



**DG INTERNAL POLICIES OF THE UNION**

**Policy Department Economic and Scientific Policy**

**Briefing note on climate change  
and its economic implications**

**IPOL/A/MISC/2006\_2**

**EP 373.568**

This study was requested by the Director General of DG External Policies  
Only published in English.

Author: Camilla Bursi  
Policy Department Economy and Science  
DG Internal Policies  
European Parliament  
Rue Wiertz 60 - ATR 00K072  
B-1047 Brussels  
Tel: +32 (0)2 283 22 33  
Fax: +32(0)2 284 69 29  
E-mail: [camilla.bursi@europarl.europa.eu](mailto:camilla.bursi@europarl.europa.eu)

Manuscript completed in April 2006.

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## 1. Global warming and impacts of climate change

- The earth's climate has been evolving continuously over millennia but the last two centuries have witnessed the development of global warming, which threatens to change the climate in an unprecedented manner.
- Global warming is created by the excessive accumulation of greenhouse gases (GHG) in the atmosphere. The main GHG are carbon dioxide (CO<sub>2</sub>), methane, nitrous oxide, ozone and chlorofluorocarbons (CFCs). Except for CFCs, the remaining gases occur naturally and make up less than 1% of the atmosphere.
- Naturally occurring GHG allow incoming ultraviolet solar radiation to pass through the atmosphere relatively unimpeded, but partially absorb and re-emit outgoing infrared terrestrial radiation. This natural process - the so-called greenhouse effect - raises the earth's average temperature from -18 °C to +15 °C, and is vital for life on earth.
- Since the industrial revolution, anthropogenic activities, such as energy generation from fossil fuels and deforestation activities, have been increasing the atmospheric concentrations of GHG beyond their natural levels, enhancing the greenhouse effect and causing an increase in global temperatures, a phenomenon known as global warming.
- Global warming can be amplified through positive feedback, such as increases in water vapour, or reduced through negative feedback, such as increases in stratospheric aerosols. The sum of all these potential changes is referred to as climate change.
- Measurement records suggest that the world has already warmed by 0.3 to 0.6 °C since 1860 and the last two decades have been the warmest. The global average surface temperature is projected to increase by 1.4 °C to 5.8 °C over the period 1990 to 2100<sup>1</sup>. Projected warming will be greater than that experienced over the last 10,000 years.
- Global mean sea level is expected to rise by 0.09 to 0.88 metres over the same period as a result of the thermal expansion of the oceans and the melting of glaciers and polar ice sheets.
- The rapid rate of change in temperature will leave ecosystems little time to adapt, making them more vulnerable to the phenomenon of climate change.

### 1.1. Impacts in Europe<sup>2</sup>

- Vulnerability to climate change in Europe differs substantially between sub-regions; it is particularly high in the south and in the European Arctic.
- Predicted sea level rises could impact up to 68 million people in the EU
- Increased precipitation is expected in northern Europe, more droughts are expected in the south. Flood hazard is likely to increase across much of Europe, except where snowmelt peak has been reduced. The water resource differences between northern and southern Europe is likely to widen.
- Soil properties will deteriorate under warmer and drier climate scenarios in southern Europe. The magnitude of this effect will vary markedly between geographic locations.
- Agricultural yields will increase for most crops as a result of increasing atmospheric CO<sub>2</sub> concentration. This effect would be counteracted by the risk of water shortage in southern and eastern Europe and by shortened growth durations in many grain crops as a result of increased temperatures. Northern Europe is likely to experience overall positive effects, whereas some agricultural production systems in southern Europe may be threatened.
- Changes in fisheries and aquaculture production include faunal shifts affecting freshwater and marine fish and shellfish biodiversity, aggravated by unsustainable exploitation levels.
- Natural ecosystems will change as a result of increasing temperatures and higher concentrations of CO<sub>2</sub>. Permafrost will decline, trees and shrubs will encroach northern tundra, and broad-leaved trees may encroach coniferous forests. In mountain regions, higher temperatures will lead to an upward shift of biological and ice-sheet zones and perturb the hydrological cycle. Loss of

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<sup>1</sup> IPCC - Third Assessment Report (2001)

<sup>2</sup> IPCC - Regional Impacts of Climate Change - 1997

important habitats (wetlands, tundra, etc.) could threaten some species including rare/endemic species.

- Timber harvest will increase in commercial forests in northern Europe, but reductions are likely in the Mediterranean, with increased drought and fire risk.
- Transport, energy, and other industries will face changing demand and market opportunities. Concentration of industries on the coast exposes these to rising sea-levels and extreme events, necessitating protection or removal.
- Recreational preferences are likely to change: outdoor activities will be stimulated in northern Europe, but heat waves are likely to reduce the traditional peak summer demand at Mediterranean holiday destinations, and less reliable snow conditions could impact adversely on winter tourism.
- A range of risks is posed for human health through increased exposure to heat episodes (exacerbated by air pollution in urban areas), extension of some vector-borne diseases and coastal and riverside flooding.
- In coastal areas, the risk of flooding, erosion and wetland loss will increase substantially—with implications for human settlement, industry, tourism, agriculture and coastal natural habitats. Southern Europe appears to be more vulnerable to these changes, although the North Sea coast already has high exposure to flooding.

### 1.2. Impacts in Temperate Asia<sup>1</sup>

- Temperate Asia lies between 18°N and the Arctic Circle, including the Japanese islands, the Korean peninsula, Mongolia, most parts of China, and Siberia in Russia
- Over the past century, the average annual temperature has increased by more than 1°C. Sub-regionally, there has been a 2-4°C temperature increase in eastern and northeaster parts and a 1-2°C temperature decrease in some parts of southeaster China.
- It is projected that there will be a warming of 2-3°C over the annual mean of the region, whilst at the same time CO<sub>2</sub> emissions will double.

Current predictions and estimations include:

- Large shifts in distribution and productivity of boreal forests, concentrated in the Russian Federation. Expansion of grassland and shrub lands and decrease of tundra up to 50%.
- Disappearance, by 2050, of up to a quarter of mountain glacier mass. Retreat or disappearance of the permafrost range.
- Potential water deficiencies in the northern part of China.
- Favourable impacts on agriculture in the northern areas of Siberia and northward shift of crop zones. 20% fall in grain production in southwest Siberia as a result of a more arid climate.
- In Japan, large areas are below mean high-water level. A 1m rise in mean sea level would engender costs of about 80 billion dollars to adapt existing protection measures. 57%-82% of sandy beaches would disappear with a 30-65 cm rise in sea levels.
- Increased frequency and severity of heat waves would cause an increase in mortality and illnesses. Heat-related deaths mainly - in urban populations - would increase.
- The economic centre of the country, North China including Beijing, Tinajin, Anhui province and inner Mongolia will be vulnerable due to: low level of water supplies; reduced soil moisture having an impact of current crop pattern and limiting the practice of cultivating two crops in succession; reduction in forests areas due to increase in demands for agriculture due to climate change and population increase; contamination of groundwater by seawater intrusion and necessary sea encroachment measures to protect population and economic activity

### 1.3. Impacts in Tropical Asia<sup>2</sup>

- Tropical Asia includes 16 countries (Bangladesh, Bhutan, Brunei Darussalam, Cambodia, India, Indonesia, Laos Malaysia, Myanmar, Nepal, Papua New Guinea, Philippines, Singapore, Sri Lanka, Thailand, Viet Nam) and 1.6 billion population, principally rural, projected to increase to 2.4 by 2025. It includes 6 of the 25 biggest cities in the world. Exploitation of natural resources

<sup>1</sup> Source : IPCC – Regional Impacts of Climate Change - 1997

<sup>2</sup> Source : IPCC – Regional Impacts of Climate Change - 1997

and rapid urbanisation, industrialisation and economic development has led to increase in pollution, land degradation and environmental problems.

- Over the past 100 years, temperatures have increased in the range of 0.3-0.8 °C. No trend in rainfall has been discernable and no change in the number and frequency of intensity of tropical cyclones.

Predictions and estimations include:

- Substantial shifts of ecosystems in mountains and uplands. Weedy species could replace tree species. Increase of tropical forest in Thailand from 45% to 80%. Increase in dry forest and decrease of wet forest in Sri Lanka.
- Sea level rise and increase in sea-surface temperature. Coral reefs could suffer bleaching.
- Accelerated recession of glaciers. A reduction in flow of snow fed rivers (decreasing in the long term) will have impact on hydropower generation, urban water supply and agriculture.
- Increase in production on rice, wheat, and sorghum yields associated with CO<sub>2</sub> fertilisation but will be more than offset by reductions in yield resulting from temperature and moisture change. The net effect is difficult to predict.
- Deltaic regions of Bangladesh, Myanmar, VietNam and Thailand, and low lying areas of Indonesia, Philippines and Malaysia are at risk from sea level rise, affecting major cities, ports and tourist resorts, fisheries, coastal agriculture. Displacement of millions of people is projected for a 1m rise in sea level. The costs of response measures could be immense.
- Malaria, schistosomiasis and dengue are likely to spread into new regions on the margins of endemic areas. The epidemic potential of malaria could increase of 12-27% for malaria and 31-47% for dengue. Waterborne diseases are expected to increase.

## 2. Political response

### 2.1. The United Nations Framework Convention on Climate Change (UNFCCC)

- The **UNFCCC**<sup>1</sup> aims at "stabilisation of CO<sub>2</sub> concentrations at a level that will prevent dangerous anthropogenic interference with the climate system, within a timeframe sufficient for allowing ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner."
- It was opened for signature at the Rio Earth summit in 1992 and came into force on 21 March 1994. Today 186 governments are Party to the Convention.
- The Convention requires precise and regularly updated inventories of GHG emissions from industrialised countries. With a few exceptions, the "base year" for tabulating GHG emissions has been set as 1990. Developing countries are also encouraged to carry out inventories. Parties agree to take climate change into account in agriculture, industry, energy, natural resources, and sea coasts activities, and to develop national programmes to slow climate change.
- The Convention places the heaviest burden for fighting climate change on industrialised nations, since they are the source of most past and current GHG emissions. They are called "Annex I" countries because they are listed in the first annex to the treaty belong to the Organisation for Economic Cooperation and Development (OECD).
- Annex I countries agree to support climate-change activities in developing countries by providing financial support above and beyond any financial assistance they already provide to these countries. A system of grants and loans has been set up and is managed by the Global Environment Facility (see "Bodies of the Convention and allied agencies"). Industrialised countries also agree to share technology with less-advanced nations.
- The last meeting of the Parties was held in Montreal in December 2005, during which a working group to discuss future commitments for developed countries for the period after 2012 was established and is due to start work in May 2006

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<sup>1</sup> <http://unfccc.int/2860.php>

## 2.2. The Kyoto Protocol

- Under the Kyoto Protocol to the UNFCCC concluded in 1997, contracting parties committed themselves to reducing the six GHG responsible for climate change: carbon dioxide (CO<sub>2</sub>), Methane, Nitrous Oxide, Hydrofluorcarbons, Perfluorcarbons and Sulphur Hexafluoride.
- To enter force the Protocol has to be ratified by 55 contracting parties, accounting for 55% of total CO<sub>2</sub> emissions in 1990. 162 countries have ratified it and it entered into force in February 2005.
- The Protocol commits Annex I Parties to individual, legally-binding targets to limit or reduce their GHG emissions. 35 countries and the EC are required to reduce GHG below levels specified in the Kyoto Protocol's Annex B, for a global cut in GHG emissions of at least 5% from 1990 levels in the commitment period 2008-2012.
- The Protocol created three cooperative mechanisms – Emissions Trading, Joint Implementation, and Clean Development Mechanism – allowing member countries flexibility in meeting their commitments with respect to reduction in emissions. The Clean Development Mechanism (CDM) allows developed countries to use certified emissions reduction credits from project activities in developing countries, and also assists developing countries in achieving sustainable development objectives.

## 2.3. Europe's Climate Change Policy

- The EU with 25 Member States is responsible for only 14% of global greenhouse emissions.
- Under the Kyoto Protocol's first commitment period, the EU committed to achieve an overall reduction of 8% of CO<sub>2</sub> emissions in the 2008-12 period, compared with 1990 levels.
- The European Climate Change Programme (ECCP)<sup>1</sup> was established in June 2000 to help identify the most environmentally and cost-effective measures to meet targets under the Kyoto Protocol. The EU has introduced a package of policy and legislative measures at the EU level and each Member states puts in place a series of domestic actions.
- In the EU energy intensity has decreased since 1990, renewables contribute to 6% of energy supply and are expected to grow significantly, agriculture land use is decreasing and forestry area is increasing, total GHG emissions in EU 25 has decreased by more than 5% from 1990 to 2003 while CO<sub>2</sub> emission rose by 1.3 % in the EU 15 in 2003 compared to 2002 due to a rise in coal use for electricity generation. More than 80 % of emissions come from the production and use of energy and from transport.
- With current measures, the EU is estimated to achieve an overall reduction of 4.1% by 2008-2012. More work is necessary to reach the targets, which could be met if Member States implement planned additional domestic measures and use flexible mechanisms.
- A second ECCP was launched in October 2005. It includes carbon capture and storage, passenger road transport, aviation and strategies to adapt to the effects of climate change.
- The first international GHG emission trading scheme came into operation in the EU in February 2005. The first phase covers the period between 2005 and 2007 and covers CO<sub>2</sub> emissions from large industrial and energy activities. These are estimated to account for 46% of the EU's CO<sub>2</sub> emission in 2010, and about 4,000 to 5,000 installations across the EU will be affected. The EC is considering an extension of the Directive to other GHG and other sectors such as aviation emissions.
- The EU emissions trading system is linked with the other Kyoto Flexible Mechanisms: Joint Implementation (JI) and the Clean Development Mechanisms (CDM). European companies are allowed to carry out emissions-curling projects around the world and convert the credits earned into emissions allowances under the EU emissions trading scheme. This increases the diversity of compliance options within the EU thereby leading to a reduction of compliance costs.
- Other measures include increasing the use of renewable energy sources, improving the fuel efficiency of new cars and the energy efficiency of buildings, reducing methane emissions from landfills and controlling fluorinated gases used in air conditioning.
- The EU is a significant donor in the field of development cooperation: 200 projects with total budget of 300 million € have been identified as having climate change relevant element. The EU is

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<sup>1</sup> <http://europa.eu.int/comm/environment/climat/eccp.htm>

helping countries to reduce GHG emissions, by assisting in the implementation of renewable energy sources and energy efficiency, providing financial support to programmes such as using solar energy to provide clean drinking water in the Sahel, improved energy efficiency and use of renewables in China, and strengthening institutional capacity on climate change in India.

#### 2.4. Asian Countries' Climate Change Policies

- Twelve out of thirteen Asian countries members of the ASEM are parties to the UNFCCC Convention. All ASEM countries are non-Annex I countries to the Convention except for Japan which has a binding commitment to reduce its emissions by 6% under the Kyoto Protocol.

Country	Signed UNFCCC	Ratified UNFCCC	Signed Kyoto	Ratified Kyoto	National Communication	Projects under CDM
Brunei	-	-	-	-	-	-
Cambodia	-	18 Dec 95	-	22 Aug 02	Yes	-
China	11 Jun 92	05 Jan 93	28 May 98	30 Aug 02	Yes	7
Indonesia	05 Jun 92	23 Aug 94	13 Jul 98	3 Dec 04	Yes	1
Japan	13 Jun 92	28 May 93	28 Apr 98	4 Jun 02	Yes	18
Laos	-	04 Jan 95	-	3 Feb 03	Yes	0
Malaysia	09 Jun 93	13 Jul 94	12 Mar 99	04 Sep 02	Yes	2
Myanmar	11 Jun 92	25 Nov 94	-	13 Aug 03	No	0
Philippines	12 Jun 92	02 Aug 94	15 Apr 98	21 Nov 03	Yes	0
Singapore	13 Jun 92	29 May 97		12 Apr 06	Yes	0
South Korea	11 Jun 92	05 Dec 94		27 Apr 05	Yes	3
Thailand	12 Jun 92	28 Dec 94	02 Feb 99	28 Aug 02	Yes	0
Vietnam	11 Jun 92	16 Nov 94	03 Dec 98	25 Sep 02	Yes	1

Source : Based on information from UNFCCC website

##### 2.4.1. China

- China is the world's second biggest emitter of GHG. As a developing country it is not yet required to reduce its emissions but China's leaders recognise that climate change will have mainly negative impacts on ecological environment and the social-economic system. It is estimated that up to the year 2030, the annual average temperatures in China will increase by 0.88 to 1.2°C.
- The average per capita energy consumption is 10-15% of the one of the USA, but with the current economy development total emissions are expected to overtake USA's by mid-century, offsetting any cuts made by the industrialised countries.
- China is the world's biggest coal producer and oil consumption has doubled in the last 20 years. Coal amounts to 67% of primary energy consumption and China's energy efficiency remains low. Due to restrictions of resources availability and market scale, China will in the long run continue to consume a huge amount of coal out of the future energy supply. Although no UN figures are available, analysts agree there is evidence to back up claims of a reduction in emissions during the late 1990s, largely due to increased efficiency and slower economic growth.
- Despite the relatively rapid economic development over the last 20 years, China's development remains modest with great regional imbalance and different urban and rural areas. Rural population accounts for about 60%; 29 million live with a per capita annual income of less than 77 US\$ and more than 20 million farmers in remote areas do not have access to power.
- On the basis of an estimation of the potential supply of agricultural products and food demand, the annual incremental costs for adaptation to climate change would be US\$0.8-3.48 billion, without adaptation, the annual agricultural loss due to global warming would be US\$1.37-79.98 billion from 2000 to 2050.<sup>1</sup>
- Financial losses due to the lack of water are estimated to reach 1300 million yuan, and up to 4400 million yuan in serious drought years in the Beijing-Tianjin-Tangshan area.<sup>2</sup>

<sup>1</sup> Erda L. 1996. "Agricultural vulnerability and adaptation to global warming in China," Water, Air, and Soil Pollution, Vol. 92, No. 1-2, pp. 63-73.

<sup>2</sup> Aiwen, Ying. 2000. "Impact of Global Climate Change on China's Water Resources," Environmental Monitoring and Assessment, Vol. 61, No. 1, March, 187-191



On the international and policy level:

- China is working with the international community and believes in the principle of “common but differentiated responsibilities”: developed countries should assume a leading role in emissions reduction and specify their emissions reduction objectives by the year of 2012, while developing countries should take a sustainable development route while expanding their economy and eradicating poverty.
- It is unclear whether China would ever agree to internationally imposed emissions restrictions.
- China stresses the significance of adaptability as an issue closely related to poverty eradication in developing countries and wishes to see more studies and actions in this field.
- China advocates technology development and transfer and international cooperation in the priority sectors of improving energy efficiency, developing renewable energy and nuclear power.
- China has completed the Initial National Information Announcement on Climate change and is developing the National Strategy in Dealing with Climate Change, which will act as guidance for policies and measures in future decades.
- China established a National Examination and Approval Council for CDM and projects have been formally approved.
- China developed an energy development strategy giving priority to energy conservation, adjusting energy structure, realising energy diversification, enhancing environmental protection, upgrading technology and encouraging innovation. In 2004, Beijing announced plans to generate 10% of its power from renewable sources by 2010 and conducted positive adjustment on policies concerning nuclear power development, and formulated plans to accelerate such development.

#### 2.4.2. *Japan*

- A major world economic power, Japan is a leading member of Kyoto and is committed to cutting emissions. It was responsible for 8.5% of emissions in 1990 and its support for the agreement has been critical in the absence of USA participation.
- Japan ratified the Kyoto Protocol in June 2002. It committed to reduce emissions by 6% from 1990 levels. 2002 figures showed total GHG emissions had risen 11% above the baseline figure.
- Japan recognises that its economy could benefit from the Kyoto agreement, as Japanese companies could capture markets for new, clean technology.

#### 2.4.3. *India*

- India figures among the top ten contributors to GHG emissions, but current gross emissions per capita are only 1/6 of the average per capita emissions of the rest of the world.
- India adheres to the UNFCCC since 10 June 1992 and ratified the treaty on 1 November 1993, acceding to the Kyoto Protocol on 26 August 2002.
- India is highly vulnerable to climate change as its economy is heavily reliant on climate-sensitive sectors such as agriculture and forestry, and its low-lying densely populated coastline is threatened by a potential rise in sea level.
- Emissions are estimated to have risen by more than 50% in the 1990s, although the country has only submitted emissions figures to the UN for one year, 1994.
- India has one of the largest renewable energy programmes in the world.
- A ‘Working Group on the FCCC’ has been established to deliberate upon measures and positions that should be taken regarding the various issues emerging out of the climate change negotiations. A separate group on the Kyoto mechanisms has also been constituted.
- India prepared its first national communication to the UNFCCC in 2004<sup>1</sup>

#### 2.4.4. *Asia-Pacific Partnership on Clean Development and Climate*<sup>2</sup>

- The US and five Asian nations (Australia, China, India, Japan, and Republic of Korea) have launched in 2005 the Asia-Pacific Partnership on Clean Development and Climate. Member

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<sup>1</sup> [www.natcomindia.org](http://www.natcomindia.org)

<sup>2</sup> US Department of State <http://www.state.gov/r/pa/scp/2006/60852.htm#members>

countries account for half of the world's population and of the world's economy and energy use. It builds on existing bilateral partnerships and multilateral climate change-related energy technology initiatives, such as the Carbon Sequestration Leadership Forum<sup>1</sup>, the International Partnership for the Hydrogen Economy<sup>2</sup>

- The Partnership focuses on voluntary practical measures taken in the Asia-Pacific region to create new investment opportunities, build local capacity, and remove barriers to the introduction of clean, more efficient technologies. The Partnership will help each country meet nationally designed strategies for improving economic and energy security, alleviating poverty, improving human health, reducing harmful air pollution, and reducing the growth of GHG emissions levels.
- The First Ministerial meeting took place in January 2006, where eight public-private sector Task Forces were established. In April 2006 Parties will meet to begin drafting a detailed action plan.
- The Partnership will be consistent with and contribute to efforts under the UNFCCC and will complement, but not replace, the Kyoto Protocol.

### **2.5. Post Kyoto**

- The EU wants international discussions on post-2012 action to start as soon as possible, and is working actively with its partners to prepare a new round of global negotiations.
- The EU believes that the global temperature rise should be limited to not more than 2 °C above the pre-industrial level, since the available evidence suggests that beyond this threshold severe impacts could increase markedly. To stay within this ceiling, emission reductions by industrialised countries should be on the order of 15–30 % below 1990 levels by 2020 and deeper cuts after that may need to be considered.

In March 2006, the EU Council reaffirmed those principles and its determination to address the climate change problem by supporting:

- A global carbon market and flexible mechanisms as a cost effective way to meet objectives and stimulate growth and the transfer of technologies processes and practices, which will reduce the impact of climate change.
- Kyoto's objectives and supplementary actions to the ECCP
- Dialogue and technical cooperation with other countries, such as the development of partnerships with notably India and China in the field of energy and climate
- Exploitation of synergies between security of energy supply and sustainable energy supply, innovation and emission reductions, to guarantee coherence between energy and climate change policy, on the domestic level but and international levels
- Provision of financial support for the functioning of flexible mechanisms of the Kyoto protocol
- Adaptation policy as complementary policy and notably the financing of the Fund for Adaptation to support projects and programmes in developing countries that are particularly vulnerable to the consequences of climate change.

### **3. Economic impacts of climate change**

According to the IPCC's conclusions of the Third Assessment Report<sup>3</sup>, the general economic impacts of climate change would be:

- Net economic losses in many developing countries, the higher the warming the greater the losses.
- A mixture of economic gains and losses in developed countries, and losses for larger temperature increases.
- Decreases in world gross domestic product (GDP) of a few percent and increasing net losses for larger increases in temperature.

In its Communication of February 2005 « Winning the Battle Against Global Climate Change »<sup>1</sup>, the European Commission states that:

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<sup>1</sup> <http://www.cslforum.org/>

<sup>2</sup> <http://www.iphe.net/>

<sup>3</sup> Climate Change 2001: Working Group II: Impacts, Adaptation and Vulnerability

- There is increasing scientific evidence that the benefits of limiting the global average temperature increase to 2 °C outweigh the costs of abatement policies.
- If temperatures continue to rise beyond 2 °C a more rapid and unexpected response of the climate becomes more likely and irreversible catastrophic events may occur.
- An analysis<sup>2</sup> of the costs and benefits shows that the costs of abatement policies and competitiveness effects can be minimised if all sectors and GHG are included in emissions reduction policies; participation in reducing emissions is broadened to include all major emitting countries; emissions trading and project based mechanisms are fully used and if synergies with other policies are fully exploited (e.g. Lisbon Strategy, energy security policy, continuing reform of the Common Agricultural Policy, cohesion policy, and air quality policies).

Although most of the studies agree with the IPCC's and the EC's assessment, some studies such as the recent one from the Economic Affairs Committee of the UK House of Lords<sup>3</sup> criticises the process and the economic approaches to the IPCC analysis and emphasise that possible positive aspects of climate change have been overlooked.

### 3.1. The benefits<sup>4</sup>

- Reducing GHG emissions generates benefits in the form of avoided damages from climate change. The potential benefits depend to a large degree on estimates of (i) the availability and costs of adaptation technologies and policies, and (ii) the sensitivity of the climate to rising concentrations of GHG in the atmosphere.
- According to the IPCC comprehensive, quantitative estimates of the benefits of stabilisation at various levels of atmospheric concentrations of GHG do not yet exist.
- Allowing for scientific and economic uncertainties, the IPCC Second Assessment Report concluded that a 2.5°C rise in global temperature could cost as much as 1.5 to 2.0 % of global GDP in terms of future damage, with significant regional variation.
- Over the past 20 years the insurance sector has seen more than a doubling of economic losses (measured in real terms), partly resulting from weather and climate-related events, though other factors such as land use changes increasing pressure on coastal areas and flood plains and more widespread insurance coverage, have also contributed to this increase.
- Many different effects of climate change have been studied in detail in recent years demonstrating that if climate change is not tackled economic damage will further increase as will the risk of irreversible damage.
- Impacts include rise in sea levels, pressure on freshwater resources, water supply and water quality, agriculture, energy use, human health as well as loss of productivity and bio-diversity and the increased likelihood of drought, flooding, storm damage and more extreme weather events. In the long run, as temperatures continue to rise, a more rapid or unexpected response of the climate becomes more likely or irreversible "catastrophic" events such as the shutdown of the Gulf Stream or the collapse of West- Antarctic Ice Sheet may occur.
- Not all regions and all economic sectors within the EU will be equally affected. For instance, the Mediterranean region will suffer most from ever greater pressure on water resources. Agriculture and forestry will be adversely affected by changes in weather patterns as will hydro-electricity production. As a consequence, considerable impacts on the competitiveness of different economic sectors in different regions can be expected.
- Avoiding climate change offers also co-benefits that may amount to a substantial proportion of mitigation costs. These co-benefits are significant and lead to lower emissions of other pollutants, lower pollution control costs and lower environmental impacts.

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<sup>1</sup> [EC Communication COM\(2005\)35](#) Winning the battle against global climate change

<sup>2</sup> [EC Staff Working Paper](#) Background paper to Communication COM(2005)35

<sup>3</sup> UK House of Lords - [Economics of Climate Change - Volume I Report](#)

<sup>4</sup> EC Communication COM (2005)35 - Annex II - The Benefits and Costs of Limiting Climate Change

### 3.2. The costs<sup>1</sup>

- The IPCC considered the costs of meeting various targets for atmospheric concentrations under various assumptions about GDP and emissions growth and based on conservative assumptions as regards technological progress with respect to abatement technologies. They found that, on average, over the period 1990 to 2100, world GDP growth would suffer a 0.003% per year decrease; the maximum reduction (to reach a very ambitious target in a high growth scenario) was 0.06% per year.
- Assuming the gradual participation of all countries in an international effort to address climate change and full international emissions trading, the study shows that reducing EU-25 emissions by about 1.5 % annually after 2012 would reduce GDP in 2025 by about 0.5% below the level it would reach in the absence of such a pro-active climate policy.
- Widespread international participation in lowering the cost of emission reductions is shown to be crucial. If the EU were to unilaterally reduce its emissions by a similar amount while the rest of the world did nothing, the costs could rise by a factor of three or more without the use of the flexible mechanisms of the Kyoto Protocol, with positive environmental effects being negligible.
- A less ambitious climate policy would come at abatement costs which would amount to only a quarter of the amount to be invested under the first scenario. However, such a policy could lead to global warming about 25 % above the level achieved in the first scenario, leading to additional costs of climate change. Given the huge risk of non-linear responses of the climate to higher GHG concentrations such a policy is unlikely to be consistent with limiting global average temperature increase to 2 °C above pre-industrial levels.
- Mitigation costs increase more than proportionally with the speed of adjustment, owing to investment cycles and the relatively long term payback from technology policies. For the EU-25, the costs in terms of GDP vary from 0.2 to 0.5% of GDP by 2025 depending on the adjustment path chosen in the short-term.
- In particular, account needs to be taken of the scope for technology policies to encourage the development and deployment of promising technologies that may emerge from 2030 onwards. International co-operation on technology should therefore become a complement to current policies even if one knows that technologies might not emerge as anticipated.
- Deeper cuts over shorter periods of time might not be compatible with long term investment cycles of costly infrastructure.

Commission studies show that the global costs of mitigation can be minimised under the following conditions:

- The inclusion of all sectors and GHG (especially non-CO<sub>2</sub> gases, bunker fuels, deforestation).
- The participation of all major emitting countries in an international effort to address climate change.
- The full and unrestricted use of emissions trading and the optimal use of other flexible measures, such as the CDM. Such schemes supplement emissions trading by allowing access to lower cost abatement opportunities. Commission estimates suggest that such schemes can reduce direct abatement costs by as much as two-thirds.
- The full exploitation of synergies with other important EU policy objectives, in particular the Lisbon strategy, the energy security policy, the sustainable development strategy, the continuing reform of the Common Agricultural Policy, and the thematic strategy on air quality.

#### 3.2.1. Cost estimates to implement the Kyoto protocol<sup>2</sup>

- The cost estimates for Annex B countries to implement the Kyoto Protocol vary between studies and regions, and depend strongly, upon the assumptions regarding the use of the Kyoto mechanisms and their interactions with domestic measures. The great majority of global studies reporting and comparing these costs use international energy-economic models.

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<sup>1</sup> EC Communication COM (2005)35 - Annex II - The Benefits and Costs of Limiting Climate Change

<sup>2</sup> Climate Change 2001 : Synthesis report (IPCC)

- Nine of these studies suggest the following GDP impacts: in the absence of emissions trade between Annex B countries, these studies show reductions in projected GDP-10 of about 0.2 to 2% in the year 2010 for different Annex II regions. With full emissions trading between Annex B countries, the estimated reductions in the year 2010 are between 0.1 and 1.1% of projected GDP. The global modelling studies reported above show national marginal costs to meet the Kyoto targets from about US\$20 up to US\$600 per t C without trading, and a range from about US\$15 up to US\$150 per tonne C with Annex B trading.
- For most economies-in-transition countries, GDP effects range from negligible to a several percent increase. However, for some economies-in-transition countries, implementing the Kyoto Protocol will have similar impact on GDP as for Annex II countries.
- At the time of these studies, most models did not include sinks, non-CO<sub>2</sub> GHG, the CDM, negative cost options, ancillary benefits, or targeted revenue recycling, the inclusion of which will reduce estimated costs. On the other hand, these models make assumptions which underestimate costs because they assume full use of emissions trading without transaction costs, both within and among Annex B countries, that mitigation responses would be perfectly efficient and that economies begin to adjust to the need to meet Kyoto targets between 1990 and 2000.

### **3.3. Sectorial impacts**

- Effects of mitigation policies on GDP show large differences between sectors, and within sectors.
- Fossil fuel-based energy and energy-intensive sectors (chemicals, iron and steel, building materials) industries, will face higher compliance costs
- Increased demand for energy from renewable sources (including biomass) and for electricity generated by nuclear energy is likely and producers of abatement equipment (energy-saving technologies, carbon storage) will benefit in relative terms
- This shift in the structure of the economy will require significant reallocation of capital and labour between sectors, while the presence of emissions trading will keep compliance costs as low as possible.

## **4. European Parliaments Position**

The European Parliament has played a leading and active role in the long discussion between Parliament, Commission and Council concerning the EU's policy on climate change and especially emissions trading. It also strongly supported the ambitious EU policy at international level.

In the context of the UNFCCC Conference of Parties (Montreal, December 2005), a resolution based on the own initiative report of Anders WIJKMAN (EPP-ED) on "Winning the battle against climate change" was adopted (450 votes in favour, 66 against and 143 abstentions). In the resolution, the EP stressed that the EU strategy on climate change mitigation should be based on:

- Building on key Kyoto elements (i.e. binding GHG emission targets, a global cap-and-trade system, and flexible mechanisms).
- Undertaking strong emissions reductions at home (starting with 20-30% domestic reductions by 2020).
- Adopting a proactive approach to engage other main actors, notably the US; developing a strategic partnership with countries like China, South Africa, Brazil and India to help them develop sustainable energy strategies.
- Vigorously promoting research and innovation for sustainable energy technologies.
- Removing 'perverse' incentives such as fossil fuel subsidies.
- Using legislation to stimulate greater energy efficiency.
- Encouraging citizens to become directly involved to a much greater extent in mitigation efforts, inter alia through the provision of detailed information about the carbon content of products and services.

The EP report calls for:

- A future regime based on common but differentiated responsibilities aiming at contraction and convergence, as well as on progressively greater emission reductions and the involvement of more countries in the reduction effort. A long-term goal should be to develop a global carbon market, based on cap and trade.
- The EU to develop a strategy to make Europe the most energy efficient economy in the world, by setting targets for annual reductions in energy intensity in the order of 2,5-3%.
- The abolition of perverse incentives for fossil fuels and the establishment of a positive incentive structure for the enhanced use of energy-efficient, low-carbon and carbon-free technologies
- Strong measures to reduce emissions from transport (contributing to 30% of the EUs CO<sub>2</sub> equivalent emission, of which about 85% is the share of road transport), including mandatory limits for CO<sub>2</sub> emissions from new vehicles of about 80-100 gm/km for new vehicles to be achieved through emission trading between car manufacturers. Severe reduction targets for the aviation sector, responsible for between 4% and 9% of all GHG emissions worldwide and increasing at an annual rate of 3%.
- Support the introduction of ecotaxes at Community level and adoption of the first European ecotax by 2009.
- Revision of the allocation methods in the current Greenhouse Gas Emission Trading Scheme (ETS) and revision of national emission quotas because of increased cross-border trade
- The creation of a new coherent political solution to improve the welfare of vulnerable populations in developing countries through a global strategy for development with appropriate economic support, based on the link between climate change, natural resource management, disaster prevention and poverty eradication.
- Assisting developing countries to adopt national energy strategies so as to minimise their dependence on imported fossil fuels, to promote technology leapfrogging, notably as regards renewable energy, in particular biomass

On 16 January 2006, the EP adopted a resolution on the Conference outcome:

- It welcomed the recognition that there needs to be a new commitment period for Annex I countries to the Kyoto Protocol after 2012, and that there should be no gap between the first and second commitment periods.
- It recalled two strategic objectives of limiting the average global temperature increase to 2°C above pre-industrialisation levels and undertaking strong emission reductions for developed countries of 30% by 2020 and of 60-80% by 2050.

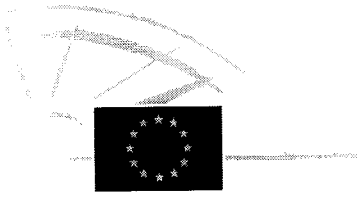
The resolution called for:

- Intensive review of the advantages and disadvantages of innovative approaches such as the concept of contraction and convergence, and the "sectorial pledge approach", whereby key developing countries would adopt voluntary GHG intensity targets for major industrial sectors and receive market and technology incentives to exceed these targets.
- A detailed exploration of the possibilities being opened up by new technologies, such as renewable energy technologies and carbon capture and storage.
- The adoption of a future international climate change regime by the rapidly industrialising developing countries, while respecting their economic development. Their reluctance to take on binding emission reduction targets at this stage was noted, but hopes were expressed that this would ultimately be possible.
- The adoption of ambitious policy of technology partnerships and transfers with developing countries.
- The EU to live up to their existing commitments, since the EU's leading position in international talks would be undermined if this is not achieved.
- The importance of an integrated EU approach to climate change policy, with sectorial policies on energy conservation and renewable energies, transport, agriculture, industry, research and development etc., complementing rather than contradicting each other and monitoring of these policies as regards their effects on climate change, and for measures to reduce these effects to the level committed to by the EU in the Kyoto Protocol.

- The diversification of EU's energy resources and a switch to alternative, more sustainable and environmentally friendly types of energy to reduce emission, dependency on external sources and vulnerability to energy supply crises.

*Camilla Bursi*  
Camilla Bursi  
Administrator

Annex: Information Sources



## Impacts of Climate Change and Economic Implications

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Provided by: Ulrich Hüsch

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## Introduction

There is a tremendous amount of scientific and political expertise on the economic impacts of climate change. The summary in Greenfacts below and the recent official publications (in particular SEC 2005/185) of the European Commission outline in a very concise way the state of the discussion of the negative or positive direct and indirect consequences (costs/benefits) of climate change.

A recent study commissioned by the UK House of Lords is of interest because it comes to the conclusion that "there are some positive aspects to global warming and these appear to have been played down in the IPCC reports". A 2006 US study concludes that "overall, the findings contradict the popular view that climate change will have substantial negative welfare consequences for the US agricultural sector."

On the other side, leading re-insurance companies like the MunichRe point at the increasing number of natural disasters (floods, hurricanes) which may have their cause in climate change. See also the the IEEP briefing for the Environment Committee on the linkage between climate change and natural disasters.

Nevertheless the IPCC reports 2001 and 1995 remain the starting point for all discussions. Other studies investigate climate change as an opportunity for technological innovation and sustainable development.

## Facts

European Commission - Environment fact sheet: Climate Change- August 2005

Greenfacts- Climate Change - What are the likely consequences of climate change?

Based on a few published estimates, global warming of up to a few degrees C would produce (from findings in IPCC 2001):

## European Commission

COMMISSION OF THE EUROPEAN COMMUNITIES Brussels, 08.02.2006 COM(2006) 40 final  
COMMUNICATION FROM THE COMMISSION FOURTH NATIONAL COMMUNICATION FROM THE EUROPEAN COMMUNITY UNDER THE UN FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC) {SEC(2006) 138}

COM(2005) 35 final COMMUNICATION FROM THE COMMISSION TO THE COUNCIL, THE EUROPEAN PARLIAMENT, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Winning the Battle Against Global Climate Change {SEC(2005) 180}

SEC(2005) 180 COMMISSION STAFF WORKING PAPER *Annex to the Communication*  
Winning the battle against global climate change" Background paper

Economic Evaluation of Quantitative Objectives for Climate Change (1999) This study identifies the least-cost packages of specific policies and measures for meeting the Community's quantitative reduction targets for greenhouse gases under the Kyoto Protocol. The study analyses separately carbon dioxide, methane and nitrous oxide emissions, and how the different sectors of the economy (i.e. power production, industry, tertiary-domestic, transport, waste sector and agriculture) could reduce the emissions. Potentials and costs of reduction of methane and nitrous oxide are assessed and the respective cost curves are derived. Energy related carbon dioxide emissions are analysed using the PRIMES energy systems model for EU Member States. The study also analyses the costs and emission reductions of an emissions trade in carbon dioxide for meeting the goals set in the Kyoto Protocol in a cost-effective way. The costs of different trading scenarios in carbon dioxide emissions are analysed using the POLES model, which models global long-term energy consumption.



## Other Think Tanks

### IEEP

Climate change and natural disasters: Scientific evidence of a possible relation between recent natural disasters and climate change Policy Brief for the EP Environment Committee (Jan 2006) As the devastating impact of recent natural disasters such as hurricane Katrina indicates, mankind is vulnerable to extreme weather events even in wealthy nations. Clearly such extreme events have always been part of life; however, with the likelihood of anthropogenic global climate change<sup>1</sup> being a phenomenon already underway, there is the prospect that 'acts of God' may in fact be getting a little help.

### MunichRE

Hurricanes – More intense, more frequent, more expensive Insurance in a time of changing risks (2006)  
"Munich Re has been analysing and documenting the effects of climate change for years. The publication "Topics Geo – Annual review: Natural catastrophes 2005" also confirms that although the insurance industry worldwide has managed to cope with the record losses of the past year, the ability to provide cover for natural hazards in the future will depend on the development of adequate insurance solutions for catastrophe scenarios that have hitherto been considered inconceivable – we have to think the unthinkable"

#### Topics Geo – Annual review: Natural catastrophes 2005

The year 2005 was marked by weather-related natural catastrophes. Roughly half of all the loss events recorded were windstorms, with costs to be borne by the world's economies exceeding US\$ 185bn. Munich Re has long been warning that increasing global warming will be accompanied by extraordinary weather related natural catastrophes and explaining why there is a likelihood of greater loss potentials. The company's fears were confirmed in 2005.

### HOUSE OF LORDS / Select Committee on Economic Affairs

The Economics of Climate Change 2nd Report of Session 2005-06 "The Committee, having considered various aspects of the economics of climate change, calls on the Government to give HM Treasury a more extensive role, both in examining the costs and benefits of climate change policy and presenting them to the United Kingdom public, and in the work of the Intergovernmental Panel on Climate Change (IPCC). We have some concerns about the objectivity of the IPCC process, with some of its emissions scenarios and summary documentation apparently influenced by political considerations. There are significant doubts about some aspects of the IPCC's emissions scenario exercise, in particular, the high emissions scenarios. The Government should press the IPCC to change their approach. There are some positive aspects to global warming and these appear to have been played down in the IPCC reports; the Government should press the IPCC to reflect in a more balanced way the costs and benefits of climate change."

### IPCC

#### Climate Change 2001: Impacts, Adaptation and Vulnerability

##### 2.4. Many Human Systems are Sensitive to Climate Change, and Some are Vulnerable

Projected adverse impacts based on models and other studies include: A general reduction in potential crop yields in most tropical and sub-tropical regions for most projected increases in temperature [4.2]. A general reduction, with some variation, in potential crop yields in most regions in mid-latitudes for increases in annual-average temperature of more than a few °C [4.2]. Decreased water availability for populations in many water-scarce regions, particularly in the sub-tropics [4.1]. An increase in the number of people exposed to vector-borne (e.g., malaria) and water-borne diseases (e.g., cholera), and an increase in heat stress mortality [4.7]. A widespread increase in the risk of flooding for many human settlements (tens of millions of inhabitants in settlements studied) from both increased heavy



precipitation events and sea-level rise [4.5]. Increased energy demand for space cooling due to higher summer temperatures. [4.5]

Projected beneficial impacts based on models and other studies include: Increased potential crop yields in some regions at mid-latitudes for increases in temperature of less than a few °C [4.2]. A potential increase in global timber supply from appropriately managed forests [4.3]. Increased water availability for populations in some water-scarce regions—for example, in parts of southeast Asia [4.1]. Reduced winter mortality in mid- and high-latitudes. Reduced energy demand for space heating due to higher winter temperatures. [4.5].

#### Economic and Social Dimensions of Climate Change (1995)

This report assesses a large part of the existing literature on the socioeconomics of climate change and identifies areas in which a consensus has emerged on key issues and areas where differences exist<sup>1</sup>. The chapters have been arranged so that they cover several key issues. First, frameworks for socioeconomic assessment of costs and benefits of action and inaction are described. Particular attention is given to the applicability of cost-benefit analysis, the incorporation of equity and social considerations, and consideration of intergenerational equity issues. Second, the economic and social benefits of limiting greenhouse gas emissions and enhancing sinks are reviewed. Third, the economic, social and environmental costs of mitigating greenhouse gas emissions are assessed. Next, generic mitigation and adaptation response options are reviewed, methods for assessing the costs and effectiveness of different response options are summarized, and integrated assessment techniques are discussed. Finally, the report provides an economic assessment of policy instruments to combat climate change.

**Dagoumas A. S. et al (2006) "An economic assessment of the Kyoto Protocol application", *Energy Policy* 34: 26-39**

Economic Implications of the Kyoto Protocol (16/03/06) A recent analysis of the economic implications of the Kyoto Protocol implementation revealed that the position of the United States of America influences the economic consequences of the Protocol more than any other factor or region considered.

**OLIVIER DESCHENES** *University of California, Santa Barbara, The College of Letters & Science, Department of Economics*, **MICHAEL GREENSTONE** , *Massachusetts Institute of Technology (MIT)*

The Economic Impacts of Climate Change: Evidence from Agricultural Profits and Random Fluctuations in Weather OLIVIER DESCHENES *University of California, Santa Barbara, The College of Letters & Science, Department of Economics*, MICHAEL GREENSTONE , *Massachusetts Institute of Technology (MIT)* January 2006 Overall, the findings contradict the popular view that climate change will have substantial negative welfare consequences for the US agricultural sector.

#### **DIW Deutsches Institut für Wirtschaftsforschung**

Impact Assessment of Emissions Stabilization Scenarios with and without Induced Technological Change. Kemfert, Claudia ; Truong, Truong P.2005 The main aim of this paper is to investigate quantitatively the economic impacts of emissions stabilization scenarios with and without the inclusion of induced technological change (ITC). Improved technological innovations are triggered by increased R&D expenditures that advance energy efficiencies. Model results show that induced technological changes due to increased investment in R&D reduce compliance costs. Although R&D expenditures compete with other investment expenditures, we find that increased R&D expenditures improve energy efficiency which substantially lowers abatement costs. Without the inclusion of induced technological change, emissions targets are primarily reached by declines in production, resulting in overall welfare reductions. With the inclusion of induced technological changes, emissions mitigations can result in fewer production and GDP drawbacks



## *World Resources Institute (WRI)*

Growing in the Greenhouse: Policies and Measures for Sustainable Development while Protecting the Climate Nov 2005 This report explores an approach to reconciling development and climate priorities, termed sustainable development policies and measures (SD-PAMs).

## *CEPS*

Industry Location and Climate Change: Policy-Making in the United States Thomas L. Brewer Nov 2005 Within the United States, the locations of carbonintensive industries have important implications for climate policy. This paper examines the statelevel and regional patterns in the distributions of key industries – coal, oil & gas and autos – and their implications for US climate policy-making. It concludes that the coal industry has a disproportionate impact on climate policy because of the distorting effect of the role of a few key coal states in national elections. The analysis is presented in the context of a ‘pluralistic political economy’ analytical model of the US economy and political system.

Technology in a Post-2012 Transatlantic Perspective Christian Egenhofer Nov 2005 The EU and the US have found themselves supporting two polar views on which strategy is the most effective in achieving stabilisation of greenhouse (GHG) emissions: ‘market pull’ vs ‘technology push’. As an advocate of the latter, the US asserts that the principal emphasis should be on technology development, financed through typical public R&D programmes. In supporting the ‘market-pull’ approach, the EU argues that technological change is an incremental process emanating primarily from business and industry, induced by government incentives. This paper argues that these two opposing positions can be explained by the respective political economies in the EU and the US but that changes are afoot that can improve the prospects for cooperation. In order to foster the convergence of views, additional conditions need to be fulfilled in both the EU and the US

## *International Energy Agency*

Deploying Climate-friendly Technologies through Collaboration with Developing Countries 2005 This paper investigates whether extending the geographic scope of OECD deployment investments to more promising locations in developing countries could increase the level of technology deployment, enhance learning, and ultimately accelerate technology cost reductions compared to an OECD-centred approach. This process would also increase developing country participation in climate-friendly technology development efforts and lower the risk of locking-in more CO<sub>2</sub> intensive energy technologies.

## *UNICE*

Competitiveness and EU Climate Change Policy Interim Report produced by COWI for UNICE October 2004 On 18 November 2004 UNICE published a study commissioned from COWI consultancy (Copenhagen) entitled ‘Competitiveness and EU climate change policy’, which illustrates the foreseeable economic effects of current EU climate policy. This study has been carried out in the long-term perspective of the March 2005 European summit, which will hold a discussion on the development of the EU’s long-term climate change strategy and on possible post-2012 targets. Summary

## *European Climate Forum (ECF) and the Potsdam Institute for Climate Impact Research (PIK)*

What is dangerous Climate Change? Dec 2004 A report launched today at the tenth UN Climate Conference in Buenos Aires (COP 10) highlights the dangerous consequences and risks for many regions, ecosystems and human cultures if global mean temperature is allowed to rise above 1.5-2°C over pre-industrial levels. The report published by the European Climate Forum (ECF) and the Potsdam Institute for Climate Impact Research (PIK) outlines the initial results of a major scientific Symposium on key regions and their vulnerability to climate change which was held in Beijing 27-30 October 2004 and attended by over sixty scientists, stakeholders and policy makers from more than 20 countries



## *Swedish Environment Institute*

Technology Partnerships for Renewables: Key to Energy Security Proceedings of the 3rd roundtable of the Asia-Europe Environment Forum Stockholm, Sweden, 26-28 August 2004 edited by Bertrand Fort and Francis X. Johnson. Asia-Europe Foundation (AEF); IGES; SEI; UNEP Copyright 2005, 272 pp. ISBN 981 05 4099 X.

Renewable energy cooperation between Europe and Asia is arguably one of the world's most significant axes of international cooperation in light of concerns over energy security, future economic competitiveness, and climate change. The EU has led the expanded deployment of renewable energy technologies, while Asia represents the main growth region for future energy consumption. Excellent business opportunities and policy co-ordination are emerging, and cooperation between Europe and Asia is a key factor in facilitating the renewable energy expansion in a way that is economically feasible, socially acceptable, and environmentally sustainable.

This volume is based on the results from the 3rd roundtable of the Asia-Europe Environment Forum, which was held in Stockholm, Sweden from 26-28 August 2004. Forty experts participated, including Internationally-respected authorities such as former Chairman of the World Summit on Sustainable Development (WSSD) Preparatory Council, Dr. Emil Salim of Indonesia, and Prof. Michael Grubb, Policy Director of The Carbon Trust of the United Kingdom (UK). The roundtable followed on the momentum that emerged from the International Conference for Renewable Energies that was held in Bonn, Germany on 1-4 June 2004.

## *Fondazione Eni Enrico Mattei*

### *Economic impact assessment of alternative climate policy strategies / Claudia Kemfert*

Milano, 2001 Nota di lavoro / Fondazione Eni Enrico Mattei ; 2001,86 : CLIM, Climate change modelling and policy This paper investigates the world economic implications of climate change policy strategies, especially the evaluation of impacts by an implementation of Clean Development Mechanisms, Joint Implementation and Emissions trading with a world integrated assessment model. Of special interest in this context are the welfare spill over and competitiveness effects that result from diverse climate policy strategies. In particular, this study elaborates and compares multi gas policy strategies and explores the impacts of the inclusion of sinks. Because of the recent decision of an isolated climate policy strategy by the United States of America, we examine the economic impacts of all world regions by a non cooperative and free rider position of the USA. It turns out that Clean Development Mechanisms and Joint Implementation show evidence of improvement in the economic development in the host countries and increase the share of new applied technologies. The decomposition of welfare effects demonstrates that the competitiveness effect including the spill over effects from trade have the strongest importance because of the intense trade relations between countries. Climatic effects have a significant impact within the next 50 years, cause considerable welfare losses to world regions and will intensify if some highly responsible nations like the USA do not reduce their emissions.

## **WWF**

### Kyoto Without the U.S.: Costs and Benefits of Ratifying the Kyoto Protocol (2001)

This paper shows that:

- if the European Union implements smart policy options, the costs to Europe of going ahead with the Kyoto Protocol without the US are limited;
- the majority of the implementation costs could well be compensated by the knock-on effect of climate change policies reducing investment that will otherwise be needed to achieve targets to reduce other pollutants that cause acidification;
- between 85 and 95 per cent of the EU's reduction target can be achieved without affecting the competitiveness of EU economies. Smart policies can offset the remaining effects on competitiveness.

