1. Kyoto2 summary

1.1 Introduction

Kyoto2 is a new approach to regulating the world's atmospheric emissions of greenhouse gases (GHGs). It offers a framework for a new Climate Protocol after the existing Kyoto Protocol expires in 2012. Accordingly we refer to it as Kyoto2 and have created a website dedicated to the ideas set out, at **www.kyoto2.org**.

Existing approaches to regulating GHGs all have significant drawbacks, which Kyoto2 aims to overcome through market mechanisms including auctions, while also minimising the need for carbon / GHG audit and accounting, and promoting global equity and prosperity.

1.2 Key features

The key features of Kyoto2 are:

- Create a unified global system for regulating greenhouse gas emissions separate from the country-based system created by the 1997 Kyoto Protocol (Kyoto1). The Kyoto1 system could either be abandoned, or could run in parallel.
- Define a series of annual caps for greenhouse gas emissions for the years ahead in tonnes of carbon dioxide equivalent (tCO2e).
- Allocate greenhouse gas production rights (Rights) by means of a global auction of Rights (limited by the cap for the year in question) open to all bidders, denominated in tCO2e.
- Producers of greenhouse gases to limit their production to the extent of the Rights held and submitted.
- In the case of greenhouse gas emissions from fossil fuels, assess the emissions at the point of fossil fuel production according to the global warming potential of the fuel in question, so requiring the necessary Rights to be held by fossil fuel producing companies.
- In the case of other industrial greenhouse gas production, assess at the point of production. Thus Rights would need to be held by, *inter alia*:
    - cement producers, which emit additional carbon dioxide from the calcination of lime beyond that of the fossil fuel consumed
    - airlines and military air forces, to account for the radiative forcing caused by high altitude emissions of nitrogen oxides, water and particulates in addition to that of the carbon dioxide from fossil fuel combustion. These additional emissions approximately treble the warming effect of aviation relative to the carbon dioxide emissions alone.
    - producers of production of Potent Industrial Greenhouse Gases (PIGGs) such as HFCs, perfluorocarbons, SF6 - and the CFCs and HCFCs excluded from regulation under Kyoto1.
- For non-industrial greenhouse gas emissions not of natural origin, such as methane from agriculture and carbon dioxide from forest burning, Rights to be issued to Governments to cover their territories on a *per capita* of population basis. Excess Rights could be sold, and countries emitting in excess of their allocation would need to buy Rights to match their emissions.
- Rights to be allocated *pro rata* to parties that verifiably destroy or commit to safe long term storage greenhouse gases.
- Allow a secondary market in Rights.
- Allow unused RIghts to be carried forward from year to year.
- Consider applying a small (under 1%) "Tobin" tax on transactions to raise additional funds.

- Apply the funds raised from the emissions rights auction, which could easily achieve $500 billion - $1 trillion to per year, to tackling both the causes and the consequences of climate change.

1.3 Investing the climate funds

A key part of the Kyoto2 proposals is that the funds raised by the auction of greenhouse gas productin Rights should be invested so as to address both the causes and conserquences of climate change. The funds could be invested in the following ways:

- a Climate Adaptation Fund (CLIMAF) to help countries adapt to climate change
- programmes to reduce fossil fuel demand and economic dependence on fossil fuels, aimed especially at poorer countries and populations where the impact of higher fossil fuel prices would otherwise cause hardship
- assistance to governments in developing policies and institutional capacity to reduce non-fossil GHG emissions such as HFCs and emissions from agriculture and forest clearance
- establishing a Low Carbon Development Bank to finance viable low-carbon energy developments and associated infrastructure
- payment of "rent" to countries with natural biomes acting as carbon sinks and stores within their territories, such as forests and swamps, to maintain (and expand) those sinks and stores
- the funding of low-carbon energy research, for example, into renewable generation technologies
- the buyout of fossil fuel deposits, such as coal mines, "in the ground", to prevent those deposits from being worked. This would also provide some compensation to fossil fuel producing countries for any loss in revenues arising.

2. Existing approaches to regulating greenhouse gases

2.1 Main approaches

The main existing approaches to regulating greenhouse gas emissions are:

- the Kyoto Protocol of the UN Framework Convention on Climate Change (UNFCCC) (**http://www.unfccc.int**). Referred to below as "Kyoto1".
- the European Emissions Trading System (EU-ETS), which applies the Kyoto Protocol within the European Union.
- Contraction and Convergence (C&C) as conceived and promoted by Aubrey Meyer and the Global Commons Insititute (**http://www.gci.org.uk**).
- Domestic Tradeable Quotas (DTQs), a system under which individuals will be allocated a personal allowance of GHG emissions which they may use up or trade, as conceived by David Fleming and further developed by the Tyndall Centre (**http://www.tyndall.ac.uk/research/theme2/summary_t3_22.shtml**).
- Carbon Taxes, taxation levied on emissions of carbon dioxide (or equivalent of other GHGs) by national government; the UK has a related approach in the Climate Change Levy raised on business use of energy.
- Carbon cap, auction and trade (CCAT), as proposed by Peter Crampton (University of Maryland) & Suzi Kerr (Motu Economic and Public Policy Research) in their paper **Tradeable Carbon Permit Auctions - How and why to auction not grandfather** (*Energy Policy* 30, pp.333-345, 2002) for the USA.

2.2 Country-based approaches in general

One of the main faults of all existing approaches (including Kyoto1) is that they allocate carbon emission rights on a country basis. This is of limited benefit in the context of the global economy, in which "embodied carbon" is freely traded across national boundaries, and of the global climate which is indifferent as to where GHGs are emitted.

Note, for example, that the recent industrial expansion in China, India and Brazil, which has given rise to huge increases in GHG emissions, much of it aimed at production for export. Why then should the GHG emissions associated with this exported production be accounted for at the point of manufacture, rather than at the point of consumption?

One reason is there is no reliable mechanism for attaching the GHG impact of a product to the product itself so that it is transferred to the importing country. To even try to do so would involve an enormous carbon audit and acounting exercise which would be both error prone and costly.

Likewise certain countries have very high emissions of GHGs not because their inhabitants are profligate in their consumption of fossil fuels, but for geographical, geological and historical reasons. Countries with substantial oil resources tend to have high GHG emissions associated with the oil industry, even though the oil may almost all be exported and the people of those countries do not themselves benefit directly from emissions arising from the oil industry.

A further difficulty arises from the major GHG / carbon audit and accounting exercise associated with any country-based system. This is only added to if trading takes place, as under the flexibility mechanisms of the Kyoto Protocol. The huge audit and accounting system required creates three serious problems:

- the sheer expense and difficulty involved in carrying out audit and accounting
- the likelihood of accidental error
- the incentive for deliberate error.

However the country-based approach has one important point to recommend it: it brings a sense of national pride and prestige to bear upon the problem. By making Governments responsible for reducing GHG emissions in their territories, they have an incentive to act in order to preserve national reputation. It is worth noting that compliance with Kyoto1 is actually voluntary, in the absence of any formal compliance mechanism. Nonetheless governments have made some effort to ensure compliance with their targets.

So while the country-based approach does not have the rigour and fairness necessary for truly effective GHG regulation, it can nonetheless harness additional resources towards GHG emissions reductions.

The original Kyoto2 proposal was to abandon the idea that GHG emissions from fossil fuels should primarily be controlled by country. However an essentially voluntary country-based process on the Kyoto1 model could in fact continue at the same time as, and in parallel with, a more rigorous, mandatory approach.

The main areas where GHGs should be regulated on a country basis are those where GHG emissions are the direct result of Government policy (or or policy failure), for example emissions of methane from defunct coal mines, and emissions of carbon dioxide and methane from the mass clearance of forest.

2.3 The European Emissions Trading System - EU-ETS

The EU-ETS inherits the problems generic to country-based controls, but adds extra difficulties of its own to make the system intrinsically unworkable. Under the Kyoto Protocol, GHG emissions reduction targets within the EU are allocated to member states to achieve as they see fit. At the same time the EU-ETS - which applies only to large GHG emitters such as steel works and power stations, some 6,000 companies in all across the EU accounting for approximately half of all emissions - allows emissions reductions to be traded between member states. This creates conflict between the different policy approaches of member states.

Thus the UK's approach to meeting its Kyoto targets is to cut back on industrial emissions by setting relatively tight targets under the EU-ETS, while doing little to reduce domestic sector emissions. Germany on the other hand is doing the opposite: pursuing reductions in the domestic sector through ambitious programmes of energy efficiency and renewable electricity generation, while granting generous Allowances (EUAs) to its industries. Because the EUAs are tradeable among member states, however, this makes it cheaper for UK industries to buy up cheap German Allowances than to invest in reducing their own emissions - frustrating the UK Government policy objective.

As a consequence the market in EUAs has been highly unstable, and in early 2007 the price dropped to around €1/tCO2e, from a high the previous year in excess of €30. This market instability calls into question its abulity to act as a long term price signal to guide large scale investment in low-carbon technologies for the future.

But maybe the biggest failing of the EU-ETS is its very limited scope. It applies only to the largest emitters of GHGs accounting for approximately half of emissions, and so leaves out small companies and the entire domestic sector. Moreover it does not yet - as Kyoto1 does not - apply to emissions from aircraft.

2.4 The Kyoto Protocol

The Kyoto Protocol ("Kyoto1")approach embodies all of the problems implicit in any country-based approach. But it also includes "flexibility mechanisms" such as the Clean Development Mechanism (CDM) and Emissions Trading.

Emissions Trading allows Annex 1 (industrialised) countries under-shooting their Kyoto Protocol GHG emissions targets to sell their surplus rights to other Annex 1 countries who are exceeding their target.

The CDM allows entrepreneurs to develop projects in the non-Annex 1 countries that reduce GHG emissions (for example, by improving the efficiency of power stations, or reducing industrial emissions of HFC gases) or developing carbon sinks (for example, by the afforestation of bare land). The Certified Emissions Reductions (CERs) so produced are tradeable and may be counted by Annex 1 countries as reductions in their own GHG emissions.

While there is concern at the quality of some CDM projects, many have positive economic and environmental impacts. The greatest area of doubt is the extent to which CDM projects actually cause reductions in GHG emissions.

Currently (March 2007) some 70 percent of CERs to be issued are based on the supression of HFC-23 (trifluoromethane, a GHG 11,700 stronger than CO2) produced as a by-product of HCFC-22 (also a GHG, 1,500 times more powerful than CO2, but excluded from Kyoto1) manufacture for applications in refrigeration and air conditioning. As a consequence carbon trading income from the sale of HFC-23 related CERs are in effect subsidising the manufacture of HCFC-22, and so undermining the use of alternative refrigerants such as CO2 and hydrocarbons with far lower global warming potentials.

Or take the example of a CDM project to increase the efficiency of a power station. The result may simply be that more electricity is generated than before, and with less local pollution, not that less fuel is burnt. While it could be argued that the increased generation would remove the need for the construction of additional generation capacity, this does not necessarily follow. The result could be that the increased profitabily of the generating company would yield additional funds to invest in new generating capacity, which would not otherwise be available, so raising GHG emissions.

So while the CDM may in some cases succeed in achieving "clean [or cleaner] development" it is not clear that emissions reductions will follow from individual CDM projects. Indeed the reverse may often be the case.

It is worth noting in this context that the great majority of CDM projects currently under way are located in India, Brazil, China and Mexico - all countries in which GHG emissions are rising rapidly as a result of rapid industrialisation (and the increased general wealth resulting from it), much of it caused by the relocation of manufacturing industry from Annex 1 countries. The true extent to which GHG emissions have been reduced by the CDM projects is thus open to question.

Another problem inherent in Kyoto1 is that countries not in Annex 1 have no GHG emissions targets to achieve. This may be "fair" in the sense that these countries have contributed little to historic GHG emissions, however it undermines any possibility of achieving a global cap on GHG emissions. It also encourages the relocation of energy-intensive industries into non-Annex 1 countries.

Likewise Kyoto1 does not address emissions from aircraft - a relatively small source of global GHG emissions at present, but one that is very fast growing.

A further problem with the Kyoto1 approach is that while it is in principle legally binding, it lacks a compliance mechanism. As John Topping of the **Climate Institute** observes, *"in the final analysis countries who do not comply with their commitments face no greater sanction*

than rude press releases from environmental NGOs ... this supposedly binding mechanism runs entirely on the honour system".

2.5 Contraction and Convergence

C&C is an idea that has been gaining a lot of ground over recent years, and it has much to recommend it above the Kyoto1 approach, principally:

- the setting of firm global caps on annual GHG emissions - essential in any effective system
- the inclusion of all countries within its framework
- the "equity principle" implicit in the allocation of emissions rights to countries on a *per capita* basis. This is based on the idea that the right to emit greenhouse gases is a common right of humanity, not a private right of the rich or big companies.

However it inherits the problems already outlined that are inherent in any country-based system. It also involves a GHG audit and accounting exercise similar to that required by Kyoto1, a source of considerable cost and likely error.

In addition, some of the "equity" promised by C&C may emerge, in practice, as illusory. Intrinsic to the system is the tradeability of the national GHG emissions rights. This will provide poor countries with low carbon emissions, and especially those with high populations, with an income stream. However this will not necessarily raise the quality of life for inhabitants of the countries concerned.

There is no particular incentive for investment in such countries, since their GHG emission rights can be traded away to other countries and provide revenue to government. Indeed the prospect of this income might cause some governments to restrict development, and associated increases in GHG emissions, in order to preserve the income stream.

The income arising from selling emission rights under C&C may also be spent in any way the government in question chooses, rather than on improving the life of the population or reducing dependence on fossil fuels. Countries might simply "capitalise" the projected income stream from C&C by taking on additional debt, funding one-off expenditures which may, or may not, be to the national or global benefit.

In the round, however, C&C is one of the best global policy options. Indeed we propose that it is the best option for controlling GHG emissions from diffuse, non-industrial sources. Those emissions are best controlled on a country basis since their emission can and should be regulated by Governments. A *per capita* allocation of permits to emit non-industrial origin GHGs to Governments has the benefits of fairness and clarity, and may be acceptable to most Governments.

However for the bulk of GHG emissions that do come from industrial sources the challenge is to find optimal ways of implementing the key objectives of C&C.

Note: a new position paper on **Kyoto2 and Contraction & Convergence** was posted on this website on 13 February 2007.

2.6 Domestic Tradeable Quotas

Another idea that has recently gained currency, and ministerial support from UK Environment Secretary David Miliband, is that of Domestic Tradable Quotas (DTQs), denominated in kilogrammes of CO2. Under this approach, individuals would be allocated a *per capita* "share" of the UK's total emissions quota which would be paid into an "account" similar to a bank account. When puchasing an energy product such as gas, petrol or coal, they would have to

"pay" the associated number of DTQs, perhaps using a plastic "swipe card". They could also sell surplus DTQs to others with a more profligate lifestyle.

In the original version of the idea, individuals would be allocated 40 percent of the national DTQs on a per capita basis, while the remainder would be sold to companies and other organisations in a Government-run auction. It has since been suggested that all DTQs should be allocated to individuals who could then sell on to organisations. The Tyndall Centre recognises that many would not want to participate in the DTQ market, and proposes that they should sell all their DTQs on receipt and buy back as they buy energy products.

The main disadvantage of a DTQ system is the huge associated accounting exercise. Most people already have trouble enough managing their money and prefer to set aside such matters as tax returns, subscribing to pension plans, or resolving debt problems, for as long as possible. To impose yet another "currency" and associated obligations on the public might - for all but enthusiasts - be a step too far.

However the Kyoto2 approach would be entirely compatible with DTQ arrangements conducted on a national or regional basis. The effect of DTQ regimes would undoubtedly be to reduce fossil fuel use and GHG emissions where in force, and would thus support the objectives of the UNFCCC and Kyoto2.

2.7 Carbon Taxes

Carbon Taxes have the advantage that there is no need to create any new "currencies" in the form of DTQs, CERs or anything else: the cost of GHG emissions becomes a simple cost measured in money. However Carbon Taxes have always been resisted by industry on the reasonable basis that so long as they exist in one country and not in another, energy intensive industries and other GHG emitters in that country suffer a disadvantage, and GHG intensive industries will simply move to where the Carbon Tax is lowest or non-existent. So, to be both acceptable and effective, Carbon Taxes must have a global application.

But who is to determine the tax level? The global policy objective should not be to determine a particular rate of carbon taxation, but rather particular levels of global GHG emissions consonant with expert scientific advice.

And where should the money raised by Carbon Taxes go? At present the proceeds of taxes raised nationally simply go to the Governments concerned. If a Carbon Tax were to be raised globally, a new mechanism for allocating the funds raised would need to be created and agreed upon.

While Carbon Taxes clearly have some merit, the approach is less effective at achieving policy objectives than that described in the following paragraphs.

2.8 Carbon Cap, Auction, Trade

The case for a Carbon Cap, Auction, Trade (CCAT) approach is well advocated by Peter Crampton and Suzi Kerr in their excellent paper **Tradeable Carbon Permit Auctions** (*Energy Policy* 30, 2002). The arguments they make are addressed at national policy, primarily within the USA. However the arguments apply equally to a global policy context.

Key features of the auction system they set out include:

- "To minimize administrative costs, permits would be required at the level of oil refineries, natural gas pipe lines, liquid sellers, and coal processing plants"
- "To maximize liquidity in secondary markets, permits would be fully tradable and bankable"

- "A standard ascending-clock auction in which price is gradually raised until there is no excess demand would provide reliable price discovery"
- "An auction is preferred to grandfathering (giving companies permits based on historical output or emissions), because it allows reduced tax distortions, provides more flexibility in distribution of costs, provides greater incentives for innovation, and reduces the need for politically contentious arguments over the allocation of rents."
- "To increase liquidity in this market, all permits are the same after their date of issue, and permits are bankable ... There is no environmental loss in making permits bankable. Current carbon emissions are reduced to the extent that permits are banked. Given the long life time of CO2 in the atmosphere, short term voluntary banking is unlikely to have significant impacts on CO2 concentrations. Allowing banking further increases liquidity in secondary markets, since all permits are the same after their date of issue."
- "permits can and should be auctioned not only for the current years but also for future issue years ... Early auctions would facilitate the development of an active futures and options market, thus improving risk allocation."
- Auctions to be held quarterly.
- The sums raised from carbon auction to go into general tax revenue, in effect funding tax cuts elsewhere in the economy.

They further point out a major advantage of auction over allocation of carbon permits:

"Advocates of grandfathering usually fail to point out that, if the permits are given to energy companies, consumers will still pay the higher energy prices. It is the carbon cap itself that will determine the price increase. Regardless of whether the government auctions permits or gives them away for free, the same energy price should be expected."

This is precisely what has been observed in the EU-ETS, where Allowances were handed out to large carbon emitters on the basis of historic emissions, giving recipients a huge financial windfall.

As to the form of auction, Crampton & Kerr conclude that an "Ascending-Clock Auction" is optimal for carbon permits. As they explain:

"The auction begins at a low price. With each round, the bidders are asked what quantity they demand at the price posted on the auction clock. If there is excess demand, the price is increased. This process continues until the excess demand falls to zero. The bidders then receive their quantity bid at the final price. This auction generates a uniform price for carbon permits. All bidders get their demands at the market price. A secondary market will allow the sale and purchase of permits as circumstances change. This design assures a highly efficient allocation of the permits."

The CCAT approach is fair, economically optimal and relatively easy to implement. Kyoto2 therefore adopts CCAT in its entirety. The main difference of substance is that it is applied globally, rather than within a single jurisdiction.

3. The Kyoto2 proposals

3.1 Introducing Kyoto2

The approach advocated in this paper unashamedly appropriates key features of existing and proposed approaches to carbon regulation, and re-assembles them into a new structure aimed at achieving the best of those approaches, while avoiding the problems.

The key ideas behind Kyoto2 are:

- The system as a whole is global in scope.
- A series of firm caps to be set on global emissions of GHGs (in tonnes of carbon dioxide equivalent, tCO2e).
- GHG production to be controlled at point of production, not emission.
- In the specific case of GHG emissions from fossil fuels, regulate the production of the fossil fuels themselves. This is the most efficient point at which to control the associated GHG emissions due to the relatively small number of points of fossil fuel production.
- The bulk of GHG production rights (Rights) to be allocated by an annual (or more frequent) global auction open to all bidders.
- Producers of fossil fuels and industrial greenhouse gases would need to hold sufficient RIghts to match their production, upon which the Rights which would be extinguished. Accordingly those needing to obtain Rights would include:
    - Companies producing fossil fuels.
    - Airlines and air forces, to account for the excess radiative forcing of aviation beyond that of CO2 alone, caused by emissions of oxides of nitrogen, particulates etc, estimated (IPCC, 1999) at 2.7 times that of CO2 alone.
    - Producers of Portland cement: the carbon dioxide emissions from the calcination of lime during the manufacture of Portland cement are approximately equal the typical CO2 emissions from the burning of fossil fuel. (**www.enviroliteracy.org/article.php/1257.html**). Collectively such emissions account for some 2.5 percent of global anthropogenic CO2 emissions).
    - Producers of Potent Industrial Greenhouse Gases (PIGGs), including HFCs (as used in refrigeration and air conditioning), sulphur hexafluoride, PFCs from aluminium manufacture and (as specifically excluded from Kyoto1) the CFCs and HCFCs. The CFCs and HCFCs are controlled by the Montreal Protocol as a result of their ability to destroy stratospheric ozone, but their global warming effects have not been addressed. The climate impact of the PIGGs is expected (**Multisectoral Initiative on Potent Industrial Greenhouse Gases** to make up 8.6 percent of total global warming by 2050.
- Rights to emit non-industrial GHGs, which arise mainly from diffuse and hard to identify and control sources, to be allocated to countries on a *per capita* basis in accord with the C&C principle, on the basis that their Governments have the power to regulate such emissions within their territories. This would apply mainly to methane from such sources as landfill sites, coal mines, sewage plants and agriculture, and to CO2 from forest clearance, specifically excluding unavoidable natural emissions.
- Rights to be tradeable allowing them to go where needed most at any point in time.
- Unextinguished Rights to be carried over from year to year.
- Where GHGs are verifiably destroyed or put into safe long term storage, Rights to be credited *pro rata*.
- Invest the money raised from the Rights auction, which could easily reach $/€ 500 billion - $/€1 trillion, to tackle both the causes and consequences of climate change, for example to: mitigate climate change impacts; help countries to adapt to new climates; and create a worldwide transition to an equitable, prosperous, low carbon economy.

3.1 The Global Cap

The reason to set a cap on global GHG emissions is, simply that this is the only way to be sure that GHG emissions do not continue to rise as they may well do - even with other excellent policy measures in place - in the absence of a cap, as has happened under the Kyoto Protocol. The cap would need to be global as the global climate responds to global GHG emissions.

A series of annual caps reaching far into the future would need to be set by parties to the UNFCCC in order to facilitate the necessary long term decisions and investments. The caps should, once agreed, only be adjusted in the light of overwhelming scientific evidence as to the need so to do. It is envisaged that firm caps should be in place for a decade ahead, creating market certainty, while less accurate ranges would be defined for the years beyond.

Ideally the caps would be set in accord with expert scientific advice from the Inter-Governmental Panel on Climate Change (IPCC). The next challenge is then to determine how rights to emit GHGs should be allocated.

3.2 Auction

A broad base of economic theory, amply confirmed by empirical evidence, suggests that auction is the most optimal means of allocating a scarce resource with many competitive buyers. This approach tends to guarantee the best return to the seller, and allocate the resource - in this case GHG production Rights - to where it will be used to the greatest economic advantage.

In the matter of the form and process of auction, the arguments of Crampton & Kerr set out in 2.8 above are broadly accepted. The use of Ascending-Clock Auction seems entirely appropriate.

The question of a hybrid mechanism is also one to consider: that is a hybrid between the "quantity-based" auction (in which the quantity is limited) and a price-based system (effectively a tax which is at a fixed level). The economic theory of such hybrid instruments was first presented in 1976 by Marc Roberts & Michael Spence ("Effluent Charges and Licenses Under Uncertainty", *Journal of Public Economics* 1976) and was recently expanded by Cameron Hepburn (*Oxford Review of Economic Policy* Vol. 22 No. 2, summer 2006) in "**Regulation by prices, quantities or both: a review of instrument choice**" with specific application to environmental regulation.

In this scenario, the auction could be subject to floor and ceiling prices. That is to say, that if the auction price fails to achieve the floor price, the quantity of Rights on offer is reduced until that floor price is achieved. If the ceiling price is achieved, the quantity of Rights on offer is increased until demand is no longer sufficient to maintain the ceiling price.

The advantages of this approach are severalfold:

- the existence of a floor price for Rights provides a secure long term price signal for investors and would prevent the possibility of a damaging price crash
- the existence of a maximum price limits potential adverse economic impacts that might arise from a very high price for Rights
- the combined effect of the floor and ceiling prices is to reduce uncertainty in the marketplace, and as regards the revenues to be raised from the sale of Rights.

Any "excess" allocation of Rights in one year could be corrected in subsequent years by an equivalent reduction in quantity offered in future years. This may be justified since the greater than anticipated revenue would be invested in reducing demand for Rights in future years.

Such are the benefits of using a hybrid auction mechanism that this approach now forms part of the Kyoto2 proposals. However suitable floor and ceiling price levels have yet to be determined

A further key question is that of who would need to buy Rights, or at what stage in the GHG production chain audit and verification is to take place. The principle applied is to go upstream to reduce the number of control points. In the case of GHGs derived from the burning of fossil fuels, which accounts for most GHG emissions, the best points to use are at or close to fossil fuel production, such as coal-washing plant, or oil refinery. This involves a relatively small number of players each producing on a large scale, so greatly simplifying the task of ensuring regulatory compliance. This also avoids the need for carbon audit and accounting at subsequent points in the supply chain.

Accordingly the main auction participants needing to acquire Rights would be fossil fuel producers who would need to acquire sufficient Rights to match the carbon equivalent of their production. Secondary participants would be cement producers, the aviation industry and Potent Industrial Greenhouse Gas (PIGG) producers.

We also need to consider a further category of GHG emissions: those avoidable (excluding, for example, emissions from natural ecosystems) GHG emissions from non-industrial sources, such as

- methane from defunct coal mines, land fillsites and agriculture
- methane and carbon dioxide arising from forest clearance.

It is proposed that a proportion of the total GHG cap is allocated to National Governments to cover such emissions, on a *per capita* basis in accord with C&C principles. This would mean that poor countries would in general not need to find cash with which to purchase Rights at auction, but might even have a surplus for sale. All Governments would be incentivised to put in place policy measures for the reduction of their non-industrial GHG emissions, while also devising systems to ensure that the actual emitters, where possible, paid their share of the cost.

A key aspect of enforcement here would be a global network of strategically located monitoring stations, including satellite observatories, which would collect data on atmospheric levels of key GHGs and land use.

3.3 Trade

It is essential that Rights be tradeable in order that those holding surpluses be able to sell them to those in deficit, so ensuring their efficient allocation in a secondary market. Participation in both auction and secondary market should not be limited to any particular category of trader, in order to allow a trading system to develop similar to that existing in financial markets.

However it is proposed that the application of a small "Tobin tax" of under 1 percent should be considered for levy on secondary Rights trades to pay for the cost of administering the trading system and to yield additional revenue.

3.4 Regulatory questions

A number of regulatory questions will need to be addressed, for example:

- Should, and if so on what terms, Rights for one year be carried over to a future year? Or "borrowed" from a future year into the current year?

- How should fossil fuel producers / Governments who end the year in deficient of Rights be penalised?

It is proposed that:

- Rights may be carried forward into future years without restriction or penalty.
- Rights may not be carried back from future years.
- Governments and organisations alike who are in Rights deficit should be penalised by paying a "buyout price". This price might be fixed at a multiple (to be determined) of the price set in the preceding Rights auction, or linked to the "ceiling price" in a hybrid auction.

However there is scope for debate on these points. See, for example, "**Managing Permit Markets to Stabilize Prices**" by Richard Newell, William Pizer, and Jiangfeng Zhang (*Resources for the Future*, June 2003), which establishes that the ability to borrow Rights from future years, subject to payment of interest (also denominated in Rights) can have a stabilising effect on markets.

3.4 Kyoto1 Flexibility Mechanisms

The Clean Development Mechanism (CDM - **http://cdm.unfccc.int**) and Joint Implementation (JI), the most important of the Kyoto Protocol's "flexibility mechanisms", have proved to be a powerful means of mobilising investment to reduce GHG emissions, from both fossil fuel and other sources. This is demonstrated by the number of Certified Emissions Reductions (CERs) expected to be delivered by 2012: 660 million, equivalent to reductions in CO2 emissions of 660 million tonnes.

However these mechanisms would play no direct part Kyoto2, since they rely on the differing status under the Kyoto Protocol of Annex 1 and other nations. Under Kyoto2 there is no such distinction and all countries are on an equal footing.

However that does not mean that organisations involved in the CDM / JI will not be able to put their experience and expertise to good use. There may also be opportunities to continue a re-configured CDM / JI if this is seen as desirable. First, let us consider the two forms of CDM / JI projects - those that reduce emissions from:

- fossil fuels and industrial sources
- non-industrial emissions of GHGs such as CFCs, methane etc.

Energy and industrial projects

Under Kyoto2 the main incentive to stop burning fossil fuels, and to reduce production of other industrial GHGs, would come from the increased cost under the global GHG production cap. Any CDM / JI -like projects aimed at reducing fossil fuel consumption and other industrial emissions would, accordingly, have no effect on global emissions.

However they would achieve targetted reductions in fossil fuel demand, so reducing the price of fossil fuels within the cap - in effect, producing "Certified Demand Reductions" rather than the current "Certified Emissions Reductions" or "Emission Reduction Units" (ERUs). This would ease the transition process towards a lower carbon economy. In the case of projects targetted at poor people, it would also create social and economic benefits for them, helping to offset the impact of higher fossil fuel costs.

Funds might therefore be allocated from auction proceeds for the purchase of CERs / ERUs, not for any reduction in carbon emissions, but for the other resulting benefits.

Non-industrial projects

Under Kyoto2 National Governments would be responsible for avoidable GHG emissions not otherwise controlled, such as methane which is emitted from numerous and diverse sources. It would be advantageous for them to reduce their need for Rights - either reducing their need to buy them or producing a surplus from their allocation for sale. Accordingly there is scope for a market in which companies bring about such reductions by way of CDM-like projects - for example to capture methane emissions at pig farms. The Government of the territory in question might, for example, pay the company a proportion of the Rights saved. Or it might agree to the sale of the Rights liberated by such a scheme within its territory, and take part of the sale value as a commission.

3.5 Invest

Current carbon dioxide production from fossil fuels (2004, IEA) is 26,583Mt. If the current spot price for EU-ETS allowances (€12.15/tCO2) is indicative of the price of GERs under Kyoto2 the sum realisable at global auction is €323 billion. However it is generally accepted that €20-25/tCO2 is sustainable. Even at the lower end of this range at €20/tCO2 we find that in excess of €500 billion per year could be raised.

Some would want these revenues to be redistributed directly to member states. If the funds were allocated to national governmments on a *per capita* of population basis this would be, in effect, an economically efficient implementation of Contraction & Convergence.

However this approach would neglect a substantial opportunity to address positively:

- the impacts of climate change on vulnerable countries, and the costs of adaptation
- the impacts of the increased costs of energy derived from fossil fuels to consumers, and especially poor consumers, arising from Kyoto2
- the impacts of reduced revenues to governments of fossil fuel producing countries arising from Kyoto2
- the need to shift towards an efficient, prosperous and equitable low carbon global economy.

Accordingly it is proposed that a number of investments and expenditures be made from the sums raised from the GER auction. These should arguably include:

- The creation of a Climate Adaptation Fund that would help poor countries in particular to adapt to climate change through engineering solutions, population relocation and the development of alternative livelihoods. Likely recipients would be countries suffering from or at risk of flood, drought, loss of glacial meltwaters, excessive heat, and loss of permafrost.
- Programmes to reduce fossil fuel demand and economic dependence on fossil fuels, aimed especially at poorer countries and populations where the impact of higher fossil fuel prices would otherwise cause hardship. One possible mechanism would be through the purchase of CERs / ERUs (see 3.4 above). Purchases could be directed towards specific countries and specific sectors in accordance with development needs and just distribution of benefits, unlike the existing CDM system which has disproportionately benefitted a few countries (notably India, Brazil, China and Mexico) while almost entirely passing by the entire African continent.
- Assistance to governments in developing policies and capacity to reduce GHG emissions within their territories, including emissions of PIGGs from refrigeration and air-conditioning, and emissions from forest clearance. The level of funding to different national governments to be based on the scale of the problems to be tackled and with particular emphasis on poor countries.
- Payment of "rent" to countries with carbon sinks and stores within their territories, for the implementation of agreed programmes of maintenance and enhancement of their

carbon sinks and stores. Preference would be given to countries wishing to preserve or enhance extensive native ecosystems and the level of payment would reflect the economic benefits foregone in preserving rather than destroying such native ecosystems. This would create a necessary "reward" for forest rich countries for preserving their forests, rather than relying entirely on the penalisation of forest destruction whch would, on its own, be unfair to many poor countries.

- The buyout of unexploited fossil fuel deposits "in the ground" such as coal reserves, in order to prevent their exploitation. One effect would be to partially compensate fossil fuel producing countries for any loss in revenues arising from the application of the Kyoto2 system.
- The funding of low-carbon energy research, for example, into renewable generation technologies and nuclear fusion.
- The establishment of a Low Carbon Development Bank with a particular mission to finance viable low-carbon energy developments and associated infrastructure. Examples of projects that might be funded include new electricity transmission lines and hydrogen pipelines to connect regions rich in renewable energy resources to energy markets.