

Human Development Report 2007/2008



Fighting climate change: Human solidarity in a divided world

Main Messages and Questions & Answers



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INTRODUCTION

Climate change is the defining human development challenge of the 21st Century. Failure to respond to that challenge will stall and then reverse international efforts to reduce poverty. The poorest countries and populations will suffer the earliest and most damaging setbacks, even though they have contributed least to the problem. Looking to the future, no country—however wealthy or powerful—will be immune to the impact of climate change.

The *Human Development Report 2007/2008* shows that climate change is not just a future scenario. Increased exposure to droughts, floods and storms is already destroying opportunity and reinforcing inequality. Meanwhile, there is now overwhelming scientific evidence that the world is moving towards the point at which irreversible ecological catastrophe would be unavoidable. Business-as-usual climate change points in a clear direction: unprecedented reversal in human development in our lifetime and acute risks for our children and their grandchildren.

There is a window of opportunity for avoiding the most damaging climate change impacts, but that window is closing: the world has less than a decade to change course. Actions taken—or not taken—in the years ahead will have a profound bearing on the future course of human development. The world lacks neither the financial resources nor the technological capabilities to act. What is missing is a sense of urgency, human solidarity and collective interest.

As the *Human Development Report 2007/2008* argues, climate change poses challenges at many levels. In a divided but ecologically interdependent world, it challenges all people to reflect upon how we manage the environment of the one thing that we share in common: planet Earth. It challenges us to reflect on social justice and human rights across countries and generations. It challenges political leaders and people in rich nations to acknowledge their historic responsibility for the problem, and to initiate deep and early cuts in greenhouse gas emissions. Above all, it challenges the entire human community to undertake prompt and strong collective action based on shared values and a shared vision.

MAIN MESSAGES

I. BROAD MESSAGES BY TOPIC

The human development impacts. The scale of the impacts on the lives of people that will come with climate change has been heavily underestimated. The types of events associated with climate change include floods, storms, droughts, and rainfall variability. Some of these events are not typically associated with climate change, others are. There is not a direct causal link between such events and climate change, rather an observable trend towards an increase in the frequency and severity of such events. The report does not present an apocalyptic view of the issue, rather it underscores that climate change is already affecting people, touching what is close to their lives; and in future it will affect even more people on a wider scale if it is not effectively addressed. There are already small incremental increases in the incidence of such events—and this could worsen on current trends. The impacts of climate change on poor people and vulnerable communities challenges developed countries to think about social justice and the ethical obligations to developing countries needed in order to solve a problem that historically they did not create. We cannot accept that the poorest and most vulnerable communities are those facing the consequences of climate change today. Future generations will face even more severe impacts. Both constituencies have neither a voice nor bear the responsibility for the signs climate change we are seeing today.

The urgency of the issue. The visible signs of global warming are everywhere, in changing temperatures and consequences such as more frequent and longer droughts, flooding, severe storms, melting glaciers, changes in rainfall patterns and the like. Most significantly for the argument to see the urgency of addressing climate change is the fact that today we are living with the consequences of the massive increase in carbon emissions that took place during the Industrial Revolution, when coal replaced water as a source of energy. Therefore, we need to act now, but we also need to think of a long-term horizon. The impact of decisions taken today will still affect people 100–150 years from today. Actions need to be long-term, to match the length of carbon cycles, not the short-term political cycles of elected officials. Yet much centres around the Bali, Indonesia conference (3-14 December 2007). This meeting of the United Nations Framework Convention on Climate Change represents a crossroads, a clear opportunity to move forward on climate negotiations for a post-Kyoto framework.

Climate change is avoidable. The report is a call to action, not a counsel of despair. Climate change, and particularly dangerous climate change, is avoidable, but only if we take concerted action now. The report urges everyone—in developed countries and developing countries—to take note of the effects of climate change on the lives of primarily poor people now and what these impacts could be in future for everyone. Working together with resolve, we can win the fight against climate change. However, countries need to do much more than what is currently happening: policy needs to move. We have the technology and the resources, but lack the necessary movement in international politics. The report presents stringent yet feasible targets for cutting emissions, and a series of specific complementary recommendations for: pricing carbon;

strengthening regulatory frameworks; supporting the development of low carbon energy provision; international cooperation on finance and technology transfer; and reforms to support adaptation to climate change in developing countries.

Mitigation. Viewing climate change in terms of a global carbon budget, the report calls on developed countries to demonstrate leadership by cutting greenhouse gas emissions by *at least* 80% of 1990 levels by 2050 and 30% by 2020. These proposed cuts are the targets necessary to avoid dangerous climate change. Though they are steeper than any current targets, the report shows that they are feasible given current resources and technology. In order to attain them, the report advocates a mix of carbon taxation, more stringent cap-and-trade programmes, energy regulation, and international cooperation on financing for low-carbon technology transfer. The report stresses that many targets being bandied about now involve adjusted and other manipulations of figures, which confuse the issue and may give the impression that measures are more stringent than is the case.

With this in mind, rich countries ought to undertake mandatory, binding emissions cuts to stabilize CO₂e during 2012-2050. It is unrealistic to expect developing countries to do this. The aim should be to gradually reduce emissions from developing countries after 2020, but at a rate which is consistent with expanding access to electricity for the 1.6 billion who do not have access and improving energy services for the 2.5 billion people who manage their energy needs through collecting firewood and dung. For this to happen, developed countries need to transfer financial and technological resources through multilateral means, expanding access to energy and improving efficiency through low carbon technology. Funds should also be made available for adaptation. A mechanism for financing should be part of whatever replaces the present Kyoto Protocol that culminates in 2012.

Adaptation. Even if everything advocated by the report for mitigation were to be carried out, some consequences have already been set in motion by global warming; therefore we must move to address adaptation. The report has a clear focus: nothing we do today will have any beneficial effect for people for decades—this inertia is the nature of climate change. Internationally, what is being said about adaptation is limited. Inequalities in ability to cope with climate change are emerging as an increasingly powerful driver of wider inequalities between and within countries. Rich countries are already adapting to climate change by investing significant financial resources to safeguard themselves, whereas poor countries are being left to their own means. Therefore, the report calls on rich countries to put climate change adaptation at the centre of international partnerships on poverty reduction.

The Adaptation Fund recommended by the Kyoto Protocol's Clean Development Mechanism has not taken off; its credits linked to emissions trading schemes. The approach is product-wise, operating through firms in Europe identified with projects in India or China, but it is not enough. We need financing through energy policy on the order of billions of dollars. Extensive menu options are spelt out in the report, from carbon finance and trading to public-private partnerships and risk guarantee instruments to help developing countries.

The report recognizes that India's carbon footprint is only one tonne per capita whereas it is 20 tonnes per capita in the United States, and four in China. The report does not expect developing countries to undertake quantitative reduction even in the post-2012 period. Realistically, we need a large multilateral mechanism to help developing countries curb emissions post-2020.

II. MESSAGES BY REGION OR COUNTRY GROUPING

A. Developed Countries

Organisation for Economic Co-operation and Development (OECD) Countries

Most wealthy countries, specifically OECD countries, are failing to meet their targets for cutting greenhouse gas emissions under the Kyoto Protocol. Even countries with the most ambitious goals or praised plans are not on track to reduce emissions levels sufficiently. The resulting effects will be felt first—and hardest—by the world's poor. Many rich countries have highly publicized targets and schemes for reducing emissions, and a few can claim some success in curbing emissions through specific programmes. Although setting ambitious targets is important, the report notes that at best, results have been mixed. Developed countries' major efforts to cut emissions include the European Union's cap-and-trade scheme, a move towards greater use of renewable energy and voluntarism. None of these efforts has produced the results needed to meet the countries' own targets.

Wealthy countries have neither demonstrated international leadership on climate change nor accepted responsibility for past emissions, yet they already spend billions adapting to its effects. This represents a double standard. Poor countries are not historically responsible for carbon emissions but are being made to deal with the impacts of climate change on their own. In developing countries, one in 19 people were affected by climate-related disasters between 2000 and 2004. In contrast, only one in 1,500 people were affected in wealthy countries. The main difference is that developed countries have the means and resources to climate-proof their infrastructure.

B. Developing Countries

The report asserts that all countries must be part of international efforts to tackle climate change, but clearly recognizes that developing countries cannot be expected to reduce greenhouse gas emissions at the same rate or over the same timeframe as what is proposed for developed countries. Economic growth and poverty reduction efforts cannot be sacrificed. However, developing countries with higher carbon footprints will need to start to undertake changes by 2020, but with support from developed countries. In general, for developing countries the report proposes international cooperation for transferring and financing new low-carbon technologies, and recommends that national governments include adaptation to climate change in their poverty reduction strategies.

Strengthening social investment programmes is another recommendation made for climate change adaptation.

Sub-Saharan Africa

Sub-Saharan Africa is already being affected by climate change and will be disproportionately hit by the effects of climate change, creating cumulative cycles of disadvantage that are transmitted across generations. Faced with existing vulnerabilities, and unequal impacts, governments in the region must act now to address its current effects and avert future catastrophe. The region will require the support of wealthy countries to adapt and to prevent reversals in recent drops in the share of people living in extreme poverty. Sub-Saharan Africa is particularly vulnerable to climate shocks such as droughts, floods and storms that will become more frequent and severe. Part of the solution lies in national governments planning. The other part falls to wealthy countries who are failing to meet their international obligations.

The report recommends a number of critical actions that need to be taken by national governments and addressed in planning efforts and poverty reduction strategies: (a) Expanding the continent's meteorological monitoring network, so that farmers can access better information about climate patterns in the region. (b) Investing in water-storage or "water harvesting" facilities in Ethiopia, Kenya, and Tanzania, countries with high levels of rainfall concentrated in a few weeks of the year. (c) Improving national social insurance programmes to protect farmers and poor urban residents from the worst effects of climate-related disasters. Projects such as the Kalomo pilot project in Zambia, which provides \$6 a month to families in the bottom 10 percent of the economy, should be expanded. (d) Investing in early-warning systems. One example is Mozambique's creation of early warning and rapid-response mechanisms following devastating floods in 2000.

Asia and the Pacific

The destructive effects of climate change have affected mainly people in developing countries. Like other regions, Asia is already seeing some of the effects of climate change and will require the support of wealthy countries to adapt and to cut emissions without damaging development and poverty reduction efforts. Small island developing states are on the front line of climate change and are already highly vulnerable to climate disasters.

Broadly, if climate change is not properly addressed, in South and East Asia changes in rainfall, temperatures and the availability of water would cause great losses in productivity for food staples, thereby thwarting efforts to cut rural poverty. Central Asia, Northern China and the northern part of South Asia are particularly vulnerable to retreating glaciers. This would affect seven of Asia's major river systems that support water and food supplies for over 2 billion people. Annual damages to gross domestic product for countries such as Fiji, Kiribati, Samoa and Vanuatu could range between 2-7% and 17-34%.

Wealthy countries must assume responsibility for the effects of warming trends on the world's poor, and Asian countries, while adapting to their effects, need to continue to

develop, but cleanly. The report recommends international cooperation on financing for low-carbon technology transfer to developing countries, e.g. China and India, to avoid the increasing use of coal as a source of energy.

Latin America and the Caribbean

The effects of climate change in Latin America could paralyse or reverse human development due to high levels of poverty and the lack of capacity to manage climate risks. The report notes that social inequality increases the impact of climate change. Those affected by climate events such as flooding and severe storms are the most vulnerable communities—who will need support to adapt to the impacts of climate change. The report points to good examples of social investment programmes, e.g. cash transfer programmes, in the region. These include Brazil's Bolsa Familia initiative, covering 46 million people; Nicaragua's Red de Protección Social, with significant results in the face of the slump in coffee prices; and support programmes to keep children in school such as Progresá in Mexico and Programa Asignación Familiar in Honduras.

Furthermore, in Latin America and the Caribbean there are approximately 45 million people without access to electricity; examples of such low access include Haiti, Honduras, Bolivia, Peru and Nicaragua. Fifty percent of the people in the region without access to electricity live in these countries. These people cannot be expected to reduce their emissions. International cooperation is fundamental to achieving improved coverage of these basic services through the transfer of low-carbon technologies to attain cleaner sources of energy.

Deforestation in the Amazon region is a great source of global emissions. The erosion of forests—vast repositories for carbon—accounts for about one-fifth of the global carbon footprint. Forests are ecological resources that generate wide-ranging public and private benefits. They are the home and basis of livelihoods for many poor people and a source of potential profit for large commercial interests. They are also a source of biodiversity. One of the challenges in forest governance is to balance the demands of competing interests with very different levels of power. In Brazil, the report notes that government commitment and the active engagement of civil society have been critical to a positive step forward: an integrated plan, begun in 2004, to prevent and control deforestation. While still too soon to determine if this will be successful, preliminary data for 2005 and 2006 suggests that the deforestation rate in Mato Grosso has slowed by about 40 percent.

Central and Eastern Europe and the Commonwealth of Independent States

The effects of climate change on transition countries are varied. Some will need to adapt more urgently, while others must cut emissions without damaging growth, development and poverty reduction efforts. The experience of transition countries highlights the important role of markets. During the first half of the 1990s, energy demand and carbon emissions declined dramatically, alongside the economies of these countries. This explains why transition economies 'over-achieved' against their Kyoto targets.

Energy policy reforms since have produced a mixed picture. Energy intensity (energy consumption per unit of gross domestic product) and the carbon intensity of gross

domestic product have fallen in all countries, though at very different rates and for different reasons. In the Czech Republic, Hungary and Poland advances have been driven by economic reforms and privatization. Ukraine has achieved far lower reductions in energy and carbon intensity, which owe less to reform than to the fact that imports of natural gas from the Russian Federation have halved the share of coal being used. Energy reform here has yet to take off and energy prices are still heavily subsidized, creating disincentives for efficiency gains in industry.

As the world's third largest emitter of carbon dioxide, the Russian Federation's energy sector is of global concern for climate change. It has a per capita footprint close to the average in OECD countries. The Russian Federation ratified the Kyoto Protocol in 2004, when its greenhouse gas emissions were 32 percent below 1990 levels, but this was due to the depth of the recession that accompanied transition. Compared with 1990 levels, there has been considerable progress. Yet the country remains an energy intensive economy, because of the partial nature of economic reforms. Many inefficient state enterprises have been dismantled, but economic recovery has been driven by energy-intensive sectors, such as minerals and natural gas. Furthermore, the natural gas sector has inefficiencies (leaks, inefficient compressors and inefficient flaring of gas), accounting for losses of about 18% of production.

Transition countries can potentially show beneficial outcomes in climate change mitigation and energy reform, but seeing those outcomes will require creating new incentive structures through energy reform.

Arab States

Countries in the Middle East and North Africa are in a water stress environment. Climate change is projected to aggravate this situation, with deep losses in water availability and consequences for agricultural productivity. In the Middle East, nine out of fourteen countries already have average per capita water availability below the water scarcity threshold. In Lebanon, a 1.2° centigrade increase in temperature is projected to decrease water availability by 15 percent because of change in run-off patterns and evaporation.

In North Africa, a 1° centigrade increase in temperature could reduce water run-off in Morocco's Ouergha watershed by 10 percent by 2020, and in Syria, 1° centigrade increase in temperature is projected to cause a 50 percent decline in renewable water availability by 2025. In Lower Egypt, a one-metre rise in sea level could possibly displace six million people and flood 4,500 km² of farmland. This poses a serious threat to livelihood security and has a tendency to reverse progress in human development. Coastal flood defences will not save the livelihoods or the homes of millions of people living in the Nile deltas.

Generally, Arab states have a low carbon footprint compare to countries such as the United States, China and other top ten emitting countries. However, within Arab states, carbon footprints are unevenly distributed. Saudi Arabia is the biggest emitter of carbon dioxide in the region. In 2004, its emissions totalled 308.2 Mt CO₂, up by around 21% compared to 1990 levels.

QUESTIONS AND ANSWERS

I. HUMAN DEVELOPMENT REPORT 2007/2008—GENERAL QUESTIONS

What sets this Report apart from other significant reports on climate change, such as the Stern Review and the Fourth Assessment Report by the Intergovernmental Panel on Climate Change (IPCC)?

The Human Development Report is an independent report commissioned by the United Nations Development Programme and focuses on the human development impacts of climate change. By contrast, the Stern Review studied economics and climate change, and the IPCC fourth assessment report provided the scientific consensus on the subject. This year's Human Development Report defines a sustainable carbon budget for the 21st century and establishes a sustainable emissions pathway that recognizes the 'common but differentiated responsibility' of countries. It builds on the scientific basis provided by the IPCC and draws on the economic analysis of the Stern Review. The Human Development Report uses a 2° centigrade rise in temperature, with 450 parts per million (ppm) CO₂equivalent (CO₂e), as a threshold for humanity; and rather than a 1% of annual world GDP cost, sets the cost at 1.6% of annual world GDP to address mitigation.

However, the report seeks to understand the implications of climate change on the opportunities the world has at present and its implications for the future of human development. In-house work done for the report on understanding how climate events impact on the poor is one of its distinctive features. For the past 50 years or more, we have witnessed more or less a linear progression and expansion of opportunities—and in the 10–20 years since 1990 we have seen even greater progress, partly due to efforts through the Millennium Development Goals. But the danger with climate change is that these positive trends and progress could stall and then reverse, leading to an unprecedented state of affairs. We could be on the brink of a climate change process that would be the catalyst for declines in health, education, employment and other factors related to human development.

The report also demonstrates and emphasizes the need to address adaptation in developing countries in the face of impending climate change. The report advocates human solidarity, collective action and social justice as the keys to meeting the challenges posed by climate change and as the pillars of international cooperation moving forward from the 13th Conference of Parties to the United Nations Framework Convention on Climate Change in Bali, Indonesia, in December 2007.

How do we know that the current warming is man-made and is not part of a greater natural ecological cycle?

There is already an overwhelming body of scientific evidence linking rising temperatures to increased atmospheric concentrations of carbon dioxide (CO₂) and other greenhouse gases (GHGs). While natural factors such as volcanic activity and solar intensity can explain much of the global temperature trend in the early 19th Century, they do not explain the rise since then. Sceptics used natural factors to support their views from the late 1980s, when the science indicated a higher degree of uncertainty on the matter. But

arguments attributing recent temperature changes to increases in the sun's output and cosmic rays have been rejected by the overwhelming majority of the world's scientists as the sun's output has declined in recent decades while temperatures on Earth have continued to rise. Temperatures in the past half-century have probably been the highest of any 50-year period in the past 1,300 years. The clear trend towards increasing global average temperatures is part of the evidence that natural changes alone do not account for global warming.

Climate change was identified as an international issue in 1988. Why is there a sudden sense of urgency?

Unlike other areas of international relations, every day that goes by without cutting back emissions threatens human development and causes irreversible damage to the environment. There is a limit to the amount of carbon dioxide that the Earth can absorb without creating dangerous climate change—and we are exceeding that limit. Moreover, the effects of emissions are cumulative. The expiry of the current commitment period of the Kyoto Protocol in 2012 provides a unique opportunity to develop a multilateral strategy that could redefine how we manage global ecological interdependence. International negotiations take time and the approaching Bali conference is the start of the next stage, an opportunity that cannot be wasted.

Why has there not been sufficient action on climate change thus far?

Initially action was delayed because of the uncertainty associated with climate science, which left a greater margin of doubt as to the causes of global warming. Uncertainty has been effectively eliminated by the IPCC's fourth assessment report that states evidence of climate change is "unequivocal". A major reason is that political cycles and carbon cycles are out of sync: politicians change every few years. By contrast, the effects of carbon emissions take decades to become apparent—and also last for decades. Although most governments are now recognizing that the evidence on climate change is unequivocal, they have yet to initiate decisive action to cut greenhouse gases by charting a new emissions pathway.

What must world leaders achieve at the Conference of the Parties (COP13) in Bali?

Immediate action is needed at the Conference of the Parties in Bali to be held from 3-14 December 2007. World leaders must agree on global targets—foremost reducing CO₂ emissions by at least 30% by 2020—and develop national strategies over the course of the next year to meet these targets.

II. HUMAN DEVELOPMENT REPORT 2007/2008—SPECIFIC QUESTIONS

A. The Human Costs

How will climate change impact human development?

Climate change presents a twin catastrophe:

- It is an immediate threat to human development, particularly for the poorest segments of society—the 2.6 billion people living on less than US\$2 a day—who

- are affected first and hardest. Climate change undermines the livelihoods of the poor, slowing progress towards the Millennium Development Goals.
- Climate change could lead to widespread ecological disaster which poses a threat to future generations worldwide by halting and reversing human development.

Why will climate change affect the poor the most?

People and countries vary in their resilience and capacity to manage the incremental risks associated with climate change because of pre-existing inequality in the world's economic and political systems. Concentrated in fragile ecological areas, drought-prone arid lands, flood-prone coastal areas, and in precarious urban slums, the poor are highly exposed to climate change risks and they lack the resources to manage those risks. In an already deeply divided world, climate change magnifies disparities between the rich and the poor. Among many current impacts on the poor:

- In the Horn of Africa, women have to walk further to find water in the dry season.
- In Kenya, children born in a drought year are 50% more likely to be malnourished.
- In Bangladesh and Viet Nam, small-scale farmers have to cope with losses caused by more intense storms, floods and sea surges.

What long-term human development reversals could occur?

Climate science predicts various environmental challenges with business-as-usual economic growth, population growth and technological/energy usage patterns (and associated CO₂ emissions). Five tipping points specifically threaten human development:

- Agricultural production and food security
 - Climate change will affect rainfall, temperature, and water availability for agriculture in vulnerable areas, particularly in sub-Saharan Africa, Latin American, and South Asia.
 - As a result, the additional number of people affected by malnutrition could rise to 600 million by 2080.
- Water stress and water insecurity
 - Changed run-off patterns and glacial melt will add to ecological stress, compromising flows of water for irrigation and human settlements in the process.
 - An additional 1.8 billion people could be living in a water scarce environment by 2080. Central Asia, Northern China, the Middle East, the Andean region, and the northern part of South Asia are particularly vulnerable to water scarcity.
- Rising sea levels and exposure to climate disasters
 - Sea levels could rise rapidly with accelerated ice sheet disintegration.
 - Global temperature increases of 3–4° centigrade could result in 330 million people being permanently or temporarily displaced through flooding, particularly in Bangladesh, Lower Egypt, Viet Nam, and in small island states in the Caribbean and Pacific.
- Collapse of ecosystems
 - All predicted species extinction rates accelerate beyond the 2° centigrade threshold.

- In particular, coral reef systems will suffer extensive ‘bleaching’ catalysing large losses of biodiversity and ecosystem services, adversely affecting hundreds of millions of people dependent upon fish for their livelihoods.
- Health impacts
 - The greatest health impacts of climate change will be felt by the poor because of high levels of poverty and the limited capacity of public health systems in developing countries to respond.
 - Major killer diseases could expand their coverage. An additional 220-400 million people could be exposed to malaria—a disease that already claims around 1 million lives annually.

B. Social Justice

Why must the current generation act on climate change?

Exposing future generations to potentially catastrophic risks is inconsistent with a commitment to core human values. The Universal Declaration on Human Rights establishes that “everyone has a right to life, liberty and personal security”—failure to act on climate change is an immediate violation of universal rights. Future generations will see our response to climate change as a measure of our ethical values, and leaving large sections of humanity even more marginalized would signify a disregard for social justice and equity between countries.

Climate change also challenges us to think in a profoundly different way about human interdependence. Whatever else divides us, humanity shares a single planet. The ties that bind the human community stretch across countries and generations. When people in an American city turn on the air-conditioning or in Europe drive their cars, their actions have consequences, linking them to rural communities in Bangladesh, farmers in Ethiopia and slum dwellers in Haiti. With these human connections come moral responsibilities, including responsibility to reflect upon—and change—energy policies that inflict harm on other people or future generations.

Who is responsible for climate change?

As the beneficiaries of energy production and consumption since the industrial revolution, today’s rich countries dominate the overall emissions account, responsible for 7 out of 10 tonnes of CO₂ emitted. While China may be about to overtake the United States as the world’s largest emitter of CO₂, per capita emissions in China are just one-fifth those of the US. Historically, the United Kingdom and the United States account for around 1,100 tonnes of CO₂ per capita. This compares with 66 tonnes per capita for China and 23 tonnes per capita for India. These historic emissions matter because cumulative past emissions drive today’s climate change.

Do we have to choose between ecological preservation and human development?

Human development and ecological preservation are part of the same process and as such do not represent contradictory ideas or policies. Development cannot be seen merely in terms of economic growth. Although economic and social development can have

destructive consequences for the environment, our challenge going forward is to identify and reverse this trend.

C. Carbon Budget

What is the limit on greenhouse gas stocks for a world committed to avoiding dangerous climate change?

Climate science identifies a 2° centigrade change in temperature from pre-industrial levels as the threshold beyond which dangerous climate change is likely to occur. The report projects that large-scale human development reversals would consequentially be unavoidable. Using simulations carried out at the Potsdam Institute for Climate Impact Research (PIKS), we estimate the lowest reasonable level of greenhouse gas stocks consistent with an approximately even chance of avoiding this threshold to be at around 450 parts per million (ppm) CO₂equivalent (CO₂e). In order to do this, the world must stay within a global carbon budget for the 21st century.

What is the carbon budget and how far beyond it are we?

The world's carbon budget for the 21st century amounts to 1,456 Gt (Gigatonnes) CO₂, or around 14.5 Gt CO₂ per year. Current emissions run at twice this level, and according to the IPCC, we could exhaust our entire 21st Century carbon budget as early as 2032.

If emissions were frozen at the current level of 29 Gt CO₂, we would need two planets in order absorb our emissions. If every person in the world had the same carbon footprint as the per capita average in high-income countries, we would require six planets.

How do developed and developing countries differ in their emissions?

With 15% of the world population, the carbon footprint of rich countries accounts for 50% of global greenhouse gas emissions and they use 90% of the carbon budget. The carbon footprint of the poorest 1 billion people on the planet is around 3 percent of the global footprint. The differences between developed and developing countries in emissions from fossil fuel burning are staggering:

- The UK (population 60 million) emits more CO₂ than Egypt, Nigeria, Pakistan, and Viet Nam combined (total population 472 million).
- With annual CO₂ emissions of 225 Mt, the 19 million people living in New York State have a higher carbon footprint than the 146 Mt CO₂ left by the 766 million people living in the 50 least developed countries.
- An average air-conditioning unit in Florida emits more CO₂ in a year than a person in Afghanistan or Cambodia does during their lifetime, and an average dishwasher in Europe emits as much CO₂ in a year as three Ethiopians do in their lifetimes.

D. Reducing Greenhouse Gas Emissions

How can we stay within a global carbon budget?

Expiry of the current commitment period of the Kyoto Protocol in 2012 provides an opportunity to develop a multilateral strategy that could mitigate climate change by

redefining how we manage global ecological interdependence. The priority is to define a sustainable carbon budget for the 21st Century, and to develop a strategy for budget implementation that recognizes the ‘common but differentiated responsibilities’ of countries. It should be emphasized that the 21st century carbon budget of 1,456 Gt CO₂ (around 14.5 Gt CO₂ per year) identified by the Report is a global one.

With this in mind, foremost, from a 1990 base-year, we need to agree on a global sustainable emissions pathway aimed at 50% reductions of greenhouse gases worldwide by 2050. High-income countries would have to target an emissions peak between 2012 and 2015, with *at least* 80% cuts by 2050. By 2020, high-income countries would need to have attained 30% reductions in emissions in order to make the later 80% target feasible.

Targets for developing countries would have large variations and depend on the capabilities of each, but major emitters in the developing world would continue economic growth and development, despite increasing emissions to 2020, but with 20% cuts by 2050. Prior to emissions the 2020 target for cuts in emissions, these major developing country emitters would need support from developed countries in the financing of technology transfer, to begin the move to a low-carbon economy, and in support to increase adaptation efforts. This would also serve as an incentive for all developing countries to eventually become party to a post-2012 multilateral agreement on climate change.

What can we do to achieve this?

The HDR 2007/2008 makes multiple recommendations for climate change mitigation:

- ♦ Set a national carbon budget in all developed countries with targets for reducing overall emissions from a 1990 reference year incorporated into national legislation.
- ♦ Put a price on carbon through taxation and cap-and-trade programmes consistent with national carbon budget goals.
- ♦ Create an enabling environment for renewable energy through ‘feed-in’ tariffs and market regulation, with a 20 percent target in renewable power generation by 2020.
- ♦ Reduce CO₂ emissions from transport through stronger fuel efficiency standards.
- ♦ Increase financing, incentives, and regulatory support for the development of breakthrough technologies, with a focus on carbon capture and storage (CCS).
- ♦ Agree on multilateral international cooperation to finance technology transfers to developing countries supporting a transition to low-carbon energy sources.

How does emissions trading confer environmental benefits?

Emission trading offers enormous potential to catalyse a phase-out of CO₂ emissions. It also allows countries to minimize the costs of mitigation efforts. How schemes are designed determine their impact on the environment. In the case of the world’s largest cap-and-trade scheme, the European Union Emissions Trading Scheme (EU ETS), governments need to do more to seize the opportunity to institutionalize deep emissions cuts. Most seriously, the scheme remains de-linked from the European Union’s own emissions reduction targets for 2020.

During Phase I of the scheme (2005-2007) permits were over-allocated with caps set above emission levels. This led to a collapse of the price of CO₂, stabilizing at below €1/t CO₂ (US\$1.3/t CO₂) in 2007. Against this backdrop, there is a strong case for empowering the European Commission to set and enforce more robust targets aligned with the European Union's 2020 emissions reduction goals. Another priority is to rapidly increase the share of permits that are auctioned in order to generate the incentives for efficiency gains and to finance wider environmental tax reforms.

What are some regulatory mechanisms governments could employ to avoid dangerous climate change?

Putting a price on carbon either through taxation or cap-and-trade schemes is a necessary condition for avoiding dangerous climate change. Currently, the price is simply too low to generate serious mitigation efforts. Economic modelling exercises suggest a carbon price in the range of US\$60–100/t CO₂ would be broadly consistent with the required mitigation efforts. Introduction of the tax would have to be carefully sequenced to direct long-term policy without disrupting markets.

But carbon pricing alone will not be sufficient to drive investments and change behaviour at the scale or speed required. Power generation, the residential sector, vehicle efficiency standards and research, development and deployment of low-carbon technologies are four key areas where further regulatory provisions are needed.

Does the Clean Development Mechanism impose the costs of carbon offsets on developing countries?

For many developing countries, the cheapest form of energy is coal or other high-emissions energy sources. For these countries, there is a real short-term trade-off in abating emissions—money spent to reduce carbon emissions is money that could be spent to provide education, better health and clean water, or intensified economic growth. Developed countries have an obligation to support achievement of reduction goals by agreeing to meet the incremental costs of new technologies and capacity building in developing countries. Buying carbon offsets is one way that this can be done, but the Clean Development Mechanism—the way through which this is achieved today—needs to be revisited.

Specifically, there are two related dangers that the European Union and other developed countries must address. The first is the danger of overuse. Opportunities for generating emission trading credits overseas should not totally displace mitigation within rich countries. If companies are able to meet their EU ETS obligations primarily by 'buying in' mitigation in developing countries while putting in place carbon-intensive investments at home, that is evidence for insufficiently ambitious targets. It is important that emission credits play only a supplementary role, as envisaged under the Kyoto Protocol. Moreover, far more stringent independent monitoring is required to ensure that carbon trading does not act to dilute real mitigation.

Who must act?

A successful multilateral framework will require the active participation of all major emitters—collective action is not a choice, it is an imperative. Yet the world’s richest countries need to shoulder the burden of historical responsibility: they have both the deepest carbon footprints and the technological and financial capabilities to show global leadership in the drive to a low-carbon future. Reductions in emissions in high-income countries would have a much greater impact on the global carbon footprint than those in developing countries. If everything else were equal, a 50 percent cut in CO₂ emissions in South Asia and sub-Saharan Africa would reduce global emissions by 4 percent. Similar reductions in high-income countries would reduce emissions by 20 percent.

What is the cost of mitigation?

It is estimated to be 1.6 percent of annual world GDP between now and 2030. This represents less than two-thirds of global military expenditure. The cost of mitigation also has to be evaluated against the enormous costs of inaction.

Can the world entirely avoid climate change if we act now?

The world is already committed to a certain degree of climate change. Even if we were to stop all emissions today, the benefits would not be seen until 2030. The reason: once emitted, CO₂ stays in the atmosphere for a long time and climate systems respond to changes in emissions slowly. As a result, there is a long time lag between today’s carbon mitigation and tomorrow’s climate outcomes. It is imperative to embark on a sustainable emissions pathway as soon as possible. By doing so we can alter the rate at which stocks of greenhouse gases accumulate in the future and hence reduce the long term impacts of climate change. Drawing an analogy with trade negotiations, delays in negotiations such as the current Doha round do not mean that negotiations will implode. In fact, despite the delay it is even possible that a decision could be taken next year without causing palpable problems. However, if there are delays in taking action on climate change, there will be very real consequences in the lives of many people, with negative effects on human development. Furthermore, carbon emissions are cumulative by nature and climate change is irreversible.

E. Protecting People from Unavoidable Climate Change**How do rich and poor countries differ in their ability to adapt to climate change?**

Rich countries and poor countries alike face the risks of climate change. They differ, however, in their vulnerability to these risks. What drives the difference between rich and poor countries is their capacity to adapt to the impacts of floods, hurricanes, droughts and other natural disasters resulting from climate change. Former Archbishop of Cape Town Desmond Tutu refers to this as ‘adaptation apartheid’. In the Netherlands, waterfront homes are being built to float on water, while in Viet Nam, adaptation to climate change is a matter of learning how to swim and float in water. Many vulnerable countries need assistance in improving their capacity to adapt. Through concerted international cooperation on adaptation aid the world can enhance resilience to climate risks and vulnerabilities.

What are the priority areas in assisting vulnerable countries with adaptation?

The priority areas are:

- *Climate-proofing development investment:* Existing infrastructure should be protected against the risks of climate change and donors should mainstream adaptation across their aid programmes.
- *Adapting poverty reduction programmes to climate change:* National poverty reduction programmes should be strengthened in ways that build resilience and reduce vulnerability. Social protection programmes represent a particularly cost-effective strategy that can help people cope with the risks of climate change while expanding opportunities for employment, nutrition and education.
- *Strengthening the disaster response system:* Disaster reduction investments through aid will deliver higher returns than post-disaster relief—every US\$1 invested in pre-disaster risk management in developing countries can prevent losses of US\$7. Disaster response should focus on ensuring that resources are mobilized swiftly to deal with climate-related emergencies and on financing the transition from relief to recovery.

What is the cost of adaptation?

Funding adaptation will cost at least US\$86 billion a year until 2015. To put this into perspective, total adaptation financing to date for developing countries has amounted to US\$26 million—this is equivalent to just one week’s worth of spending under the United Kingdom’s Flood Defence Programme. These expenditure priorities require re-evaluation.

How will adaptation be funded?

The major multilateral funds for adaptation should be unified into a single fund with simplified uptake procedures. A shift in emphasis towards programme-based adaptation is also necessary. Adaptation should be a fundamental aspect of national development strategies complementing, and not replacing, funds for other development priorities. Financing proposals for adaptation include:

- *Resource mobilization through carbon markets:* Mobilizing resources for adaptation through markets for mitigation offers two broad advantages: a predictable flow of finance and a link from the source of the problem to a partial solution. Market based initiatives would include carbon taxation and cap-and-trade schemes.
- *Wider levies:* Adaptation financing could be mobilized through a range of levies. Applying levies to carbon emissions, for instance, would have the twin benefit of generating revenues for adaptation while simultaneously improving the incentives to promote mitigation.
- *Financing linked to income:* A number of commentators have argued that adaptation commitments should be linked to developed country wealth. One proposal suggests that all Annex I Parties under the Kyoto Protocol set aside a fixed share of their GDP to finance adaptation. Another advocates the development of a formula for contributions to adaptation financing that links responsibility for carbon emissions with financing capabilities.

F. Deforestation

What role does deforestation play in contributing to climate change?

Deforestation releases sequestered carbon into the atmosphere as a result of burning and loss of biomass. It is estimated that around 6Gt CO₂ are released annually from deforestation. According to the IPCC, this accounts for about 11 to 28 percent of total emissions. If the world's rainforests were a country, deforestation would make that country the world's biggest contributor to CO₂ emissions. Taking into account only emissions from deforestation, Indonesia would rank as the third largest source of annual CO₂ emissions (2.3 Gt CO₂) and Brazil would rank fifth (1.1 Gt CO₂).

G. Energy

How do countries differ in access to energy?

Countries vary immensely in their access to energy. Inequalities in aggregate and per capita carbon footprints are related to wider inequalities in economic growth, industrial development, and access to modern energy services. Climate change and the curtailment of excessive fossil fuel use may be one of the greatest challenges of the 21st Century, but an equally urgent challenge is the expanded provision of affordable energy services to the world's poor. Living without electricity affects many dimensions of human development, and around 1.6 billion people in the world today lack access to such services.

The vast global inequality in access to basic energy services has to be considered alongside concerns over the rise in CO₂ emissions from developing countries. However, technology transfer from high-income to developing countries could contribute to ensuring that developing countries have increased access to energy without a corresponding increase in their carbon footprints.

Can nuclear energy provide an answer?

Nuclear energy is one low-carbon option—currently accounting for around 17% of the world's electricity generation. However, it raises some difficult questions for policymakers. While nuclear power offers a source of electricity with a near-zero carbon footprint and reduces dependence on imported fossil fuel, it raises concerns about safety, environmental repercussions, and the proliferation of nuclear weapons. These concerns are reflected in widespread public opposition to the expansion of nuclear energy. Consequentially, though it is likely to remain a part of overall energy supply, in terms of long-run climate mitigation nuclear energy is unlikely to play a prominent role.