Smith School of Enterprise and the Environment

UNIVERSITY OF OXFORD

International climate change negotiations: Key lessons and next steps

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Smith School of Enterprise and the Environment

The Smith School is an interactive hub within Oxford University that engages with, educates and equips public and private enterprise with the solutions, knowledge and networks needed to address the major environmental challenges facing our planet.

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- A translator and integrator
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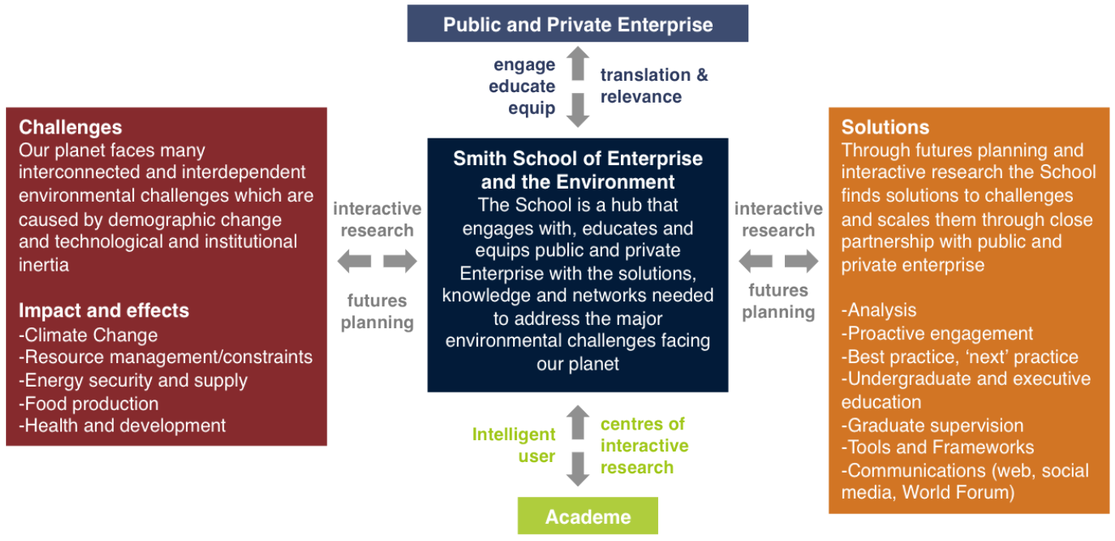

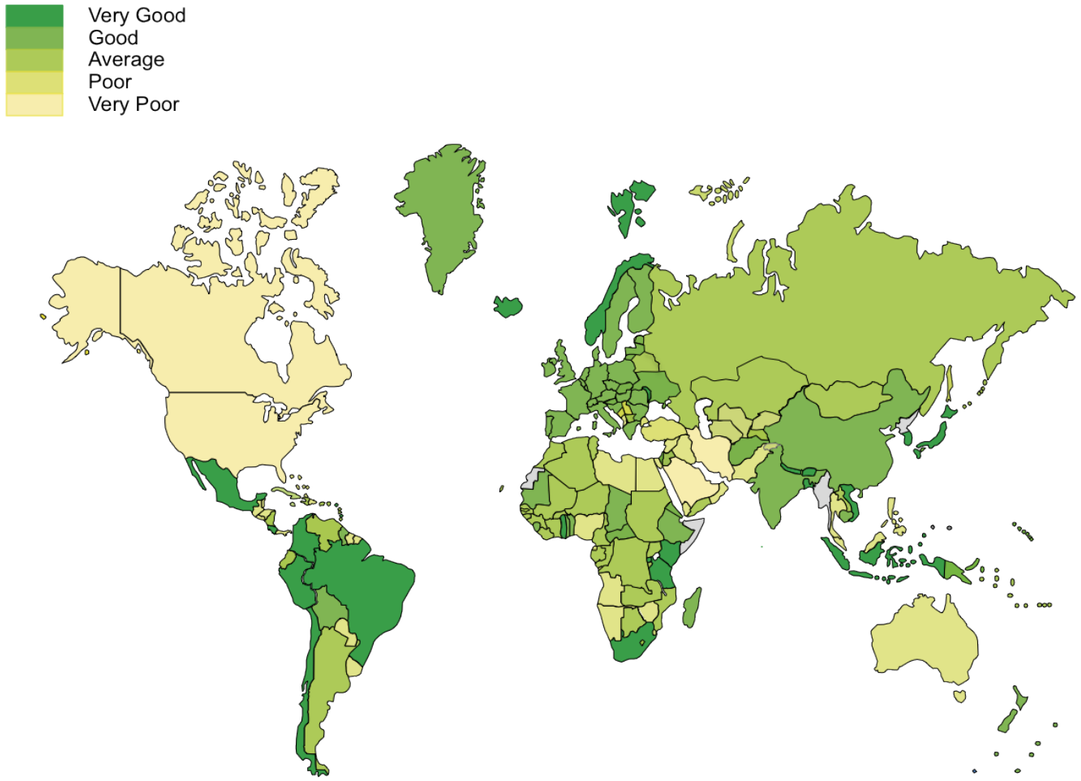

Figure 1 - A map of countries of the world rated in terms of national actions and commitments on climate change. Annex I countries are rated based on submissions pertinent to the Cancun Agreements.
'Very good': meet IPCC recommendations, Annex I: 25 - 40% reduction by 2020, Non-Annex I: submitted NAMA, 15-30% below BAU by 2020, or vocal in pressing for action.
Those countries not participating in the UNFCCC process are coloured grey.

Executive Summary

The challenges to policy makers raised by climate change are wide-ranging and the threats posed to society are substantial. It is now widely recognised that reducing greenhouse gas emissions and deforestation are of the greatest urgency and there is, at last, a clear mandate for effective political, technological and financial action on a global scale, although the process for achieving this remains frustratingly elusive.

This report provides a summary of the international efforts to address the problem of climate change through the UNFCCC and G8/G20 processes. In particular, the outcomes of the Copenhagen and Cancun Conference of Parties (COP) negotiations are examined. From this, key lessons that can be drawn from the negotiations are:

- The current actions pledged are still a long way from what is necessary: individual Governments need to take more action to curb emissions

- New forums for negotiations should be utilised in parallel with the UNFCCC process, focused on bilateral and regional action

- The pledge-and-review system set up in Copenhagen and Cancun is a useful way forward in the absence of an international legally-binding agreement

The report puts forward a series of next steps or actions that would be practical in furthering practical action. Notably:

- Strong decisive steps are needed from key governments to place a long-term, stable and appropriate price on greenhouse gas (GHG) emissions. This will signal to the corporate sector that climate change is to be dealt with seriously, and stimulate appropriate investment from that sector to produce market-facing solutions

- Limiting emissions from deforestation is a key area in which incentives need to be put in place immediately

- RD&D spending on clean energy should be increased with the public sector using its limited funds to leverage private sector investment

- The co-benefits between energy security, economic stimulus through energy efficiencies and innovation, and tackling climate change should be highlighted

The report emphasises that funding for mitigation and adaptation in least developed countries is also critical. The Green Climate Fund set up at Cancun marks one attempt at achieving this. Equity is also critical to the climate change issue, and needs to be properly considered in any proposed solutions. Potentially running alongside other funding mechanisms, a cap and trade system based on a per capita emissions target by mid-century is proposed here as a potential method of generating financial flows from developed nations to the least developed world, whilst creating incentives for local decision making.

To conclude, although the challenges raised by climate change are considerable, these challenges are also major opportunities for innovation and development.

The Scope of the Study

Introduction

Recent painstaking analyses, based on ten different indicators of global temperature change which include air and sea temperatures, melting ice and rising sea levels, produced by US and UK Government and Meteorological Office scientists, show that global temperatures have been rising since the 1850s [1].

The US National Oceanic and Atmospheric Administration conclude from separate data that June 2010 was the hottest on record [2]. In 2010, record high temperatures were reported in 17 countries, including 53.5˚C in Pakistan. Temperatures in Moscow in the summer of 2010 were 20˚C above normal. Global temperatures reached a record high for 2010, as predicted by climate modellers.

By contrast, solar activity this decade is reported to be at an unusually low level. The global average temperature rise of 0.4˚C over the past two decades can be safely attributed to the rise in greenhouse gas (GHG) levels in the earth's atmosphere – largely due to use of fossil fuels and to continuing deforestation, as set out by the Intergovernmental Panel on Climate Change (IPCC) in their latest report.

The need for urgent political action to manage this existential threat to our global civilisation could not be clearer.

The Conference of Parties (COP) rounds of the United Nations Framework Convention on Climate Change (UNFCCC) in 2010 in Cancun concluded with the 'Cancun Agreements' which represents the best outcome possible under the circumstances.

The negotiations ended with an agreement that concreted and built on the Copenhagen Accord produced at last year's COP. However, despite the relatively good outcome, action is still a long way from what is necessary to ensure global warming does not continue to dangerous levels. Individual governments should take more action to curb their emissions. Urgency needs to be re-injected into the negotiations.

Here we provide an appraisal of the UNFCCC process and an analysis of the variety of action plans, at national, regional and international levels, that will now be required to ensure the emissions reductions so urgently needed.

The paper is structured as follows.

Chapter 2 examines the outcomes of the UNFCCC negotiation process in the context of the history of the climate change negotiations.

Chapter 3 then addresses the outcomes of the Cancun climate change negotiations.

The key lessons that can be taken from the negotiations so far are discussed in Chapter 4.

Chapter 5 addresses the future and the steps that are needed to progress the negotiations and action on climate change.

Chapter 6 reflects on the potential parallel proceses that will leed to progress in climate change action.

Finally Chapter 7 summarises the key findings of the paper.

The International Climate Change Negotiations

History of the Negotiations

To understand the implications of the outcomes from Cancun, it is necessary to put the conference and what it was intended to achieve in perspective.

The problem of climate change was brought to light at an international level by the first IPCC Assessment Report in 1990 which highlighted the issue as a subject in need of a political platform. The IPCC was created in 1988 by the World Meteorological Organisation and the United Nations Environment Program to provide a review of the consensus scientific view on the subject.

The findings of the IPCC spurred the beginning of the climate change negotiations in 1991 which have since developed in essentially three stages.

Initially, climate negotiations acted to establish a framework of governance. This took the form of the UNFCCC which was adopted in 1992 and entered into force two years later.

Following this, negotiations proceeded to set up the Kyoto Protocol; this began in 1995, in 1997 the Kyoto Protocol was adopted, and the stage concluded in 2001 when the detailed rules for the Protocol's implementation were finalised in Marrakesh at the seventh COP.

The Kyoto Protocol set up emissions reduction targets for 37 developed countries and the European community, this group of countries being referred to under the Kyoto Protocol as Annex B countries (Annex I under the FCCC). The individual emissions targets were intended to reduce emissions by developed countries by 5 per cent against the 1990 levels over the 5-year period of 2008-2012. No targets were set for developing countries.

In addition, the Kyoto Protocol established market-based mechanisms to help countries reach their targets in a cost-effective way. The major instruments are the Emissions Trading Schemes (ETS), inspired by the success of the SO_2 trading schemes in the US at reducing acid rain; the Clean Development Mechanism (CDM); and Joint Implementation (JI) [3].

Currently the negotiations are in the third stage: the formation of policy for the post-2012 period when the Kyoto Protocol's first commitment period ends.

These negotiations have proceeded along two tracks. The first track, known as the Ad hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol (AWG-KP), is intended to negotiate improvements in the Kyoto Protocol and a second set of emissions targets. This track covers only the developed countries signed up to the first commitment period of the Kyoto Protocol (not the US).

The second track was launched by the Bali Action Plan to work on an 'agreed outcome' under the UNFCCC and is known as the Ad hoc Working Group on Long-Term Cooperative Action (AWG-LCA). This includes negotiations on mitigation actions for developed countries, nationally appropriate mitigation actions (NAMAs) by developing countries, financial arrangements, adaptation, technology transfer and a system for monitoring, reporting and verification.

There has been much debate about the form of the agreement for the post-2012 period, principally, whether or not it should take the form of a single

instrument that would replace the Kyoto Protocol or two instruments, one to extend the Kyoto protocol and the other under the UNFCCC.

There are divisions among countries, with developed countries generally preferring a single instrument and developing countries favouring two instruments [3].

So far the current phase of the negotiations has been unsuccessful in its aim to produce a new legal instrument for the period beyond 2012. Despite some advances made in other areas the global legal deal remains elusive.

In a very important sense, the Kyoto process can be deemed a failure. The original objective, for the developed (Annex 1) nations to reduce emissions by 5 per cent below 1990 levels by 2012, although far too modest to halt global warming, will not be met without the use of the compliance system.

Over the period since the adoption of the UNFCCC thousands of negotiators, meeting at least twice a year, have formed themselves into a negotiating community which is unable to move with the times. Since 1992 the science of climate change has become considerably more sophisticated, and the need to defossilise the global economy by the middle of the twenty-first century has emerged.

Since that time, too, a group of nations representing a very large proportion of the world's population has formed a new category of emerging powers. China, India, Brazil, Mexico, South Africa and Indonesia can no longer be placed in a category of 'non-Annex 1' countries together with Ethiopia, Haiti etc. And CO_2 emissions from China now match the US at the head of the world emissions table.

Arguably, however, more progress has been made since 2000 outside the UNFCCC process.

The British Government took a leading role in 2003, unilaterally declaring its intention to reduce CO_2 emissions by 60 per cent by 2050, and introducing its internal ETS in 2004. This was followed by the European Union's adoption of an ETS in 2005.

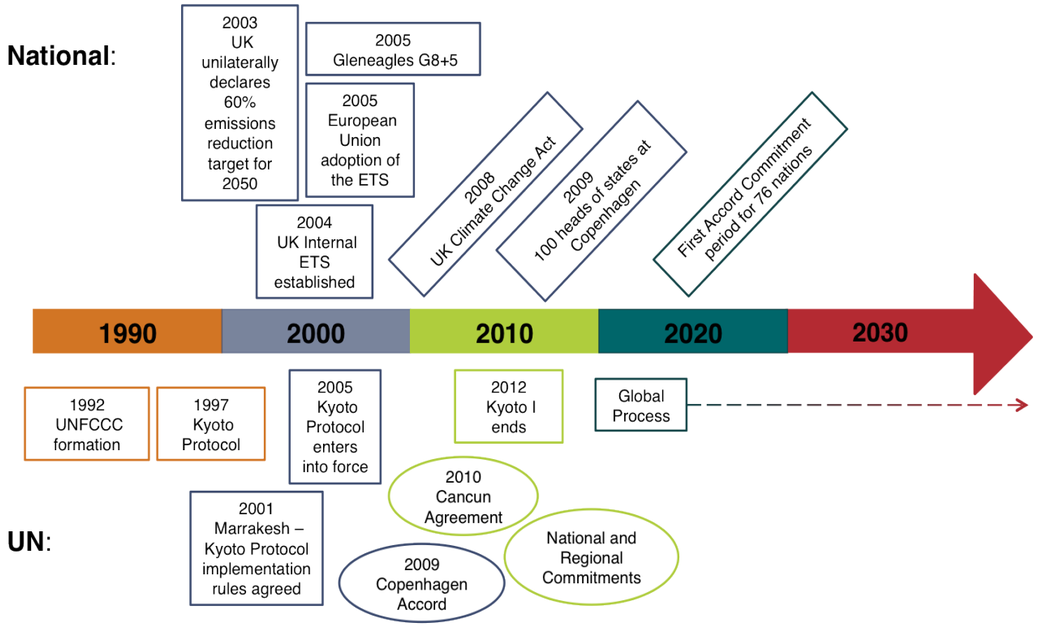

Figure 2 - Timeline of climate change related political actions.

In 2005 the UK Government decided to place climate change at the top of its international agenda, initiated by an international conference on the impacts of climate change, and followed by successive meetings of G20 science, energy and environment ministers, all leading up to the G8 meeting at Gleneagles, with the UK Government in the Presidency.

Recognising the rising importance of the rapidly emerging powers, the heads of states of China, India, Brazil, Mexico and South Africa were invited for the top agenda item, climate change, thus creating the G8+5 grouping.

Over subsequent years each head of state in the Presidency of the G8 retained the G8+5 format and maintained climate change as the lead agenda item.

On the diplomatic front, Sir David King was tasked by the British Prime Minister in 2003 to travel widely abroad to speak on the importance of managing global warming, delivering around 70 lectures a year for the following 4 years, including many addresses to parliaments and discussions with heads of state, government ministers, and business leaders.

The British Foreign Office expended considerable resource on raising the profile of climate change in key embassies around the world – including more than 20 experts in the Beijing Embassy. Most noteworthy, perhaps, was a Memorandum of Understanding reached between the British and Chinese Governments which enabled a British team, assembled by Sir David King, to work with a Chinese team on climate change flood risks in the Yangtze basin area, including Shanghai.

The British team had used detailed climate models to examine flood risk to the UK out to 2080, and had produced an action plan for the UK to adapt to the risks [4].

The future risk to the Chinese economy from a combination of fluvial flooding down the Yangtze river and rising sea levels highlighted the critical threat of climate change to China's future prosperity [5]. The Chinese politburo clearly took a decision in 2006 to reduce China's dependence on fossil fuels and to push hard in international negotiations for global action. Their particular concern was the obstructive position of the Bush administration. The red lining of draft agreements in the G8+5 process by the US sherpas over this period was the major block towards further progress.

With the European ETS inaugurated in 2005, a new factor emerged. As this new trading market in CO_2 was established in London, the financial community and the business community became engaged in the issue of global warming, with important consequences. The CEOs of many major international companies became champions of the need for action on climate change. This was a very important message for the politicians. A major section of the business community was urging action.

In addition, the number of pieces of legislation on climate change at a national level have increased considerably in the past few years. Whilst negotiations at a global level appear to have stalled, action at national level is progressing. The amount of action at this national level should be ramped up over the next few years.

Copenhagen and Cancun

The Cancun Outcomes in Context

The outcomes of the last COP at Cancun can only really be understood in the context of the Copenhagen negotiations. This is for two main reasons; first, the Cancun Agreement is largely based upon the key elements of the Copenhagen Accord. Second, the reaction to the Agreement is largely due to the differences in build-up between the Copenhagen and Cancun negotiations and the disappointment that resulted from the outcomes of Copenhagen. While the actual outcomes of the two conferences are not substantially different, the reaction to that of Copenhagen in most cases was one of extreme disappointment. The outcome from Cancun, on the other hand, has been heralded as a veritable success.

There were notable differences in build up between the two COP meetings. Prior to the Copenhagen negotiations, expectations in the media were raised to an impossibly high level. Copenhagen was therefore perceived by many as a failure. Curiously, many people (outside the media) could see clearly in advance of the meeting that a fully-formed legal agreement would be unrealistic, the negotiations having failed to progress at the rate necessary to produce any decisive agreement [6].

But the media built up false expectations not in any way dampened by the absence of a much-needed sense of realism from the UNFCCC, or from the Danish Government. With a record attendance of NGO representatives and researchers, the circus atmosphere did little to douse expectations.

Despite this, the negotiators did make some productive advances; instead of a legally-binding agreement, the Copenhagen conference produced the Copenhagen Accord, a political agreement which was negotiated by 28 countries in the final days of the conference.

But the failure of the Copenhagen conference to produce a legally-binding agreement led some to question the UNFCCC as a forum for decision making. Many negotiators left Copenhagen with a sense that the UNFCCC process was broken [3].

All this did little to build expectations for Cancun and as such anticipation for the outcome was low. The Cancun Agreement that emerged from the COP meeting in comparison was therefore a pleasant surprise for those who had been following the negotiations.

The Cancun Agreements

The Cancun Agreement is based heavily upon the Copenhagen Accord and the pledges made to it following the Copenhagen negotiations.

The Copenhagen Accord marked an unprecedented drafting exercise on climate change, but, at only around two and a half pages, contained only twelve operational paragraphs. As this would suggest, the Accord was not strong on detail but represented many delicate and hard-won compromises between competing interests [7].

When the Accord was being negotiated however, other countries were not kept informed of the progress of the negotiating group and the Copenhagen Accord negotiations were conducted separately from the official UNFCCC negotiating groups. When the Accord was revealed to the COP for adoption a small number of states blocked consensus. As a result, the legal status and future of the Copenhagen Accord within the UNFCCC process was unclear [8].

The Cancun Agreement, by incorporating many of the key points of the Accord into the official UNFCCC process, has clarified this.

The Cancun Agreement does more than just incorporate the key ideas of the Accord however; it also elaborates them and makes them operational. The two and a half pages have been upped to thirty. The Cancun Agreement integrates and elaborates on all of the main parts of the Copenhagen Accord, including:

Agreed Limit to Temperature Increase – Shared Vision
The 2°C limit to temperature rise was recognised and the scientific reasoning for this. The Cancun Agreement also agrees that deep cuts in emissions are necessary to achieve this. Room was left for a change in this limit of 2˚C to a lower limit of 1.5˚C as part of a review of the Agreement's implementation to be completed by 2015. This is in a large part in deference to the Maldives and other small island states which had pushed for a 1.5˚C limit on global temperature change.

Mitigation

The Copenhagen Accord established a bottom-up pledge-and-review process that allowed each country, both developed and developing, to define its own mitigation actions, including developed country emissions targets. These targets and actions were to be submitted to the UNFCCC Secretariat for compilation. 76 countries, including all Annex I and 39 non-Annex I countries, submitted targets or actions to the Secretariat. These countries together represented 85 per cent of global emissions. These submissions were included in the Cancun Agreement via their inclusion in two information documents; one for developed country targets and one for developing country actions. Whilst this does not make them legally binding it does integrate them into the UNFCCC process.

A registry for developing countries to list nationally NAMAs for which international support is sought, proposed in the Copenhagen Accord, was set up by the Cancun Agreement. These supported NAMAs will then be subject to international consultation and analysis (ICA).

Finance

In the Copenhagen Accord it was established that developed countries would collectively commit to providing new and additional resources approaching US$30 billion in 'fast start' money for the 2010-12 period, to be balanced between adaptation and mitigation for least developed nations. This amount is set to increase towards US$100 billion per year by 2020. This has been incorporated into the Cancun Agreement. In addition, the Accord also called for the creation of a Green Climate Fund through which a significant part of the finance would be transferred, and a High Level Panel to identify potential sources of revenue to meet the US$100 billion per year target [3]. These calls were answered in Cancun. As established in the Cancun Agreement, the fund will be managed by a board of 24 members, split between developed and developing countries, and will be administered for the first three years by the World Bank. The Cancun Agreement also notes the pledges of adaptation and mitigation finance pledged to the Copenhagen Accord. At the time of writing, this amounts to a total of US$27.9 billion.

Forestry

At the Cancun negotiations progress was made on forest carbon. Building on statements made in the Copenhagen Accord, a framework for reducing emissions from deforestation and forest degradation as well as halting and reversing forest loss (REDD+) was established. The Cancun Agreement provides countries with guidance on REDD+ readiness and recognises and sets out a phased approach for implementation. There are still several key questions left for clarification in further negotiations; definitions and reference emission levels need to be clarified in addition to questions regarding finance.

Adaptation

The Cancun Agreement set forth detailed provisions on adaptation in the Cancun Adaptation Framework and creates an associated Adaptation Committee, taking further the declarations in the Copenhagen Accord which recognised the need for adaptation to both the adverse effects of climate change and the potential impacts of response measures. The Agreement also establishes a Technology Mechanism to facilitate technology development and transfer. This Technology Mechanism is made up of two parts, one of which is operational immediately; the Technology Executive Committee. The second part, the Climate Technology Centre and Network, requires further negotiations before work can begin.

Monitoring, Reporting and Verification (MRV)

The Cancun Agreement built upon previous MRV guidelines and established a new standard for transparency; all major economies are to report on progress in meeting their national climate targets and actions on a more frequent basis. National communications and inventories will now be produced at least every four years by all large emitters in addition to biennial update reports on their GHG emissions. In addition developed countries are to enhance their reporting of any support given to developing countries. Developing countries' reporting on their mitigation actions was also strengthened with supported national actions being subject to ICA. This ICA process for the supported NAMAs will be conducted by the Subsidiary Body on Implementation.

Legal Form

The Cancun Agreement, like the Copenhagen Accord, does not cover the issue of the legal form of the post-2012 climate regime. It postpones decisions on this issue to next year at COP17 in South Africa.

Implications of the Negotiations

The most notable aspect of the negotiations in Copenhagen and, to an even larger extent, in Cancun is the fact that at last all of the major emitting nations have begun to seriously engage in the climate challenge. This is an essential and highly positive result.

The adoption of the 2˚C target shows that attention is being paid to the science of climate change. In addition the poorest nations of the world are making their presence felt to a larger extent. For example, the African nations protested by walking out en masse when they feared the Kyoto treaty was about to be abandoned at Copenhagen. In addition, the small-island states, notably the Maldives and Tuvalu, are increasingly vocal [9]. This is clear from the inclusion of 1.5˚C as a possible limit to temperature rise in the Copenhagen Accord and Cancun Agreements.

The changing world power dynamic has been more apparent in the negotiations in recent years. Reflecting its emergence as a global power, China is much more assertive. In addition, India took on a much more constructive role in this year's negotiations at Cancun.

Fractures within the developing country negotiating bloc (the G77) were more apparent [3]. Other developing countries are putting increasing pressure upon China to accept limits on its emissions.

The Copenhagen Accord and Cancun Agreement mark the first occasion that the rapidly emerging economies and the US have put forward mitigation actions and have accepted any type of internationalisation of their climate change policies. In addition, it is the first time that the emerging economy countries, such as the BASIC countries (Brazil, South Africa, China and India), agreed to any international consultation or analysis concerning their emissions reduction actions. India was particularly progressive on this issue at the Cancun negotiations.

These developments are very positive in terms of breaking down the 'firewall' between developed and developing countries and in recognising the changing global power structure.

With regard to the funding pledged by developed countries for adaptation and mitigation measures in developing countries, the fast start sum of $30bn for the period from 2010 to 2012 is similar to what had been promised by the EU and the US earlier in the negotiations.

The more important figure of $100bn per year by 2020 promised to developing countries is more in question. This money is to 'come from a wide variety of sources, public and private, bilateral and multilateral, including alternative sources of finance'. While this amount is in line with estimates of the type of sums that are required [10] it is unclear how this money is to be raised.

Experience from the past makes it clear that it is not politically feasible to transfer such large sums of taxpayers' money to the developing world. It is even more unlikely at present with developed countries

feeling impoverished due to the recession. At the present time sovereign debt in some developed countries has returned to the post Second World War level of around 120 per cent of GDP, which makes a cash flow of this magnitude very unlikely.

A much higher level of public engagement with the issue of climate change and a greater awareness of the risks posed will be needed for governments to be able to commit to such amounts [11].

Analysis of Current National Targets and Actions

Analyses by UNEP and the WRI, among others, have suggested that the pledges made to the Copenhagen Accord, now adopted under the UNFCCC process, together are – conditional on various assumptions – probably not sufficient to ensure that the global mean temperature does not rise above the 2˚C limit established in the Agreement.

At present it has been estimated that the current pledges equate to a greater than 50 per cent chance that warming will exceed 3 °C by 2100 [12]. The Annex I pledges together will, if implemented, result in a reduction in emissions from developed countries by 2020 of 12-19 per cent below 1990 levels. This falls short of the range of emissions reductions (25 to 40 per cent) that the IPCC states would be necessary to keep within the 2˚C temperature increase range [13]. Japan and Norway are the only two developed countries to make sufficient pledges: of 25 per cent and 30-40 per cent below 1990, respectively. The EU has pledged deeper cuts, of 30 per cent, should other nations sign up to a global deal.

The US has pledged to reduce emissions by 17 per cent below 2005 levels by 2020. This equates to around 3 per cent below 1990 levels – less ambitious than the reductions of the Kyoto Protocol. Canada, by aligning itself with the US, is the only country to weaken its ambitions by increasing its emissions allowances relative to those it agreed to in the Kyoto Protocol.

The Copenhagen Accord marked the first time that some developing countries volunteered to undertake emissions actions. Indonesia was the first non-Annex I country to pledge its commitments. Indonesia has pledged emissions cuts of 26 per cent from current levels by 2020 increasing to 41 per cent with assistance. China and India have pledged emission intensity reductions of 40-45 per cent and 20-25 per cent relative to 2005 by 2020, respectively. These pledges from the group of rapidly emerging economies emphasize the need to differentiate this group from the poorer developing nations.

On the positive side these pledges represent a very significant shift beyond both the business-as-usual scenario and the original protocol position. They mark a significant step forward. What these analyses point out is that these commitments on emissions reductions will over the coming years need to be ratcheted up to meet the 2˚C rise limitation.

It is relevant to recall that the Montreal Protocol of 1987, requiring countries to reduce CFC emissions to manage the destruction of ozone in the stratosphere, was quantitatively insufficient for the intended purpose. Subsequently the CFC emissions reduction programme was very substantially improved, and the ozone reduction problem has been managed. As new low CO_2, energy efficient economically viable processes and technologies are developed and dispersed, and the economic risks attached to climate change become more apparent, there is good reason to believe that the same will happen with CO_2 emissions.

Assessment of Key Pledges

As the submissions made were decided upon at a national level by individual countries it is likely that the targets put forward are realistic and will be met. However, it could be useful to assess how ambitious or feasible the emissions-reductions targets are. Here the submissions of the major three emitters are assessed; the US, the EU and China.

China

As the largest emitter of CO_2 in the world, China's actions towards climate change are particularly important. China has pledged to reduce its CO_2 emissions per unit of GDP ('emissions intensity') by 40 to 45 per cent by 2020 compared to 2005. This target ensures that emissions are limited without constraining economic growth.

When examining China's past emissions it is found that from 1990 to 2005 the carbon intensity of its economy improved by 36 per cent without any international commitments. China's pledge has therefore been seen by some as simply a continuation of current trends [14]. However, the outcomes of these assessments all depend upon what is included in the baseline. When other nation's pledges are converted to a similar measure, i.e. intensity, it has been found that China's target is comparable to that of developed countries such as the US and the EU [15].

China's pledge also included other actions; to increase the share of non-fossil fuels in primary energy consumption to around 15 per cent by 2020, and actions of re-forestation. China is currently leading the race in green technology. In 2009 China had the greatest aggregate investment in clean energy, with investment levels of US$34.6 billion. This is in comparison with an investment of US$18.6 billion from the US who ranked number two [16]. It has the world's largest manufacturing capacity for solar collectors and solar cells and is likely to soon reach the same status for wind turbines [17].

Most remarkable is their reforestation programme. The Loess plateau project, initiated some 12 years ago, has resulted in the greening and reforestation of an area the size of Belgium. In the run-up to Copenhagen President Hu Jintao committed China to completing the task by 2020: this will correspond to an area the size of France, and will be a truly remarkable and exemplary achievement. China has pledged to increase forest coverage by 40 million hectares and forest stock volume by 1.3 billion cubic meters by 2020 from 2005 levels [18].

China's climate change policies will provide significant emissions reductions compared to a business as usual scenario. The energy efficiency and renewable energy being developed mean that the electricity networks in China will have to be modernised to be able to integrate these intermittent energy sources. In order for China to meet its targets it will need to intensify its efforts to make structural changes in its economy and increase the service sector share [19].

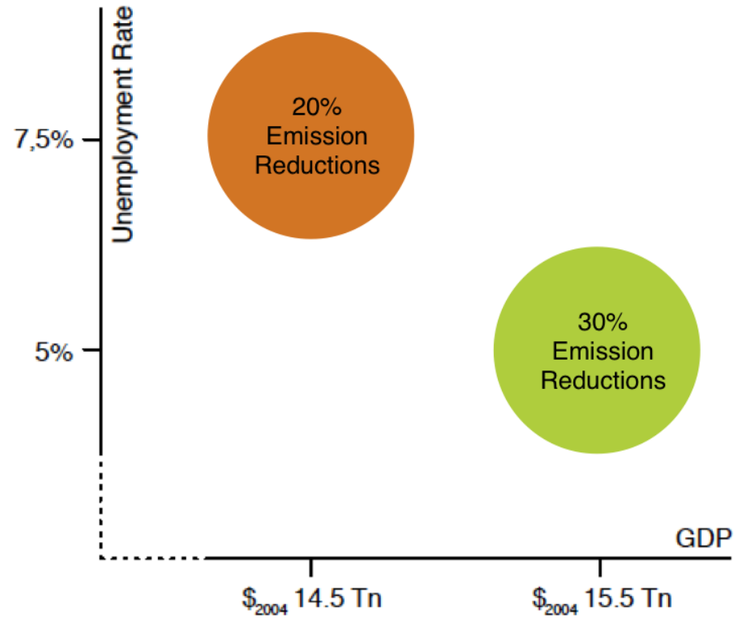

Figure 3 - Conceptual diagram showing the effects of moving from a 20% emissions reduction target to a 30% target on European GDP and unemployment rates, based upon GEM-E3 simulations. Source: Adapted from Jaeger et al. 2011

The EU

The EU has pledged a target of 20 per cent GHG emission reductions by 2020 compared with 1990 levels, which will be increased to 30 per cent if other major economies commit to significant reductions [20].

The global economic recession has led to a significant fall in emissions compared with business-as-usual expectations, which has assisted the EU in meeting its objective. The EU ETS will clearly play a significant role in achieving its goals, but in addition each of the 27 nations comprising the EU will need to introduce obligations and regulations required to meet the national objectives.

A considerable scaling up of the effort will be required to improve the energy intensity of the economy and the carbon intensity of the energy mix. As pointed out elsewhere [9], the objectives for 2020 should be set within an overall target for 2050, so that for each country within the EU large-scale energy infrastructure, such as coal-fired power stations, are replaced with energy efficient, low CO2 energy systems, as they come up for renewal but not before, so as to minimise the potential for an adverse impact on the economy. In the UK the opportunity is immediate, since about £200 billion worth of energy infrastructure will need to be replaced over the coming decade [21]. This infrastructure will be productive until mid-century and beyond, and will need to be fit for a defossilised economy.

Due to the impact of the financial crisis upon the levels of CO2 emitted by the EU, the move to the more ambitious target of 30 per cent emissions reductions by 2020 is being considered irrespective of the actions of other countries.

A recent study analysing the effects that this could have on GDP growth and employment rates produced the surprising result: increasing the ambition could have a positive effect on both of these factors. The lower 20% target is no longer strong enough to mobilise investment and innovation in the low carbon economy. If a decisive move to a 30% target was made, combined with clear policies, a positive cycle of increased low-carbon investment, job creation and innovation could be triggered.

Without requiring further action from other actors on the international level, it was found that this move to a 30% target could increase the growth rate of the European economy by up to 0.6% per year, create up to 6 million additional jobs, increase European investments from 18% to 22% of GDP in 2020 and increase European GDP in 2020 by $842 bn (2004 value) [22].

Figure 3 shows a conceptual diagram of the effect of this increased ambition level upon European GDP and unemployment levels, based on the outcomes of GEM-E3 model simulations conducted by Jaeger et al. (2011).

The US

The US pledged an emissions reductions target of 17 per cent by 2020 relative to 2005 levels. This amount equates to a 3 per cent decrease by 2020 compared to 1990 levels. This is less than the total 5 per cent target of the developed countries in the Kyoto agreement. The biggest downside of the US pledge, however, was that the proposal stated that it was based upon anticipated US legislation [23], which did not materialise. There is therefore great uncertainty over the future actions of the US. Of course, it would have been unwise for President Obama to commit to anything beyond this, risking the US Congress later rejecting the international agreement.

The passage of climate and energy bills in the US will be key to the development of climate negotiations at the international level. While the US energy and climate policy endorses a cap and trade system and outlines a pathway of emissions reductions to 30 per cent below 2005 levels by 2025, the US targets are deemed to be demanding for its economy. Profound changes will be required, particularly regarding the energy mix [19]. The US position in the process therefore gives continued cause for concern.

Learning from the Negotiation Process

Negotiations Forum

The failure of the Copenhagen negotiations to reach agreement threw doubt on the ability of the UNFCCC process to produce viable results; but the ability of COP16 in Cancun to salvage an Agreement has restored hopes. However, suggestions that new forums for climate change debate are necessary need to be seriously considered. The G20, G8 and Major Economies Forum (MEF) are possible forums for climate change progress.

These smaller meetings do have potential. The G8+5 grouping played a very important role in raising the profile of climate change with key heads of state and with the public. The G20 countries make up around 75 per cent of global emissions; any deal made in this forum will clearly be of enormous significance to potential reductions. Furthermore, nations have a tendency to follow trends, and the agreement of such a large section of the global community is likely therefore to lead to other nations following suit.

There is debate about whether agreements made within smaller groups of countries such as the G20 undermine the multilateral regime [24]. The UNFCCC COP is the only forum in which the very poor developing nations can be heard and as such the poorer developing nations see the UN as the only venue open to them to express their views. Such input from least developed countries has already stimulated progress in some areas in the climate negotiations; these nations have been instrumental in ensuring that adaptation is properly considered. As such for both substantive and legitimacy reasons the process by which agreements are reached is very important. Ghosh [24] argues that if decisions are made outside the UNFCCC process there are likely to be consequences for the coherence of the regime.

The main block to a global legally-binding agreement through the UN is that neither the US nor China are currently willing to accept binding targets that have been internationally defined. Given that the G20 or the MEF cannot produce legally binding agreements, progress could be made with these nations in other aspects of climate change policy.

It must be accepted that negotiations in smaller groups could lead to much more substantive outcomes in reaching the most pressing goal – immediate GHG emissions reductions – if the groups don't include obstructionist countries such as OPEC (Organisation of the Petroleum Exporting Countries) and the ALBA (Bolivarian Alliance for the Americas) groupings.

While the equal voting system and the need for consensus make the COP an excellent forum for many countries, particularly developing countries, where their voices are heard and for promoting equality, the need for consensus also makes it a problematic forum for dealing with difficult, complex problems like burden-sharing. The pursuit of consensus can, in practise, lead to stagnation [17]. Smaller groups are very useful in getting details of an agreement in place.

This is not to argue that the UNFCCC has no role to play in the climate negotiations. It is likely, however, that over the coming years it will be used to verify and legitimise actions and decisions taken in these other forums, and to act as a sounding board for all nations.

Legal Form

In the run-up to Copenhagen there was a great deal of pressure for the conference to produce a legally binding agreement. Copenhagen was viewed to be a failure by many largely due to its inability to deliver on this. At Cancun, there was very little build up in this respect and a legally-binding deal to replace or continue the Kyoto Protocol was neither expected nor achieved. This outcome has been postponed until the next COP meeting in South Africa. However, postponing decisions on this will not be an option again given that the first commitment period of the Kyoto Protocol ends in 2012.

Is a legally binding document essential? From the view point of developing countries, a legally binding agreement is seen as an assurance that the developed world will meet its targets. Furthermore, if a legally binding agreement is not agreed then the developed world will effectively be weakening its commitments to reducing emissions, while, at the same time, developing countries are being required to do more. Thus, the negotiations appear to some to be moving away from the 'differentiated responsibilities' between countries, an aspect of the climate change regime that is considered extremely important by the developing world [25].

In addition, a global deal is needed in order to prevent leakages of carbon from parts of the world which do not have carbon emission limits [9]. The main hindrance to a global, legally-binding agreement is that China seems unwilling to accept a binding agreement, and the inability of the US to progress action through its Senate and Congress and its insistence on "symmetry" between developed and developing countries means that it is unwilling to accept a legally-binding agreement.

Meanwhile, other developed countries are unwilling to sign up to an agreement that the US is not a part of. Japan in particular at the Cancun negotiations explicitly stated that it would not accept a second commitment period of the Kyoto Protocol, displaying a clear preference for a single instrument. This single instrument was initially suggested with the object of bringing the US on board, and other developed countries have expressed a preference for the replacement of the Kyoto Protocol by a single instrument that captures the market-friendly elements of the Accord. In deference to the US, the single instrument would have a flexible approach that is tailored to national circumstance and allows for domestic political constraints.

However, following the strong statements from Japan on this matter, developing countries responded equally strongly in signalling their preference for the continuation of the Kyoto Protocol. Developing countries oppose the single instrument as they fear that the new instrument would alter the balance of responsibilities in the climate regime [25]. Given the difficulties within the US in joining any internationally defined binding agreement, it is questionable as to whether these compromises in the single instrument will make a difference to its participation.

Another important, if not critical, consideration is the inability of the UN to enforce or punish nations that may break any agreement. Getting all the UNFCCC countries to join a climate treaty whereby they agree to limit their emission would be an important achievement, but it does not mean that nations will keep to it. The reluctance of nations to join a legally-binding agreement unless they know that they can meet its stipulations does signal that the concept is taken seriously. But in order to ensure that countries do keep to their targets, it is probably necessary to have some form of enforcement mechanism.

At present, at least one nation is expected to be unable to meet its Kyoto target. Greece is officially recognised by the independent Compliance Committee as non-compliant with national system requirements and Canada is also set to be non-compliant with its emissions targets (though it could buy itself into compliance by 2015).

That said, enforcement mechanisms such as trade measures may act as a further deterrent to the US, China and India joining in with an agreement. Sanctions may prove to be economically inefficient and discriminatory against poorer countries [26]. It has been suggested that the use of social sanctions may well be preferable [27].

One feasible enforcement mechanism is a 'name and shame' process linked to pledge and review and independent monitoring and verification. At present, focusing on forcing through a legally binding agreement has proven to be a hindrance to progress in tackling climate change.

At Cancun, the issue was essentially put aside in the final agreements and decisions on it postponed for a further year. This did allow advances to be made in other areas that were introduced in the Copenhagen Accord. It remains unlikely that anything other than a severely weakened legally binding agreement would be signed by the major emitters of CO_2. The future of the Kyoto Protocol does not look bright [6].

In order to make rapid and realistic progress, focus needs to shift from form to function. Concentrating on creating a legally binding document will not produce the desired action. Instead, negotiations should focus on areas where progress has been made. For example, real progress was made in the areas of deforestation, technology, finance and adaptation. Concentrating and solidifying agreement on these areas will be considerably more productive. In addition, the pledge and review process provides a critically important new pathway for immediate action.

Pledge-and-Review

The pledge-and-review process adopted by the Copenhagen Accord marked a move towards national-based action in mitigating and adapting to climate change. This approach was cemented via the integration of the voluntary commitments into the UNFCCC process at Cancun.

This shift away from the top-down action has stimulated discussion about the relative merits of top-down versus bottom-up approaches [28]. In reality, both bottom-up and top-down policies are compatible and necessary.

In developed and emerging countries the bottom-up approach is the only feasible way of ensuring participation. The pledge-and-review process marks a useful way to stimulate national action, and enables China and the US to participate. While the 'review' part of the pledge-and-review system was largely absent, and in fact was steered away from by the BASIC countries at Copenhagen, a large degree of transparency is embedded in the system.

At Cancun progress was made in the area of monitoring and verification. Credit for this goes largely to the Indian Environment Minister. The publication of the pledges raises the level of ambition in the commitments as well as increasing pressure on all nations to meet them [29]. It is hoped that national commitments will therefore be met.

A registry for developing countries to set out NAMAs for support by developed countries has also been set out. This is a useful tool as, at present, developed countries have a tendency to hold back finance due to scepticism over the end use of such money [30]. In this forum, developing countries can set out specific plans for action so that investors know where the money will be going, and this could stimulate increased funding. It also challenges developed countries using this as a line of defence over lack of financial support.

Temperature and Emissions Targets

An important step was made with the agreement on the target to limit anthropogenic warming to 2˚C. This is a good 'goal'. One of us has pointed out on many occasions, since 2005, that there is a high degree of uncertainty in translating a specific limitation on an asymptotic figure for temperature rise to a stabilisation target figure for GHG emissions.

For example, if the asymptote for GHG atmospheric levels is 450 ppm CO_2 equivalent, the best available science produces a rather broad probability distribution function [31] peaking at 2.1˚C but with a so-called 'fat tail' to high temperatures. Even at this low level of GHGs, there is a 20 per cent probability – based on current science – that the ultimate temperature increase would be more than 3˚C.

The scientific message is clear: the risk of a dangerously high temperature at any level above the present (387 ppm CO_2; approximately 420 ppm CO_2 equivalent) is relatively high. GHG emissions must be reduced, in order to manage this risk downward at the fastest rate that can be achieved.

Paths to maintain a GHG asymptote below 450 ppm CO_2 equivalent were developed some years ago by the UK Government and one path to 550 CO_2 equivalent was published in the UK Government's Stern Report [32].

Figure 4 shows the business as usual emissions trajectories prior to 2007(curve a, 2007) and after the global debt crisis (curve b, 2009). Trajectories are also shown for stabilisation at 550 ppm CO_2 equivalent (curve c) and 450 ppm CO_2 equivalent (curves d, e and f).

Curves d, e and f all represent pathways which achieve the same objective; stabilisation at 450 ppm. These curves demonstrate that it is the total emissions over the time period shown that determines the asymptote, not the rate of emissions. It is the build up of CO_2 and other GHG's in the atmosphere which causes the temperature to rise. As recently pointed out [33], it is therefore possible to estimate the total amount of fossil fuel (expressed as C) burnt to CO_2 that would generate an estimated mean temperature rise of 2˚C. This is 1 trillion tonnes of carbon, with a standard uncertainty of 1.6 to 2.6˚C. Over half of this amount has already been emitted. (Note that this estimate excludes other GHGs).

The curves in figure 4 can be simply restated. In 2010, global anthropogenic activity is resulting in the emission of 36 bn tonnes of CO_2 equivalent, as shown on the upper business-as-usual curve. Curve d demonstrates that global emissions should be reduced to 18 bn tonnes by 2050, i.e. a 50 per cent decrease. Taking 18 billion tonnes per annum as averaged across the expected population of 9 billion by mid-century yields 2 tonnes per person.

Based on this figure, the UK Government revised its commitment of a 60 per cent reduction by 2050 made in 2003 to a reduction of 80 per cent, made in 2007. Currently UK emissions are at 10 tonnes per person per annum, so the British commitment equates to a reduction to 2 tonnes by 2050.

This unilateral commitment, followed now by the EU, represents an interesting political and ethical statement. It suggests that the emissions target per country by mid-century could be determined by population size, and not by development status (Annex I, non-Annex I; or developed, rapidly emerging, and developing). This does provide a potentially equitable way forward, and we return to this in Chapter 5 below.

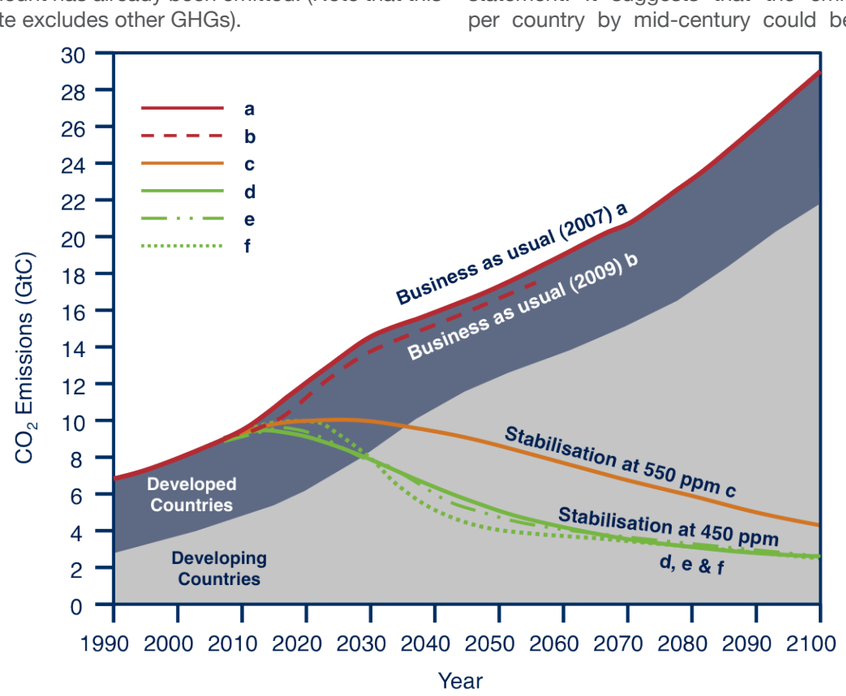

Figure 4- Predicted future greenhouse emissions according to several different scenarios; trajectory a represents the 2007 business-as-usual predicted emissions; b shows the 2009 business-as-usual predicted emissions following the global economic collapse; c shows an emissions trajectory enabling stabilisation at 550 ppm CO_2 equivalent; d, e and f show three different pathways to stabilisation at 450 ppm CO_2 equivalent. Note: Emissions expressed in gigatonnes of carbon, to convert to gigatonnes of carbon dioxide multiply by 3.67. Adapted from UK Department of Environment, Food and Rural Affairs.

Corporate Sector Actions

The stance of the corporate sector is critical in innovating market-facing solutions and in demonstrating the economic feasibility of defossilising the global economy.

There has been progress in this area; a significant proportion of the corporate sector has indicated a desire to be involved in moving towards a low carbon economy [34]. An example of this is the Carbon Disclosure Project, a project which holds the world's largest database on corporate actions and information on climate change.

Initiatives such as this are voluntary and so the information put forward is not verifiable. However, it is a good first step. To move these projects on would require compliance and review systems to be put in place.

Governments should act to incentivise the private sector to make the transition to the green economy. Regulations should be put in place to encourage long-term thinking in the corporate sector that will incorporate climate change mitigation and adaptation. Long-term stabilising policies should be put in place to give the sector confidence in investing in green technology and in making the transformation to a green economy.

There is evidence to suggest that a switch to a green economy could be very profitable for many nations, sectors, industries and firms. The total value of the carbon market grew 6 per cent to US$144 billion by the end of last year despite global GDP falling by 0.6 per cent and developed countries GDP falling by 3.2 per cent [35].

It has been estimated that by 2020 the world market for environmental technologies will have grown to around EURO2.2 trillion [36]. Innovation can lead to economic growth [37] by developing new industries and creating new employment. In the UK, the sectors that are likely to benefit from a transition to a green economy, namely the finance and science based sectors, are those that the UK excels in. The transition is likely, in fact, to benefit the UK and US even if it is costly to the world economy overall [38].

The UK Government Stern Review [32] projected that preventative action taken now to limit temperature increase to 2˚C should be expected to cost between -2 per cent and +5 per cent of global GDP by 2050, (although this is commonly expressed as +1 per cent).

More recently, a study of the cost of German climate change policy targets to reduce Germany's emissions by 40 per cent under 1990 levels by 2020 was undertaken using a systems dynamics model [39]. This study found that the German target would create at least 500, 000 jobs and add at least 2-3 per cent (EURO 70 billion) to the German GDP by 2020.

These figures demonstrate the sensitivity of the outputs to the nature and input of the economic models used [40]. The global financial crisis highlighted limitations in equilibrium economic models that are often currently used to assess policy options [22]. These models can inherently exclude win-win strategies in terms of climate policy through the assumption that there is a single equilibrium state for the economic system [22]. Research is now being undertaken to rectify this. One initial outcome is the study on the EU target mentioned in Chapter 3 where the increased ambitions incentivised higher investment levels, job creation and GDP growth [22].

While moving to a green economy is likely to generate a net benefit to economies, there will be losses from some sectors, such as the fossil fuel sector [17]. At present, this sector represents a challenge to the acceptance of climate change policy (and science) both in government and in public opinion. Last year in the US the lobby seeking to undermine climate change science spent around US$170 million on lobbying against climate change science, while only US$22 million was spent in support of all environmental causes.

Global Fossil Fuel Supply Capability

Energy and climate change are inextricably linked through CO_2 emissions from fossil fuels. However, it is worth noting at this point that even were there not strong environmental reasons for switching away from fossil fuels to renewable forms of energy, analyses of oil supply and demand demonstrate a second incentive to transition away from oil.

Recent studies of global oil production capacity have emphasised that conventional oil production will probably go into decline soon, signalling the likely end of low cost, abundant oil. A survey of reliable conventional oil reserve data found that the public reserve figures should be reduced from 1150 – 1350 Gb to 850 – 900 Gb [41].

Oil discoveries have been decreasing in the past few decades, with the discovery rate peaking in the early 1960s. In addition oil field production rates follow an approximate bell-shaped curve – oil field production cannot be maintained at a constant rate until resources are exhausted due to geological constraints.

Once peak production has been reached the average rate of decline in production is estimated to be 4.07 per cent pa [41]. A substantial portion of today's producing oil fields are currently in decline. Of 430 giant oil fields that are in production 261 are in decline. In 2007, out of 20 of the top producing oil fields, representing 27 per cent of global oil supply, 16 were in terminal decline [42].

On top of conventional oil reserves, the world has a large amount of unconventional oil (heavy oil, and oil from shale and tar sands). The rising price of oil has made extraction from unconventional sources economically attractive. The result of this has been Canadian tar sands and deep-sea drilling coming increasingly into production over the past decade. Unconventional oils currently make up just over 2% of total oil production [43].

The extraction of unconventional oil is both environmentally damaging and energy and water intensive. These factors alone could limit future production. In addition, the rate of extraction of unconventional oil is currently very slow and, if the peak of conventional oil production is reached within the next two decades, it will not be able to meet increasing demand [44].

Given that demand for oil will continue to increase over the coming years due to inertia in the transition to low carbon transport these physical restrictions on supply may induce a global recession, determined by an unaffordably high oil price. It is urgently necessary to diversify the sources of energy production. Having economies that are dependent upon oil is no longer advisable [41].

All qualitative indicators point to substantial future increases in oil price. In addition, estimates of future oil prices are, over time, increasing; the World Energy Outlook (WEO) of 2008 [42] estimate of 2030 oil price is $135 higher per barrel than the 2007 WEO estimate of $65 per barrel [41].

The negative effects of increased oil prices on the global economy are substantial. The International Energy Agency (IEA) [45] carried out an analysis concluding that over the period 2002 to 2006 increases in oil prices lowered world GDP growth by an average of 0.3 percentage points per year. High oil prices are likely to have played a role in the global economic downturn in 2008, acting to increase the vulnerability of the economies of all oil importing countries [46].

There are other clear benefits in diversifying the means of producing energy. The UK, for example, has an existing energy production infrastructure that will need to be renewed within the next ten years; if government decisions are implemented in a timely fashion this energy infrastructure will be replaced by a combination of indigenous renewable energy, nuclear energy, dispersed microgeneration energy sources, and a smart grid, while initiating the switch of road transport onto the grid through hybrid and electric vehicles. The United Kingdom is in a prime position to lessen its dependence on oil. This will also act to stimulate the economy – finance that would previously have gone straight to oil producing countries will remain in the country and jobs will be generated from the switch.

The economic imperative to move away from coal and gas is less strong; there appear to be vast reserves of very cheap coal remaining and discoveries of natural gas continue apace. Developments in gas extraction technology have enabled access to large amounts of natural gas. A higher future carbon price, through a carbon tax or a trading scheme, will, of course, be needed to reduce GHG emissions. It is, nevertheless, worth noting that recent studies [47] have been increasingly pessimistic about the abilities of coal to continue to meet increasing demand over coming years.

Next Steps

Pricing Carbon

It is generally agreed that one of the most useful tools in inducing action on mitigating emissions is the pricing of GHG emissions. While by itself pricing will not be sufficient to tackle climate change, it is nonetheless a key part of climate policy.

The need to price environmental externalities is a basic lesson from environmental economics. It sends a signal to the marketplace that governments are serious in taking action on climate change, incentivises reductions in emissions, and draws attention to the cost-effectiveness of investment in low carbon infrastructure [48]. Importantly, a high price incentivises the research, innovation, wealth creation chain, developing new energy efficient and low carbon technologies for the market. Setting a global price on CO_2 emissions would clearly prevent carbon leakage.

There are three main ways of pricing CO_2: CO_2 taxes, CO_2 trading, and implicit pricing via regulations and standards. Each of the three approaches has different advantages and disadvantages, and all three are likely to be used in some form at some level of government.

Regulation and Standards-Based Policies

These include efficiency standards for various goods, vehicle fuel-economy standards and best-available control technology standards. While undoubtedly a useful mechanism, there are several drawbacks to using a regulation and standards approach to reducing emissions.

For example, regulatory standards are very often only applied to new, rather than existing, equipment which limits the opportunity for near-term reduction. Emissions would also therefore be dependent on the rate of capital stock turnover. Importantly, increasing the cost of new stock without affecting that of the existing stock means that incentives are created to continue using the old, higher CO_2-emitting stock, thereby delaying emissions reductions [49].

Furthermore, in terms of cost-effectiveness, standards and regulatory approaches cannot compete with CO_2 trading.

CO_2 Taxes and Trading

Taxes and trading in the economists' idealised world would provide the same results as each other [50]. However, idealised conditions seldom occur. Taxes will fix the CO_2 price but leave the quantity of emissions uncertain and trading fixes quantity but leaves price uncertain. Setting taxes too low would lead emissions to overshoot their target. A globally agreed CO_2 tax therefore would offer less certainty than CO_2 trading in meeting a desired target. By the same logic CO_2 trading can lead to much more price uncertainty and volatility than taxes which, in a world where businesses prefer clear and stable signals for decision-making and investment, is not ideal.

In either case, achieving a significant reduction in emissions requires a real commitment from governments: if the CO_2 caps for the trading process are insufficient, the CO_2 trading price will be too low to induce effective action; and the argument for governments imposing lower taxes than needed is even stronger. It is worth noting that the UK Government, noting the need to incentivise utilities to invest in low carbon infrastructure, has decided to introduce a floor to the CO_2 price.

CO_2 trading schemes have become the dominant form of pricing since the Kyoto Protocol introduced market mechanisms as a way of reducing emissions. The markets have grown considerably since the formation of the EU ETS and look set to grow further both geographically and in volume.

In 2008, the CO_2 trading markets were worth around US$120 billion and it is estimated that within a decade trading volumes could reach US$1 trillion. This would be similar to trading in commodities like oil, gas and gold [50].

CO_2 trading has been adopted instead of carbon taxes largely due to its appealing political characteristics. Current trading schemes start by distributing allocations free of charge and move to auctions over time. This appeals to industry as it allows for a less dramatic adjustment than a tax.

However, free allocations based on historical emissions have significant drawbacks. First, given the considerable market value of permits, free allocations imply giving high emitters significant 'windfall profits'. This effectively rewards those that are responsible for (unknowingly) causing the problem. It can also incentivise increases in emissions in order to gain more permits. Such 'grandfathering' could act to give competitive advantages to incumbent firms if they get large allocations; thereby reducing competition [51].

Concerns have been raised that trading in CO_2 may create or reinforce power monopolies and constitutes 'carbon colonialism' [35]. These objections indicate strong advantages of moving to auctioning of permits or to other forms of permit distribution, such as on a per capita basis, as discussed in the following section.

Funding for Mitigation and Adaptation in Developing Countries

One of the big issues of climate change is that those who have not caused the problem will be those that suffer the effects most. The costs of climate change for the less developed countries are estimated to be high. Furthermore, the less developed countries, such as many of the African nations, cannot afford the high costs of mitigation and adaptation.

The least developed nations are often neglected in climate change deals. In 2008, investment in sustainable energy in developing countries reached US$36.6 billion [35]. Of this amount Africa received less than 1 per cent.

There is a trend for investment from developed countries to be concentrated in the countries with emerging economies within developing regions (see figure 5). For example, in 2008, of the investment in Asia and Oceania, China and India together

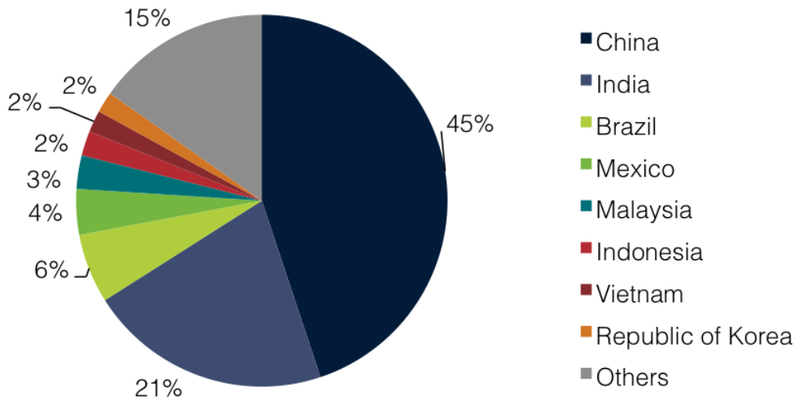

Figure 5 - Registered CDM projects by host party, total number 3195. (Source: http://cdm.unfccc.int)

accounted for 80 per cent. In South America, Brazil accounted for 88 per cent [46]. To date, Africa hosts fewer than 2 per cent of all registered CDM projects.

There are several reasons for this. First, African and other least developed countries make up a very small percentage of the world's GHG emissions. Therefore investors have focused on the 'low-hanging fruit' of high emission nations.

In addition, the majority of emissions savings opportunities in the least developed countries come from smaller projects, as demonstrated by figure 6. The costs of establishing a CDM project are high due to the strict requirements and administration processes. For smaller projects these requirements and costs make up a much larger fraction of the project costs in comparison with larger projects.

There are two strategies that have been developed to overcome these issues in the form of the Bundling Approach and the more recent Programmatic Approach introduced in 2007. The latter was introduced in order to overcome issues with Bundling Approach which required very high levels of planning due to its inflexibility. The strict requirements when implementing a CDM project represent another reason the majority of projects have been implemented in emerging nations; there is relatively more safety involved in investing in an emerging nation with the proven experience and technical skills to carry out the project.

The current international approach to climate mitigation and adaptation financing is insufficient as it lacks a functioning and permanent system for resource transfer to developing countries. It largely depends upon arbitrary contributions of grant resources from governments' treasuries. In addition, the private financial flows as mentioned above do not meet the climate needs of developing countries. Long-term and stable flows of climate financing that are sufficient to meet the requirements of developing countries are unlikely to materialize in view of the dire fiscal prospect of most developed nations.

The Cancun Agreements sets out funding for developing nations approaching US$30 billion for 2010-12 and moving to US$100 billion by 2020. This latter figure is in the range of that estimated to be

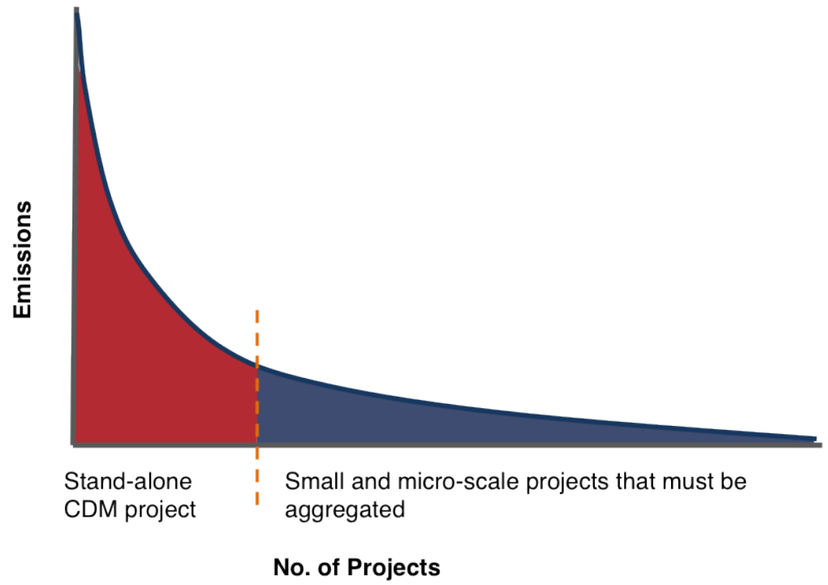

Figure 6 -The long-tailed emissions reductios curve for CDM projects. The majority of the emissions reductions opportunities in the least developed countries lie within the tail. Adapted from UNEP 2008 [52].

required in order for developing countries to deal adequately with the threat of climate change [29]. There are three key issues with this funding strategy. First, it is unclear where this money will come from and whether it will actually be delivered. Second, how the money is to be distributed is contentious. Third, ensuring the money is spent effectively will be both difficult and likely to intrude on the ruling governments of the recipient nations, and hence subvert democratic decision making.

The developed world does not have a good track record when it comes to delivering on money promised [53]. For example, developed countries already appear likely to fail to meet the Millennium Development Goal targets of providing Official Development Assistance (ODA) of 0.7 per cent GDP by 2015. The current economic downturn will make it even more difficult for developed countries to raise the public funds required.

There are further concerns surrounding the US$100 billion for mitigation and adaptation for developing countries. One major worry is that the funds will in fact not be 'new and additional' but may be diverted or relabelled 'development aid'. One issue that underlies this concern is that there is not currently a clear baseline of current climate aid. The voluntary nature of ODA makes it easy for donors to vary the amount and nature (e.g. goods and services in kind) depending upon political and economic situations. These programs for health, poverty alleviation and promoting the rights of women and children also act to make communities more resilient to climate change [53].

In terms of the distribution issues, there are scientific challenges to clearly defining what risks and losses are additional due to climate change. Differences in how vulnerability is defined would lead to very different distributions of the funds. For example, if it is defined biophysically then low-lying land such as islands and deltas, drought zones and areas fed by glaciers would be most deserving, but should vulnerability be defined using social factors then the funds would be distributed to the poorest or most densely populated regions. It has been suggested that an international centre should be set up with the purpose of identifying these additional losses [30].

The developed world on the other hand has concerns over the end use of the money once it has been put forward. The developed world seeks assurance that the money would actually go towards mitigation and adaptation actions [54]. However, attempts to control or monitor what the recipient government spends climate money on may be perceived to impinge significantly on their democratic decision making processes, as with many conditional aid systems.

Given the uncertainties regarding the developed world's production of mitigation and adaptation funding it is useful to consider alternative sources of finance. A new international approach must be introduced to make sure that the accepted level of climate stability is effectively achieved on time and with the least cost. It must also provide a new, stable and credible financing system for developing countries which is decoupled from economic ups and downs of donor community. CO_2 markets, in a reformed form, are a feasible model for delivering the financial flows to the developing world on the scale required.

Perversely, the current cap and trade systems act as an incentive to developing countries to emit CO_2 to qualify. It should be noted that the least developed countries will not always have such low GHG emissions; if the economies of the poorest developing nations continue to develop along the high-carbon route then they will contribute more and more in the future. According to the IEA [46], global energy demand is predicted to grow by 55 per cent by 2030. Just over 90 per cent of the increase in the energy demand from 2007 to 2030 is projected to come from non-OECD countries [52]. In the run up to 2030 the new energy supply infrastructure will require investment of up to US$26 trillion, with around half of this required in developing countries. If the investments made are not directed towards growth in climate-friendly technologies, emissions will increase by 50 per cent by 2050 [10]. It would likely be far easier and cheaper for the developing world economies to be incentivised to grow along a low-carbon pathway, rather than attempting to convert at a later stage after investing in high-carbon infrastructure.

A number of proposals for alternative mechanisms to the current international approach to developing country financing have been put forward over the past few years based upon a variation on the current cap-and-trade system.

In his book Kyoto2 Oliver Tickell proposes a global system based upon auctioned upstream emissions permits [55]. In this system, greenhouse gases would be regulated as close to the point of production of the fuels themselves as possible. Permits to release greenhouse gases would be auctioned in a global cap and trade system. The caps would be set annually at levels which have been calculated to prevent dangerous levels of climatic change. The funds raised by the auction process would be used to tackle the causes and result of climate change, in particular the needs of developing countries and those most adversely impacted [55].

Mutsuyoshi Nishimura, a former climate negotiator of Japan, and Akinobu Yasumoto, Executive Vice president of the Japan Machinery Federation, have also put forward a proposal based upon a global cap and trade system. In this proposal, emissions allowances are sold to emitting enterprises before they burn fossil fuels. The concept of obligations to lower emissions is not a part of this proposal and governments are not required to make any reduction efforts. Emissions will be reduced as allowances will only be given up to the amount of 660GTCO_2 – the amount it is estimated that can be emitted without pushing warming over the 2°C mark –over the period of 2010-2050. This period of time can be split into four ten year phases, for example as displayed in table 1. Reducing the availability of carbon allowances over time will increase the price and incentivise low carbon innovation.

As all CO_2-emitting enterprises of the world buy allowances for the amount of CO_2 they emit, they bear the expense of the carbon cost in the first instance. The carbon cost is then passed on to the price of their products, thus internalizing the externalities. Households world-wide eventually defray the carbon cost when they buy those products. In the end, the cost of emitting carbon is passes on to the households of the world who are the ultimate polluters and should pay for the carbon price.

Emission Phase	Carbon Budget for 2°C
Phase I (2010 - 2020)	250 GT
Phase II (2021-2030)	200 GT
Phase III (2031-2040)	150 GT
Phase IV (2041-2050)	60 Gt

Table 1 - Carbon allowances of 600 GT CO_2 for 2010 - 2050 divided into four 10-year phases.

The proposal offers a new form of climate financing by letting governments collectively earn new revenue. This would be used to help people, sectors and countries in need and to promote investment on breakthrough technologies. It was estimated that the proposal can yield new revenue of the order of $500-600billion per annum assuming a carbon price of $25 per ton CO_2. The distribution of revenue amongst governments must be negotiated and agreed upon collectively by governments. A common assumption is that governments will find it difficult to agree on how much climate financing will go to government A and how much more to government B. Proponents of the proposal, whilst recognizing the difficulties, believe that governments will most likely come to terms amongst themselves since it is senseless to renounce collective new wealth of substantive magnitude.

Our Proposal

Here we present a proposal based upon a variation of this global cap-and trade concept. The proposal has origins in the contract and convergence principle as proposed by the Global Commons Institute in the early 1990s. This principle describes a trajectory whereby the overall emission level is reduced over time whilst the per capita emissions rates of different countries converge on a low value aimed at meeting the 2°C objective.

This allows developing countries to maintain some emissions growth in the intermediate phase, which is made up for by a decrease in developed country emissions. The overall amount emitted should not be more than will cumulatively push temperature increases over 2°C. In the global cap and trade system we propose here, emissions are traded based on a per capita allocation of CO_2 trading permits at some future date (2050 is favoured by many).

The per capita system functions by setting a forward trajectory for CO_2 emissions per head per nation, this amount being the same for all countries by the target date. These trajectories can be simply calculated, as

in Chapter 4, given the estimated national and global populations in the future and the amount of CO_2 that it is 'safe' for us to emit to stay under a temperature increase of 2˚C.

Currently this figure is 2 tonnes of CO_2 per capita by 2050 (figure 4). Since many least developed countries have emissions per capita today that fall well below this amount, they could be issued with CO_2 trading permits at 2 tonnes per person at initiation of the trading process, and sell off their unused share to developed countries that produce over their limit. This would mean an immediate cash flow from rich to poor countries. In addition, it would encourage the least developed countries to develop low-carbon economies in order to sustain the in-flow of money. This avoids the least developed nations emerging with carbon-intensive economies.

It is considerably more attractive for these growing economies to be fully incentivised as early as possible to maintain low emissions. (Additional regulations may need to be put in place in order to discentivise population growth, and other potential negative consequences.) However, developed and emerging nations would be required to pay for CO_2 emitted above their agreed trajectories, out to 2050.

Whilst the authors recognise the issues that have been raised with implementing such a scheme [56] and the current lack of political will displayed in the negotiations towards this goal, it is important that solutions that tackle effectively the problems of climate mitigation and financing are aimed at.

There are signs that the political acceptability of this novel approach is growing. This idea has been pressed by many analysts and has support from developing countries. President Kagame, for example, explicitly expressed his support for this solution in a speech to the UN in 2009. Implicit in the emissions targets set by the UK government in 2007 is the acceptance of the per capita approach as an equitable goal to aim for by 2050.

This solution is seen by many as being equitable - an essential factor in any solution to climate change. Industrialised countries have produced the significant majority of the CO_2 in the atmosphere while industrialising countries will be worst affected and will not be able to develop along traditional pathways due to emissions restrictions. Currently, industrialised countries are responsible for around 55 per cent of the stock of GHGs in the atmosphere [57]. The changing face of the global power structure has risen to the fore in recent years. In the future, emerging nations such as the BASIC countries are likely to be increasingly vocal. It is unlikely that a future deal could be reached, including this group, which does not take equity properly into consideration. This solution could be a way of bringing emerging nations such as China and India into the global climate change regime. India has in the past indicated an inclination towards this concept.

In summary, this scheme would demonstrate the resolve needed to properly manage the process of defossilising the global economy by 2050 in an equitable and efficient manner, and also recognises that the least developed nations will in time join the emerging economies group and potentially become the high CO_2 emitters of the future.

It is clear that resolve to act on climate change needs to be strengthened if such a scheme were to be implemented. There needs to be increased action at all levels and individual political champions or figure heads setting examples for others. In order for this to happen, the best and most up to date science possible needs to be available and communicated to political decision makers and leaders. Climate related research needs to ratcheted up to fill in gaps of knowledge.

Funding for Research, Development and Demonstration (RD&D)

Many commentators have called for much greater public investment in energy RD&D to address the need for new low carbon technologies to cover energy production, transport, storage, conversion and usage [58]. Indeed, over the past ten years there has been a very significant increase in research activities in these areas in universities and public research institutions around the world.

But government finance can in general only stimulate the first part of the full RD&D process. The turnover in the global energy sector is measured in trillions of dollars. The proportion spent on RD&D in this sector is notoriously low, and by far the largest part of that is spent to address technological issues around oil discovery and production.

What is now required from governments is a major stimulus to this cash-rich sector to encourage a significant proportion of turnover into fossil-free energy technologies and alternatives, such as carbon capture and storage (CCS).

From his position in the UK Government, in 2001 Sir David King initiated an analysis of the level of energy research, public and private, in the UK. The result was stark. With the privatisation of the energy sector in the 1980s, Europe's largest gas and electricity RD&D centres, based in the UK, were broken up and shared out between the emerging utility companies, and then closed down. The level of funding in energy RD&D in the UK had therefore collapsed to a very low level [59].

A subsequent IEA analysis [27] showed that this was an international trend, with the largest decrease in the area of nuclear power RD&D. Faced with the obvious need to rejuvenate research effort into low carbon energy sources meetings were held with the CEOs of the major UK utilities, and the outcome was the establishment of a new Energy Technologies Institute (ETI) in the UK as a public-private partnership.

The ETI is a £1 billion investment over 10 years, half the funds being raised from the private sector. The idea is to stimulate a much bigger and more realistic investment by the private sector into low carbon energy RD&D within each of their own organisations. Energy companies, whether in the oil, coal or gas production sectors or as utilities, will need to reconfigure and transform their operations in order to remain competitive over the coming few decades. This applies equally to oil and gas producing countries, where economic diversification will be the key to future development.

The formation of the ETI embodies recognition of a way that a government can maximise funding for RD&D, by stimulating investment from the private sector. The private sector has a larger capital pool available for investment than the public sector; the energy sector is worth globally around 3 trillion US dollars pa. The private sector has to be incentivised to invest optimally in RD&D given "knowledge spillovers" that imply they cannot capture all of the returns; and governments have to demonstrate that they will benefit from increased funding for RD&D.

The economic pay-off for increases in RD&D can be very high. A recent study of energy RD&D programs found that a very large proportion of them produced positive net economic gains as well as both environmental and security benefits [60].

There is, however, a tendency for companies to make short-sighted investments in order to maximise profit immediately. Government policy should act to encourage long-term planning in private sector investment decisions. Public funds should be strategically invested so as to increase spending from the private sector.

There are some areas of RD&D that would be important to focus on. Globally, coal reserves are abundant and low cost; one area with a large potential for emissions reductions will therefore be in CCS for coal. A competitive source of electric power generation with lower emissions levels is also an important area for further research; options here include direct solar, hydrogen power and storage, nuclear power, solar photovoltaics and wave and tidal power. A focus of RD&D on energy efficiency gains will act to counter any increases in the cost of energy production, and so stimulate growth. This will in turn lead to more opportunities for innovation.

Forestry Carbon Sequestration

Recent estimates suggest that forestry could contribute an average 6.7 billion tons of emissions reductions annually, with over two-thirds of this potential coming from tropical nations. Making full use of the forest carbon sink is appealing to both the developed and the developing world.

Developed nations see forest carbon sequestration as a low-cost option for mitigating climate change and meeting commitments for reduced net emissions. For the developing world, forest carbon payments could provide a sustainable source of much-needed income.

At the most recent climate negotiation talks in Cancun the parties agreed on a framework on forest carbon. The lack of political opposition to an agreement on forest carbon, along with its large potential for reducing emissions, meant that it was a key area in

which progress could be made.

The Kyoto Protocol established two separate programs for forest carbon. Annex I nations may generate carbon removal credits from certain land use, land use change and forestry (LULUCF) activities. In the developing world, the CDM rewards certain afforestation and reforestation projects by allowing them to generate emissions credits that can be sold to Annex I nations.

These programs are inadequate, however, to effectively and comprehensively address the role of forests in the carbon cycle. Significant sources of forest emissions and forest sinks remain outside the scope of either program. Neither program, for example, addresses the massive amounts of carbon lost to tropical deforestation in the developing world.

To increase the scope of coverage, some countries have encouraged adoption of an international program for reductions in emissions from deforestation and degradation (REDD) from developing countries. Others have suggested expanding that to include not just avoided emissions, but increases in carbon sequestration via forest planting and management (REDD+).

Recent work at the Smith School for Enterprise and the Environment proposes a still more comprehensive approach, the Forest Program for Inventories in National Carbon (PINC) that applies to all forest carbon sequestration activities in Annex 1 and non-Annex 1 countries alike [35].

The Agreement developed at Cancun is based around a REDD+ scheme. Although there is much to do before it is truly operational, the Agreements do provide guidance for countries preparing to be REDD+ ready.

Previous proposals differ with respect to the funding mechanism for forest carbon sequestration. Some proposals suggest a dedicated fund with resources provided by Annex 1 countries. Others have suggested that an international forest carbon program should be linked to the international emissions allowance trading program; i.e., reductions in deforestation and gains in sequestration would be rewarded with payments in the form of marketable GHG emissions allowances.

The magnitude of finances required indicates the need for the involvement of the private sector. The CO_2 market could provide an incentive that would motivate the private sector to contribute to scale. The establishment of these new market mechanisms will be a point of discussion next year at COP17 in South Africa.

There is a general trend in the discussions towards a focus on national accomplishments rather than on project-by-project assessments. This has two important implications. First, it will be up to individual nations to develop domestic forest carbon policies and programs in response to the international forestry agreement. Second, the rewards for accomplishments will accrue to national governments.

The challenge for national governments, then, in promoting forest carbon sequestration is designing a program that reliably induces landowners to protect and expand their forest carbon inventories – whether through regulations, subsidies, information campaigns, tax policy, or other mechanisms – and to take steps that will conserve and expand forest carbon stocks. In nations with large holdings of public land it may also be possible to use direct management by the government to increase carbon sequestration.

Careful design of domestic programs for both private and public lands will be key to the success of the international forest carbon sequestration initiatives. It will also determine the extent to which individual countries benefit in terms of environment quality, resource management and economic development.

Parallel Processes

For many, the 'moment of reckoning' in the climate change negotiations will be in 2012 when the COP returns to Rio twenty years after the UNFCCC was opened for signature there in 1992. In the run up to the 2012 COP in Rio there needs to be sufficient progress in South Africa. This remains the only opportunity for the issue of the future of the Kyoto Protocol to be decided. At the time of writing, the political will of major emitters such as the US and China is simply not behind a comprehensive global agreement. In addition, other nations, namely Japan and Russia, are becoming increasingly vocal in their resistance of a second commitment phase to the Kyoto Protocol.

There are areas of importance that can be moved forward in South Africa. For example, progress has been made on issues of forests, climate finance, adaptation and technology. The area of climate finance is particularly significant; securing and delivering the fast-start funding for developing countries is essential both for them to mitigate and adapt to climate change but also to help to build trust between developed and developing countries. It is vital that the rift between developed and developing countries is healed as quickly as possible. Ensuring that the fast-start money promised by the developed nations materialises is one way of going about this. Positively, on the subject of finance, there is no particular opponent to the progression of negotiations; there is therefore no obstacle to finalising the finance deal.

Had a new legally-binding global agreement for the second commitment period come into being at Copenhagen or Cancun, there would still likely have been a gap between 2012 and it entering into force. As this did not happen, a gap between commitment periods is now a certainty. This has implications for the systems that have been set up during the first commitment period, which needs urgent COP attention.

The problem of an absence of internationally agreed emissions reductions targets has largely been overcome by the domestic pledges now officially recognised by the UNFCCC process. Mechanisms such as the EU ETS and other trading schemes were stimulated by the expectation of an agreement. However, as they are the result of years of careful negotiations and invested political and financial capital there will be resistance to abandoning them at this stage; they are likely to continue regardless. What will be missing is the institutional architecture, the compliance system and some challenges for the CDM. The main recipient of the CDM investment has been China and as such this could have implications for China's participation in a global agreement. However, we note that the emissions reductions generated by the CDM in China are a drop in the ocean compared with the total amount needed. Of far greater importance are the policy decisions enforced by the Chinese Government. China is now considering a domestic CO_2 trading program for its Five-Year Plan from 2011 to 2015.

Over the near- to long-term parallel processes aimed at reducing emissions are likely to evolve in different regions. There is widespread recognition that market instruments such as CO_2 trading schemes will have a role in supporting emissions reductions in a cost-effective manner. In the EU, the ETS is the main driver behind the 20 20 20 plan for emissions reductions across the 27 constituent nations.

In the future, it would be beneficial for the EU ETS to be linked to other regions or countries that have or plan to introduce CO_2 trading schemes. Potential

partners include Japan, Canada (Western Climate Initiative), Australia (NSW Greenhouse Gas Abatement Scheme), New Zealand and the US (Regional Greenhouse Gas Initiative). Linkage of these systems would open up new opportunities for mitigation and increase market liquidity for participating companies. Linkage between systems face various challenges [50], but they are not insurmountable.

The developing and emerging world has signalled its interest in being included in CO_2 trading markets. Again, here there are planned schemes in several countries that could be linked to the EU ETS either on a sectoral or nationwide basis. Mexico is in the process of setting up a voluntary program for GHG accounting and reporting which at present covers 21 per cent of national emissions but which is to be expanded to cover 80 per cent. This scheme will provide essential capacity building for future participation in the CO_2 markets. President Calderon has expressed interest in joining a North American trading scheme with the US and Canada. In Brazil, the introduction of a domestic cap and trade scheme is being considered [35].

For many of the least developed countries, there are significant advantages in incorporation into trading agreements. Developing nations are frequently left out of global trading agreements and this hinders their growth. Inclusion of developing nations in CO_2 trading agreements would create internal incentives to engage in climate change mitigation and adaptation. Inclusion could be based on NAMAs for which support is claimed. Incentivising those countries to grow their economies with low carbon dioxide intensity through internal democratic decision making in this way should be a priority.

The creation of parallel trading schemes in some parts of the world will generate CO_2 price differentials, and it must be anticipated that some large countries will impose no financial disincentive on CO_2 emissions. This would encourage the high CO_2 emitting manufacturing sectors to move their operations into these countries or zones.

The natural response would be an imposition of CO_2 border tariffs on goods entering the CO_2 trading zone. (In order to benefit from the imposed tax, the response of the exporting country would be to impose the border tax at the point of export with agreed verification procedures). In this way the carbon leakage problem could be managed. However, multiple CO_2 prices and trading regimes would not be favoured by the World Trade Organisation. In time the advantages of a single globally traded CO_2 pricing mechanism could be a significant driver towards a global agreement.

Other nations with similar interests are likely to group together to develop solutions. For example, countries that have a large portion of the world's forests, such as many of the nations of South America, may group together to adopt procedures to collectively reduce deforestation. Strong support for this is driven through the potential profitability under the REDD+ scheme, which offers significant incentives for avoided deforestation and reforestation. The declaration by the Government of Brazil at Poznan to terminate all deforestation by 2025 has been a precursor to such action.

Summary

The challenges raised by climate change are manifold and substantial. Reducing GHG emissions and deforestation are now issues of the greatest urgency. Defossilising national economies over the coming four or five decades is less of a technological issue – there are many solutions, and many more will be developed – than a behavioural, social and political challenge. There is much inbuilt social inertia in meeting these, but the challenges are also major opportunities for innovation and improved human well being.

The Copenhagen Accord of December 2009 was a major turning point in action on climate change. In an ideal world, the major global powers – the US, China and the EU – would have provided leadership to the UNFCCC process, and a global deal would have been achievable. In the absence of this, the challenge is now being met through unilateral commitments, initiated prior to Copenhagen but massively extended through the Accord, and now integrated into the UNFCCC process in Cancun. The UNFCCC process will continue to be a vital component of action as we move on. It will act to verify and legitimise the actions of individual nations, and is an important sounding board, where the voices of small nations and of less developed nations can be heard. It also acts to galvanise public and political opinion.

Strong decisive steps are needed from governments to place a long term price on GHG emissions. This will signal to the corporate sector that they are dealing with climate change seriously, and stimulate appropriate participation from that sector. The potential profitability of moving to a green economy cannot be stressed enough, but it does need a price on the emission of GHGs to stimulate action in the market place.

Global equity is central to the debate. A cap and trade system based on a per capita emissions target by mid-century is a potential way of generating financial flows from developed nations to the least developed world, creating incentives for local decision making.
It is important to note that the world is now engaged in solving the challenges of climate change as never before. Nations have a more realistic idea of what is actually involved in taking action. Major developments are taking place. Action is now required at the individual country level to increase their emissions reduction comitments. A new sense of urgency needs to be injected into the negotiation process.

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Acronyms

ALBA	Bolivarian Alliance for the Americas
AWG-KP	Ad hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol
AWG-LCA	Ad hoc Working Group on Long-Term Cooperative Action
BASIC countries	Brazil, South Africa, India and China
CCS	Carbon Capture and Storage
CDM	Clean Development Mechanism
CFCs	Chloroflourocarbons
COP	Conference of Parties
ETI	Energy Technologies Institute
ETS	Emissions Trading Scheme
GHG	Greenhouse Gas
ICA	International Consultation and Analysis
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
LULUCF	Land Use, Land Use Change and Forestry
MEF	Major Economies Forum
MRV	Monitoring Reporting and Verification
NAMA	Nationally Appropriate Mitigation Action
NGO	Non Governmental Organisation
ODA	Official Development Assistance
OPEC	Organisation of the Petroleum Exporting Countries
PINC	Forest Program for Inventories in National Carbon
RD&D	Research, Development and Demonstration
REDD	Reducing Emissions from Deforestation and Degradation
REDD+	Reducing Emissions from Deforestation and Degradation and Carbon Sequestration
UNEP	United Nations Environment Programme
UNFCCC	United Nations Convention on Climate Change
WEO	World Energy Outlook
WRI	World Resource Institute

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(all web-links live as of July 2011)

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