debate over the success of the US Sulphar Dioxide emissions trading scheme. It has been claimed that this scheme brought about a 50 per cent reduction in acid rain between 1990 and 2000. However, such claims ignore the *comparative-baseline* problem that the EEA group of 32 countries secured a comparable reduction (69 per cent) in SO_2 over a similar timescale (1990-2007) through a combination of regulation, subsidies and voluntary action.