

# REFLECTIONS ON THE STERN REVIEW (2)

## A Growing International Opportunity to Move Strongly on Climate Change

*Lorraine Hamid, Nicholas Stern & Chris Taylor*

### 1. Introduction

The Stern Review made a clear case that strong and urgent action to tackle climate change makes economic sense in terms of the reduced risks of future damage. That was the task of the first half of the Review (Parts I, II and III). The challenge of developing economics and other measures and institutions to tackle the problem is then a matter of developing public policy that both reflects the risk and uncertainty associated with climate change, and embodies the necessary international collaboration on this global issue. That was the task of the second half of the Review (Parts IV, V and VI). This paper highlights the basic economic principles behind the policy recommendations in the Stern Review and takes forward the analysis and proposals of the Review. It is written in the light of developments since the Review was published, reflecting on interaction with policy makers and analysts around the world and other commentators on the Review. We argue that across the world, progress of understanding and developing the necessary policy response to climate change has been

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**Lorraine Hamid** is an Economic Advisor to the Stern Review of the Economics of Climate Change, HM Treasury. **Nicholas Stern** is Head of the Stern Review of the Economics of Climate Change, Adviser to HM Government on the Economics of Climate Change and Development, and Head of the Government Economic Service. From June 2007, he will take up a new appointment as the first holder of the IG Patel Chair in Economics and Government at the London School of Economics. **Chris Taylor** is an Economic Advisor to the Stern Review, HM Treasury.

especially rapid in the last few months. Building on these developments and our initial analysis, we outline a policy programme going forward for international collective action to tackle climate change.

## **2. Using economic principles to understand climate change policy**

The Stern Review is a review of the economics of climate change and its global policy implications. It is a document for use by policy makers and is therefore not detailed on the technicalities of the economics, but brings economic principles to bear throughout its exposition of the economics of climate change and international policy responses. The Review draws on four key areas of economic thinking in its analysis of the policy response to climate change.

The first area is the economics of risk. As science increases our understanding of the risks associated with increasing warming from higher concentrations of greenhouse gases (GHGs) in the atmosphere, possibly resulting in large and irreversible changes in the climate, we conclude that a quantity based target that limits this concentration—an atmospheric greenhouse gas stabilisation target—is the appropriate policy for managing the risks associated with climate change. Given the risks, this sets the context for what may be tolerable or acceptable levels of risk. The Stern Review recommends that stabilisation targets should be set in the range of 450ppm to 550ppm by 2050.

The second is the basic microeconomics of markets, prices and costs, together with modern public economics. Meeting a quantity target by 2050 cost effectively will require decisions on which instruments to use over the short term to deliver reductions efficiently and consistent with a long-term target. The use of carbon pricing instruments is central to the efficiency argument. To keep down costs, it is essential that policies are flexible over the short term. Markets are key to this. Using the market to deliver prices, and therefore determining the costs of complying with the quantity-based stabilisation target, also has implications for how climate change policy is assessed. In this context, it is not the social cost of carbon that drives pricing, but instead it is the market price that arises from whatever the chosen stabilisation target is, and the associated emissions path. The accompanying paper by Dietz *et al.* (2007) outlines this in more detail.

In terms of insights from modern public economics, this theory goes beyond markets and looks at the challenges of limited information, constraints on taxation tools (especially redistribution), oligopoly, and so on. Here, the economics deals with economic policymaking in the presence of imperfect markets and limited instruments. Such analysis explains why a combination of tools such as prices alongside regulation, will be important and explains why efficiency cannot be separated from re-distribution.

Third are the economics of collective action, including game theory. The former gives us insight into what can be achieved by combining the desire to be responsible with structures and incentives that give people an interest in working together and building trust. Building frameworks that embody these incentives, spaces for mutual understanding and resolution, are fundamental to building effective international collective action to tackle climate change.

Fourth is that economic policy cannot proceed without explicit account of ethics. This is true generally, but is of special importance in climate change. The reasons are that international equity is at centre stage and many of the key people affected are not present in the polity and market place. This can take us to notions of ethics beyond the simple ones of standard welfare economics and give very different perspectives on the role of market data in inferring preferences.<sup>1</sup>

In summary, the economics clearly drives the Stern Review's analysis of policy responses to the climate change problem. Despite this, there has been less commentary on this area of economics in the Stern Review. As such, in contrast to the accompanying paper by Dietz *et al.* (2007), this paper reflects more on comments and interactions with policy makers around the world, than on formal academic commentary. This may well reflect the tendency to date for academic economists to be less involved in this debate.

We will now move on to discuss how these areas of economics influenced the Stern Review's recommendations on international climate change policy.

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<sup>1</sup> See Stern (2007a) for a full discussion of value judgments, ethics and discounting in the economics of climate change.

### 3. Risk, policy design and the costs of action

We will now outline the basic high-level conclusion of the Stern Review and the implications for the design of climate change policy. The Review found that a large reduction in the risks of climate damage would be achieved by stabilising the concentration of greenhouse gases somewhere below 550 ppm. The annual cost to the world would be in the order of 1% of global GDP<sup>2</sup> and is substantially less than the cost of the damages thereby avoided. The accompanying paper, Dietz *et al.* (2007) shows that this result is robust to reasonable changes in assumptions and has stood up well to scrutiny. This estimate of the cost of action does, however, depend on sound policy and, in particular, on two factors: what policies are used and how they are implemented. Further, action must begin early—delay is costly. The policies required are (i) that the externality of greenhouse gas emissions is priced via taxes, trading schemes or implicitly through regulation,<sup>3</sup> (ii) that there is adequate and well-used public funding to support the development and deployment of low-carbon technologies,<sup>4</sup> and (iii) overcoming barriers to changes in behaviour that could improve the take-up of less carbon and energy intensive consumption of goods and services.<sup>5</sup> We will examine briefly what each of the elements means for policy going forward in more detail below. We shall also examine a further key element of international action—avoiding deforestation.

On policy implementation, the Review demonstrates that the global cost estimate is dependent on there being flexibility in what, where and when emissions are reduced globally. Further, for policy to have real impact on long-term investment decisions, mitigation policy must be clear, predictable and deliver long-term frameworks in which business can adequately plan and respond.<sup>6</sup>

To be credible and cost-effective, policy will need to be able to respond to new information on the science of climate change and the economic costs of making emission reductions. Private investors expect that policy

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<sup>2</sup> This is discussed in Chapter 9 of the Stern Review; see Stern (2006).

<sup>3</sup> This is discussed in Chapters 14 and 15 of Stern (2006).

<sup>4</sup> Technology policy is discussed in Chapter 16 and international technology co-operation is discussed in Chapter 24 of Stern (2006).

<sup>5</sup> See Chapter 17 of Stern (2006) for a discussion of regulation and its role alongside carbon pricing and technology policy.

<sup>6</sup> See, for example, Blyth and Yang (2006) for a discussion of the impact of uncertainty in climate change policy on investment decisions in the energy sector.

will be adjusted if it turns out to be either inadequate in driving the necessary scale of reductions, or overly expensive. It will be necessary, therefore, to strike a balance between the need for shorter-term flexibility in policy, with the need for longer-term certainty on the likely scale of emission reductions required and the policy framework in which they will be achieved. Whatever the framework, changes to policy that are based on predictable and transparent rules, need not undermine investor confidence and can retain the credibility of the policy framework.<sup>7</sup>

The crucial point on policy design is that the task of achieving stabilization of atmospheric greenhouse gas emissions is now very urgent, given that we are now at 430ppm CO<sub>2</sub>e (equivalent) and that there are powerful arguments for stabilising below or well below 550ppm CO<sub>2</sub>e (see accompanying paper by Dietz *et al.*, 2007, and the first half of the Review). The economics of risk imply that stabilisation targets are the best way to effectively manage the risks of global warming and that action cannot be delayed. This is because the flow-stock nature of the accumulation of GHGs means that a delay in strong action of 20 years or so could make a 530 ppm CO<sub>2</sub>e stabilisation target unattainable or very costly. To illustrate: if we aim to stabilize emissions at 550 ppm by 2050, we require global emissions to peak in 2020 and reduce by 1.5% annually thereafter. If emissions peak ten years later in 2030, then the rate of decline required doubles to 3% per year.<sup>8</sup> This highlights an important issue for policy makers: if constraints on greenhouse gas emissions are necessary to meet a stabilization goal, there is a clear case for policy to be put in place as early as possible, to allow the process of reduction to be as smooth as possible and avoiding sharper, and more costly, downward corrections in emissions at a later stage.<sup>9</sup>

#### 4. A global market failure requiring global action

The causes and effects of climate change embody two key features that make it a global problem, requiring a global response. The first is the fact that temperature changes are influenced by the stock of greenhouse gases

<sup>7</sup> See Helm *et al.* (2005) for a useful discussion of credible carbon policy and analogies to the transparent rules basis of the UK Monetary Policy Committee for setting interest rates to target inflation rates in the UK.

<sup>8</sup> See Figure 8.2 and Box 8.2 in Chapter 8 of Stern (2006).

<sup>9</sup> This holds regardless of what that goal is and when it is agreed.

in the atmosphere, and that any addition of GHGs to that stock has the same effect, regardless of its geographic origin. The impacts of climate change affect the basic elements of life for people around the world—water, food, health, and the environment. Most of the impacts are channelled via water, for example through floods, droughts, storm surges and sea level rises.<sup>10</sup> The second is that the distribution of the impacts of climate change tends to be most severe and occurs most quickly in the poorer regions of the world where people are more vulnerable and less able to respond to the impacts. At the same time, the poorer countries are the least responsible for the stock of gases currently in the atmosphere.

Building international collective action to tackle the externalities and market failure embodied in the emissions of GHGs is therefore imperative. No single country, however effective its policies in reducing emissions, can have the necessary impact in controlling global atmospheric concentrations of greenhouse gases to achieve the required stabilised concentration levels. Tackling climate change is therefore an international collective action problem. But at the same time, national policy and legislation is the framework in which mitigation policy is implemented and enforced. Therefore, to have a chance of stabilizing global greenhouse gas emissions, international collective action must be founded on and linked to domestic approaches to policy that reduce emissions.

Tackling climate change at both national and international levels requires leadership from the top levels of government. The risks and possible economic impacts of climate change, as well as the appropriate design of public policy, affect all sectors. The challenge is to adapt across the economy and to manage the change to a low-carbon economy. Such policy clearly goes beyond the remit of environment ministers. It should be at the heart of national economic policy and be a central part of international economic cooperation.

International agreements on emissions reductions are valuable in building a shared understanding of appropriate action and building confidence in markets on the future direction of policy. However, constructing a powerful and credible international enforcement mechanism is likely to be difficult in the short term. Formal compliance mechanisms are likely to be

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<sup>10</sup> The physical impacts associated with rising global temperatures are summarised in Chapter 3 of Stern (2006).

effective only for specific and limited infractions. However, the desire of the domestic population to behave in a responsible manner can, in itself, provide an effective enforcement mechanism.

Around the world, public concern and awareness about climate change is growing rapidly. It both influences and sustains international co-operation, national aspirations and private sector leadership on climate change. The public will pressure governments that fail to act in a responsible manner. Further, failing to act may damage their international relationships. California and China are examples of where public concern has led to a country or region taking on targets or embarking on strong policies, without formal international agreements underpinning them. In other places that already have international agreements to reduce emissions under Kyoto, countries such as France and the UK, and regions such as the EU have chosen to take on voluntary targets that go beyond the ambition or time line of their Kyoto commitments.

## **5. Developing national policy frameworks across the world**

Concern over climate change and its impacts has been a topic of national public policy discussion for some years now, with action plans emerging round the world—both from countries already signed up to international emission reduction obligations (Kyoto ratifiers), and those outside of such agreements. Diverse policies are being pursued, which have important implications for international emission reduction strategies going forward. Often, the policies have a strong element of national interest driving them, such as energy security, but in effect, they can constitute important contributions to tackling climate change due to the avoided greenhouse emissions that the policies entail. In many instances, it is clear that climate change policy has useful harmonies with pursuing other important national objectives such as local environment pollution, energy security and growth. Indeed, the potential consistency, with good policies, of the three objectives of economic growth, energy security and climate responsibility was a key argument of the Stern Review.

Since publication, the Stern Review team has had the opportunity to discuss the results of the Review with policymakers, academics and business leaders across the world, in particular in the EU, China, India, Japan, Indonesia, Africa and USA, Canada and Australia. We have been struck by

the growing intensity of focus, and indeed progress, on developing policy to reduce energy intensity as well as overall emissions.<sup>11</sup>

The development of policy in the EU has accelerated significantly in the last few months. After the experience of low carbon prices arising from excessive distribution of permits in Phase I, the European Commission rejected several of the draft National Allocation Plans for Phase II of the EU Emissions Trading Scheme, asking for allocations to be reduced in a number of countries—a move that will increase the credibility of the EU emissions market for 2008–2012. This has sent a strong signal on the role of carbon markets at the centre of the EU's strategy to deliver deeper emissions cuts. The European Spring Council in March 2007 also agreed to a new independent EU commitment to reduce greenhouse gases by at least 20% by 2020, and pledging to go further up to 30% compared to 1990 levels by 2020, as part of an international agreement by other developed economies. The EU has also agreed mandatory targets that 20% of energy use must come from renewable sources by 2020, the phasing out of the use of traditional tungsten light bulbs, and aspirations to develop several carbon capture and storage plants in the EU by 2020.

In China and in India, policymakers are also demonstrating a strong interest in moving towards more secure and sustainable energy use. China is beginning to implement measures to meet its domestic target to reduce the energy output ratio by 20% by 2010. The target will be met via energy efficiency audits<sup>12</sup> and major investment projects for manufacturing industry, and changes to taxation of vehicle sales. A new tax ranging from 5%–15% on energy-intensive products for export such as aluminium and cement has been introduced.<sup>13</sup> In India, the Integrated Energy Policy under the 11th Five Year Plan is being taken forward—including changes to energy subsidies, plans for more efficient coal-fired power plant and further development of innovative new technologies for renewable energy.

In Japan, debates between government, industry and civil society on the challenges of designing further domestic and international action are

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<sup>11</sup> See Stern (2007b) for more detail on the nature of the international discussions as part of the research and dissemination of the Stern Review.

<sup>12</sup> These are the personal responsibility of managers of top 1000 energy-intensive companies in China.

<sup>13</sup> MoFCOM, China introduced the new taxes on exports of energy intensive goods on November 1st, 2006. See Stern (2007b) for more details.



intensifying. There is encouraging news of rapid technological progress in Japan—increasing confidence on the role of plug-in hybrid vehicles and imminent breakthroughs in solar technology. Japan is also increasingly recognising the role of trading and investment strategies in creating stronger co-operation with China and India. There is also strong business interest in global sectoral approaches to emission reductions in energy intensive industries such as cement or aluminium that could limit concerns about international competitiveness in such industries.

In Africa, climate change has risen sharply up the agenda. The decision by the African Union to make climate change one of the key themes for its Summit in January 2007 has further focussed attention of African leaders on the vulnerability of their countries, and to the opportunities for adaptation, sustainable land management and low-carbon development.

In the US, too, there have been some very significant moves to reduce dependence on fossil fuels, and some states, cities and businesses have set objectives to limit greenhouse gas emissions. At the state level, California has committed to making a 25% reduction in emissions compared to 1990 levels by 2020, and 80% reductions by 2050. Several other states are considering similar moves. There is progress on the implementation of a regional emissions trading scheme covering most of the North Eastern states of the US. In advance of the 2007 State of the Union address, a group of leading business and environmental organisations called for US Congress to provide national legislation to require significant reductions of greenhouse gas emissions over the short- and medium term. In his State of the Union Address in January 2007, President Bush outlined plans to improve efficiency, reduce emissions and improve energy security particularly in the transport sector. Energy efficiency standards in such large markets can stimulate innovation and influence markets throughout the world.

In the light of these policy developments, there are clear opportunities to build momentum towards effective international collective action on climate change.

But we cannot be complacent. We stress in the Review that the sum of these global initiatives needs to be at a scale commensurate with the task of achieving stabilisation goals. The slow progress in international discussions means that we cannot yet be confident that international action will be strong enough, or be put in place quickly enough to have a chance of stabilising global emissions in the next few decades.

We will now look more closely at some of the features of the policy instruments necessary for mitigation over the short- and long term and their role in developing international collective action.

## **6. Carbon pricing, technology policy and international action**

The Review emphasised the need for three elements to mitigation policy as outlined in Section 3 above. Much of our discussion with policy makers has focused on the role of carbon pricing and developing low-carbon technology in international efforts to tackle climate change. There are important distinctions between the different options for policy instruments for pricing and technology that merit particular attention.

On pricing instruments, the Stern Review emphasised that either taxes or trading can be used to price the externality of greenhouse gas emissions. The Review does, however, emphasise the role of emissions trading in building international action. This is because trading policies offer a powerful instrument that encourage both least-cost emissions reductions and facilitate international co-operation. Where developing countries are involved in such markets, trading offers a channel for financing low carbon investments in these countries. Given their low incomes and the strong feeling of inequality arising from the fact that the rich countries are responsible for most of the existing stock of GHGs and continue to emit much more per capita, such flows are likely to be crucial to secure the involvement of poor countries in moving from energy efficiency to low-carbon. Further, carbon trading flows that are driven by trading by governments as well as the private sector from countries with reduction targets, do not cut into funds to overseas development assistance, which are vital to support development more generally.

How policy makers determine whether to use taxes or trading will vary by region and sector. In general, taxes are likely to be most useful in sectors that have a large number of small emission sources, which may also be mobile (such as road vehicles). In such sectors, the transaction costs for a large number of small emitters being involved in emissions trading schemes may be prohibitive. In many countries, it may also be that these sectors already have a fiscal policy in place that makes the use of taxation for carbon purposes easier to implement than a new approach to using emissions markets.

In other sectors that have large, stationary sources of emissions (such as electricity generation or heavy industry), transaction costs for involvement in trading will be lower, making them more suited to using emissions markets. In many cases, these sectors are also competing internationally. Inclusion in an international trading scheme therefore helps to reduce the risks that different carbon prices used at the domestic level impact on competitiveness.

Moving now to consider the policies beyond carbon pricing to deliver new low-carbon technologies, the Stern Review stressed that direct public support is required to support the introduction of public goods such as the ideas and technology arising from the R&D stage of innovation and adaptation. Further, there is an international element to these public goods that can be supported by international co-operation. For example, in the case of developing fusion technology,<sup>14</sup> the scale of the costs and risks implies that an international approach is preferable and the EU, US, Russia, China, India, Japan and the Republic of Korea agreed terms to split the costs. International agreement can reduce duplication, reduce costs and increase the scale of technology investment by spreading the risk.

Developing new lower-cost abatement technologies helps encourage greater mitigation ambition, and transferring these technologies to developing countries is also a valuable way to build international co-operation. In other areas where costs and risks are lower, competition in developing new technologies at the national and international level will generate powerful forces for technological change, provided, of course, there is a framework of incentives for cutting GHG emissions.

We now turn to examining how the Stern Review assessed the steps necessary to build effective international collective action to tackle climate change.

## **7. Building effective international action**

The process of building international collective action has, of course, already begun through the institutions of the UN Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. Since agreement

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<sup>14</sup> [www.iter.org/](http://www.iter.org/)

on its basic articles in 1997, this forum has provided an important basis for action, providing a framework for international co-operation and collective action on climate change that includes international emissions trading, technology transfer and planning for adaptation. Currently the discussions focus mainly on reductions between 2008 and 2012, although the discussion of the post-2012 framework has begun. In terms of what is needed to stabilise global emissions, this cap on emissions in Kyoto ratifying countries is only a first step over a short time period—in total, the countries who have ratified the Kyoto Protocol represent around 40% of global emissions as set in 1990.

Going forward, a decade on from when the Kyoto Protocol was first agreed, our understanding of the science and the risks to the planet and its people has sharpened, as have our views on the economic and policy challenges of making a transition to a low-carbon economy. The arguments for strong and urgent action are now firmly established, and the range of sensible stabilisation targets and thus the necessary emission reductions, are clear. We are now entering a critical period for the future of international co-operation. Agreement on a successor to the Kyoto Protocol for post-2012 must be found very soon if a damaging policy hiatus is to be avoided; such a hiatus would be potentially problematic at a time when constructing a stable framework is vital to investment and longer-term planning. A common understanding both of the risks and of the urgency of action is fundamental to success in fostering truly global co-operation.

So, how can we create sufficiently ambitious structures which manage to involve the major players? How will the USA, China, India, Brazil and the EU move together towards stronger action to take on the challenge of climate change?

From the analysis of the Stern Review, from policy and other developments since publication, and from our own interactions we would suggest a way forward as follows for international discussion, understanding and agreement.

- (i) *Setting a quantity target for stabilizing greenhouse gases.* The Stern Review argues for this to be in the range of 450ppm–550ppm CO<sub>2</sub>e by 2050, the upper limit of this range being the highest risk of average warming and impacts that might be acceptable, given our current understanding of the science. This is a crucial decision. To go beyond

550 ppm CO<sub>2</sub>e would be very risky. And it implies a clear quantity direction for emissions paths. We, as a world, would have to see a peak in absolute emissions within 20 years and absolute cuts of 30% or so by 2050.

- (ii) *Addressing the equity concerns of the impacts of climate change in the developing world.* This requires that the developed world contribute the largest part of reductions necessary to reach stabilization at the upper limit of 550 ppm CO<sub>2</sub>e by 2050. To achieve this will require reductions from 1990 emission levels of at least 60%–90% by 2050 from the entire developed world. This demand for reductions should then be met by supply from a global carbon market allowing for trade, including the developing world. The opportunity to participate in a global carbon market will ensure that the reductions are made at least cost, while driving flows of carbon finance to the developing world. These flows will need to be in the region of at least \$20–\$30 billion per annum to play a strong role in covering the incremental costs of low carbon investment in the developing world.<sup>15</sup>
- (iii) *Scaling up the supply of reductions from the developing world and building a truly global carbon market.* This will require two things. First, improvements to the system of recognising emission reductions in the developing world, going beyond the largely project-by-project approach of the Clean Development Mechanism. In this respect, moving towards using programmatic, sectoral or technology-based baselines is crucial. At present we do not see national caps as being acceptable to most developing countries, at least not at levels consistent with a sensible global carbon price. However, the delivery of carbon finance through effective trading schemes that are based on scarcity, together with development and transfer of relevant technologies, could build the foundation for eventually making such caps acceptable. To facilitate scaled up involvement in global carbon markets by the developing world, technical work should be accelerated on defining and measuring reductions from different policies and measures across multiple sources and sectors against the expected Business As Usual emissions

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<sup>15</sup> See Chapter 23 of Stern (2006) for more details.

(BAU) in developing countries.<sup>16</sup> This is challenging work that will need the input of expert researchers, regional development banks and other multilateral institutions.

The second is to ensure that emerging national emissions trading schemes are designed to be ‘outward-looking’ from the outset, such that they can be linked to other emissions trading schemes worldwide. Underlying mechanisms and institutions for developing standards for verification and accounting of emissions are crucial to the credibility and tradeability between schemes and should be worked on to support the implementation of linking.<sup>17</sup>

(iv) *Increasing the level of support for the development of new low-carbon technologies.* Carbon pricing alone will not be sufficient to reduce emissions on the scale and pace required. Public energy R&D has halved in the past two decades. Globally, support for energy R&D should at least double, and support for the deployment of new low-carbon technologies should increase two to five times. Private and public support for energy, research and development tend to move together, and public–private partnerships and strong creativity from the private sector will be vital to progress. Private and public sectors should work toward providing a portfolio of abatement technologies that includes carbon capture and storage and renewable energy sources.

(v) *Recognising the crucial role of carbon capture and storage, particularly for coal.* Technology policy should not try to identify one single technological solution. But unless rapid and effective progress is made in proving and developing carbon capture and storage for coal, it will be extremely difficult to meet sensible global emissions targets. Many countries, particularly, but not solely developing countries, will be using coal for electric power for decades to come. The reasons for this range from energy security concerns, to cost and the speed of build for coal plants. Coal is the most polluting of hydrocarbons from the perspective of climate change. Progress on this front is therefore urgent and vital.

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<sup>16</sup> For an interesting analysis of developing countries’ mitigation opportunities from current policies and detail on sectoral approaches, see papers by the Centre for Clean Air Policy at [www.ccap.org/international/developing.htm](http://www.ccap.org/international/developing.htm)

<sup>17</sup> See Chapter 22 of Stern (2006) for more details on linking and the establishment of global carbon markets.

- (vi) *Overcoming barriers to behavioural change.* This is necessary across sectors and at several levels where market failures in sectors such as buildings and consumer goods, prevent simple price instruments from informing preferences. Regulatory measures can play a powerful role in cutting through the complexities in these markets that prevent individuals taking up lower carbon options. Minimum standards for buildings and appliances will therefore be important going forward, as they can be a cost-effective way to improve emissions performance and consumer behaviour, for example in emissions standards for vehicles and building regulations for low-carbon infrastructure. So too will information policies, including the labelling of goods.
- (vii) *Fostering a shared understanding of the nature of climate change, and its consequences.* This can play a key role in shaping behaviour, as well as in underpinning national and international action. Governments can be a catalyst for this through setting out the evidence on climate change in public discussion and through the education system.<sup>18</sup>
- (viii) *Avoiding deforestation.* Emissions from deforestation are a significant source of emissions, some of which can be reduced at relatively low cost. It is worth taking action to reduce deforestation, both to maintain the global function of forests as carbon sinks and to protect other benefits, including biodiversity, watershed management and their role in local climate systems. This action should be led by the countries in which the trees stand, with support from the international community for the opportunity cost of alternative uses of the land, which in many cases are relatively low. Such support should also recognise the costs of administering and enforcing protection, and of managing the political transition as established interests are displaced. Large-scale pilot programmes should begin to develop experience and understanding of costs involved. In the longer run, linking avoided deforestation efforts to carbon markets may be effective. But in the short term, given the possible volume of reductions from this source, there may be risks of de-stabilising the crucial

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<sup>18</sup> Chapter 17 of Stern (2006) outlines this in more detail.

process of building strong carbon markets if deforestation is integrated into these markets, without agreements that strongly increase scarcity and therefore demand for more emissions reductions.<sup>19</sup>

- (ix) *Financing adaptation.* We are already locked into the next 20–30 years of climate change of between 1 to 2 degrees increase in average global temperatures. So adaptation is necessary, especially as it is the poorest, most vulnerable who will be hit hardest and earliest by higher temperatures. All countries, rich and poor, will have to face up to adapting to the expected changes and this is likely to be costly. In the developing world, spending to adapt will undermine funding for development policy, putting strong pressure on developing country budgets and Overseas Development Assistance. It is therefore essential to meet G8 and European commitments made to double aid flows to the developing world between 2005 and 2010 and to move on to 0.7% of GDP by 2015. In the longer term, putting adaptation needs at the centre of development policy will be necessary to plan effectively to meet the challenges at least cost.<sup>20</sup>

## 8. Conclusions: the way forward

Building a framework that begins the urgent task of stabilising atmospheric greenhouse gases is in all of our interests and will ultimately be supported and embedded across the world by the support of people who are convinced it is necessary and are willing to assist in it.

At the same time, we must not forget that while climate change is a major threat to the future sustainability of human societies and ecosystems, tackling climate change also brings opportunities for a new economic transition and a source of growth.

We can decrease the risk of catastrophic climate change and its associated profound risks to the planet and its people now and in the future, while in the process become more energy- and resource efficient and develop new technologies. If we manage to do both of these, we will have

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<sup>19</sup> See Chapter 25 of Stern (2006) for more detail on approaches to managing emissions from land use change and avoiding deforestation.

<sup>20</sup> See Chapter 26 of Stern (2006) for more detail on policy responses to adaptation.



got a very good deal for a relatively small cost to global GDP. One per cent per annum now and forever must be a price worth paying.

Our interactions following the publication of the Review and policy developments since publication have convinced that it is now possible to build international collaboration on the basis of national commitments which are voluntarily chosen and not necessarily as part of a contemporaneous or binding national agreement. Time is short not only for action but also, specifically, for building a medium- and long-term framework beyond 2012. This year is pivotal to getting momentum and agreement to tackle climate change for the long term. There are crucial meetings in 2007 such as the G8 summit in Germany in June and the UNFCCC conference of the parties in December. The first crucial international gathering on the issue in 2007, the European Spring Council in March, made very strong progress.

The movements that we have described briefly in other parts of the world also give grounds for hope that action is possible on the appropriate scale and within the necessary timeframe. Decisions in the next two years will be vital for setting the world on a path that can avoid the most severe risks of climate change, and we must all work to ensure those decisions are fit for purpose. To be fit for the task at hand, we must act urgently, strongly and internationally.

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