European Climate Platform (ECP)

An Initiative of Mistra's Climate Policy Research Programme (Clipore) and the Centre for European Policy Studies (CEPS)

FINANCIAL IMPACTS OF CLIMATE CHANGE: WHAT SCALE OF RESOURCES IS REQUIRED?

ARNO BEHRENS

ECP REPORT NO. 6
OCTOBER 2008

Presented at COP14/CMP4 in Poznań, at the Mistra/CEPS side event "The New Finance Architecture for post-2012", 4 December 2008 Venue: Grebe Room, 19:30 to 21:00

Originally prepared for the 5th European Climate Platform (ECP) seminar "The Financial Architecture for the post-2012 period", 30 September 2008. Text will be revised based on discussions in Poznań.

ISBN 978-92-9079-826-2

Available for free downloading from the CEPS bookshop (http://shop.ceps.eu)

Contents

Financial Impacts of Climate Change:
What scale of resources is required?

Arno Behrens

ECP Report No. 6/October 2008

Executive Summary

This paper summarises various estimates of the financial impacts of climate change. It differentiates between studies referring to incremental costs (UNFCCC, World Bank, Oxfam, UNDP, OIES) and those referring to costs expressed as a percentage of global economic output (Stern Review, UNDP, Vattenfall, European Commission, OECD, IPCC). Based on these studies, the paper presents the potential order of magnitude of costs to the EU27, as well as estimations of the role of the public sector in contributing to these costs. Finally, it identifies the gap between these estimated spending requirements and currently available finance and presents some proposals on how to close this financing gap.

The shows that financial cost estimates vary widely, depending - inter alia - on the emissions reduction target and the time horizon for action. However, with a certain level of generalisation, it may be concluded that global costs of combating climate change could range from 0.5% to 2.5% of global GDP by 2050. Data for the year 2006 suggests annual global costs of between €200 billion and up to €1 trillion. Reductions in real GDP growth would be very small and baseline levels of output in 2050 (i.e. the future level of GDP without climate action) would be reached only few months later than in the mitigation scenario.

Due to their economic capabilities and historic responsibilities for global warming, industrialised countries will need to take the lead in climate mitigation by bearing considerably higher shares of the global costs than developing countries. Depending on the methodology of allocating global costs to different countries, the EU27 may need to shoulder costs of more than €50 billion per year (up to almost €200 billion), of which between €7 and €17 may need to be financed by the public sector (€27-64 billion in the highest cost scenario).

Finally, the paper concludes that the ratio between existing and required resources to fight climate change could be anywhere between 1:10 and more than 1:100. The average of all cost estimates points to a ratio of around 1:50. Several proposals have been brought forward on how to close this financing gap, most of them within the ongoing negotiations in the 'Ad Hoc Working Group on Long-Term Cooperative Action under the Convention' (AWG-LCA) of the UNFCCC. These and other sources of money and delivery methods are briefly presented and will further be discussed in Background Paper No. 2.

The paper is work in progress and we hope to revise it after having received comments.

Financial Impacts of Climate Change: What Scale of Required Resources?

Arno Behrens*

ECP Report No. 6/October 2008

1. Introduction[1]

This paper deals with the key elements of the possible financial architecture for the post-2012 climate change regime. It identifies different estimations of the scale of finance required for mitigation, adaptation and technology (research, development, demonstration and deployment) and endeavours to bring more clarity to the vocabulary and methodologies used in the discussion on financial architectures. Furthermore, the paper assesses the role of the private sector investment, and introduces some thinking on what developing countries should finance domestically and what should be financed internationally. Finally, it gives an overview about the relevant discussions within the UN Framework Convention on Climate Change (UNFCCC), including some of the proposals for the design of a future financing architecture made by parties of the Convention. The paper is work in progress and we hope to revise it in the future, after having received comments.

2. How much? Estimating Global Financing Needs to Combat Climate Change

The growing importance of the financial implications of climate change is reflected in a growing amount of studies dedicated to the issue. International organisations such as the World Bank, European Commission, UNFCCC, IPCC and more recently UNDP and OECD have brought forward their own estimates. The topic was also covered by the Stern Review commissioned by the UK Treasury. Private sector contributions include estimates made by Vattenfall and Oxfam. All these studies differ in methodology and their selection of GHG reduction targets, base years and time horizons. Some deal with total costs, others with certain financial flows. Some of them estimate incremental costs in currency units, while others express their findings as a share of a future global GDP. This heterogeneity makes a comparison between different studies a rather difficult task. The numbers presented here shall thus only give an overall indication of the estimated magnitude of costs associated with global adaptation and mitigation efforts in response to climate change. They should be taken with extreme care, given the experience with similar cost estimates for other environmental challenges in the past.[2]

---

* Research Fellow, Centre for European Policy Studies.

[1] This paper is the third in a series devoted to the financial implications of climate change. The first one estimated the possible EU share in annual global costs of tackling climate change and assessed the implications for the EU budget (Behrens et al., 2008). The second paper dealt more specifically with the contribution of the European Commission to financing climate change mitigation and adaptation in developing countries (Behrens, forthcoming). This paper provides a synthesis of the former two and looks beyond the European Union to the global financial architecture required to deal with the estimated global costs of climate change.

[2] For example, McKinsey & Company (2008) note that costs for reducing chlorofluorocarbons (CFCs) in the early 1990s were significantly below earlier estimates. The same is true for the annual costs of reducing acid rain through the US SO2 cap-and-trade programme. While they argue that global carbon abatement is a task far more complex and large-scale then than CFC and US SO2 abatement, they stipulate that "the basic principle – that many of the factors that will reduce future costs are unforeseeable – likely still holds true".

2.1 UNFCCC estimates of incremental investment and financial flows

Perhaps the most comprehensive analysis of existing and potential investment and capital flows to address climate change has been published by the UNFCCC (UNFCCC, 2007a). The analysis does not deal with total cost estimates, but refers to an investment flow as "the initial (capital) spending for a physical asset" and to a financial flow as "an ongoing expenditure related to climate change mitigation or adaptation that does not involve investment in physical assets" (UNFCCC, 2007b). Examples of investment flows directed at mitigating climate change include investments by governments, corporations or households in renewable energy (e.g. wind power) and energy efficiency. Financial flows, on the other hand, largely refer to climate change funds established by the Convention and its Kyoto Protocol (e.g. Clean Development Mechanism).

The methodology of the UNFCCC analysis is based on a scenario analysis identifying additional investment in the year 2030 by comparing a reference with a mitigation scenario. It takes into account seven mitigation sectors (energy supply, industry, transport, buildings, waste, agriculture, forestry) and seven adaptation sectors (agriculture, forestry and fisheries (AFF), water supply, human health, natural ecosystems, coastal zones, infrastructure). But it should be noted that projections of future investment and financial flows are not available by source.

The analysis concludes that an additional €199-306 billion[3] ($248-381 billion) from private and public sources would be required in the year 2030 to return global GHG emissions to the level of 2004 (26 Gt CO_2). While this sum is substantive in terms of current funding under the UNFCCC and the Kyoto Protocol, it only represents 0.3-0.5% of estimated global GDP and 1.1-1.7% of estimated global investment in the year 2030. It includes about €161-169 billion ($200-210 billion) required for mitigation, with funds mainly flowing into the transport sector, buildings, industry and agriculture (see Table 1). Annual investment in the fossil fuel supply sector, on the other hand, is reduced by €54 billion ($67 billion) in 2030. This is not due to declining output but rather due to reduced growth in this sector in the mitigation scenario.

As for technology research, development, demonstration and deployment, the analysis stresses the importance of reducing the costs of key technologies - such as end-use efficiency, CCS, renewables, nuclear energy, large hydropower and biofuels - to meet the mitigation scenario. This would require "an ambitious and sustained increase in global funding for R&D of low GHG emitting technologies" (UNFCCC, 2007a). Government energy R&D budgets would need to double to about €16 billion ($20 billion) (see also Stern Review, 2006), while government support for deployment of low GHG emitting technologies (i.e. renewables, biofuels and nuclear energy) would need to double to about €48 billion ($60 billion) per year[4]. Additional investment and financial flows are thus estimated at €28-36 billion ($35-45 billion).

---

[3] Financial data originally quoted in 2005 USD was exchanged into EUR using the average 2005 USD/EUR exchange rate (1.2441). Source: Eurostat.

[4] According to the Stern Review (2006), some €26.5 billion ($33 billion) are spent globally each year on deploying low-carbon energy sources. Almost half of this amount (€12.9 billion/$16 billion) is spent on existing nuclear power plants, some €8 billion ($10 billion) on renewables and another €4.8 billion ($6 billion) on biofuels.

Table 1. Global additional investment and financial flows necessary in 2030 to return global GHG emissions to 26 Gt CO_2

Mitigation sector	**Additional investment (€bn /$bn)**	**Share needed in non-Annex 1 countries**	**Main driving forces**
TOTAL	*€161-169/ $200-210*	*46%*	*Transport, buildings, industry and agriculture.*
Energy supply	€-54/$-67	57%	Increasing investment for CCS in power plants, renewables, nuclear and hydro. Less investment in electricity transmission and distribution, production of fossil fuels and coal-fired generation.
Industry	€29/$36	54%	Energy efficiency improvements, installation of CCS infrastructure.
Transportation	€71/$88	40%	Hybrid vehicles and efficiency improvements. Only $9bn for biofuels.
Buildings	€41/$51	28%	Increased efficiency in appliances, space and water heating and cooling systems, and lighting.
Waste	€0.8/$1	65%	Capture of CH4 from landfills and wastewater for use in fuel or electricity production.
Agriculture	€28/$35	65% of non- CO_2 emissions reductions. No data available for agro-forestry.	Non-CO_2emissions reductions (rice cultivation, cropland practices and livestock management), removal by sinks through agroforestry.
Forestry	€17/$21	99%	Reduced deforestation, forest management.
Technology	€28-36/$35-45	Not available.	Technology R&D and deployment (see below).

Source: UNFCCC (2007b).

Table 2 summarises additional investment and financial flows needed for adaptation purposes in 2030. These may total at least €39-137 billion ($49-171 billion). This figure does not take into account some estimated €10-18 billion ($12-22 billion) for reducing harmful impacts of climate change on natural ecosystems, which would raise total investment and financial flows for adaptation to €49-155 billion ($61-193 billion). The large margin of the estimate is due to infrastructure adaptation cost estimates, which range from €6-104 billion ($8-130 billion) depending on assumptions about the share of infrastructure investments vulnerable to climate change in gross fixed capital formation, and the costs of climate-proofing these investments.

Due to limitations in estimating adaptation costs, the above figures should be treated as indicative only and may be understated, as they do not take account of some activities that may require additional finance to adapt to climate change. For example, infrastructure adaptation cost estimates only take into account the additional costs for climate-proofing new infrastructure, ignoring the costs associated with climate-proofing existing infrastructure. Also, estimates for the health sector do not include the possibility of new diseases spreading due to climate change. On the other hand, these estimates are based on fixed costs and do not take into account improved technologies and learning curves, which may reduce costs of adaptation. As an indicator for possible reductions of the costs for new technologies, IEA (2006) reports about a 15-19% cost reduction for each doubling of capacity of renewable energy sources (except wind).

Table 2. Global additional investment and financial flows needed for adaptation to the adverse effects of climate change.

Adaptation sector	Additional investment (bn EUR/bn USD)	Share needed in non-Annex 1 countries	Main driving forces
TOTAL	*€39-137/ $49-171*	*€23-54/$28-67*	*Infrastructure, AFF, water supply, coastal zones.*
Agriculture, Forestry and Fisheries (AFF)	€11/$14	51%	Purchase new capital, such as irrigation systems, equipment for new cops and fishing practices, and relocation of processing facilities.
Water supply	€9/$11	85%	Construction of additional infrastructure.
Human health	€4/$5	100%	Treatment of additional cases of diarrhoeal disease, malnutrition and malaria.
Coastal zones	€9/$11	50%	Protection against coastal storms and sea level rise.
Infrastructure	€6-104/ $8-130	33%	Modifications or changes in operations of infrastructure, building infrastructure to support activities that cope with climate-affected sectors or resources.

Source: UNFCCC (2007b).

Tables 1 and 2 indicate the share of investment and financial flows needed in developing countries (non-Annex 1 countries). They amount to €74-78 billion ($92-97 billion) for mitigation and at least another €23-54 billion ($28-67 billion) for adaptation in the year 2030. The most costly sectors for mitigation efforts will be transport, forestry, and industry. Funds for adaptation will mainly be focused on infrastructure, water supply, and agriculture, forestry and fishery (AFF). The magnitude of these financial transfers may be explained by the fact that developing countries will be especially vulnerable to the impacts of climate change while offering most of the cost effective opportunities for reducing emissions. For example, UNFCCC (2007b) estimates show that 68% of the projected global emissions reductions will occur in developing countries with only 46% of global mitigation investments and finance flowing to these countries.

The UNFCCC analysis does not differentiate between different sources of projected future investment and financial flows. The above figures thus refer to both private and government investments. However, the role of private investors is stressed as households and corporations contributed 86% to total global investments flows of €6,229 billion ($7,750 billion) in the year 2000. Similarly, most investments (60%) in physical assets were provided domestically, with only 22% provided through FDA, 18% though foreign debt and less than 1% through ODA. Applying the same figure, i.e. 86% being private investment, the total public share of expenditure would amount to €28-43 billion ($35-53 billion).

2.2 Other incremental costs studies

The World Bank published two studies in 2006 with estimations about the costs associated with climate change. Like in the UNFCCC analysis, the World Bank differentiated between costs for mitigating GHG and costs for adapting to the impacts of climate change (see table 3 for a summary). Within the World Bank context, reported costs refer to the incremental investment costs of achieving a lower carbon energy base that need to be mobilised on top of the baseline investment needs for clean energy (World Bank, 2006a). The first study estimates total annual costs at around €56-80 billion ($70-100 billion). Estimate for mitigation costs vary widely between less than €8 billion ($10 billion) to over €161 billion ($200 billion) per year, depending on the stabilisation target, the pathway to stabilisation, and the underlying pathways of developing countries. Costs of about €48 billion ($60 billion) per year were considered a central estimate for stabilising at 550 ppm CO_2e.[5] In a later World Bank study (2006b), estimated global incremental, upfront capital costs of decarbonising the power sector were revised downward to €32 billion ($40 billion) per year between 2006 and 2050, of which about 50% to 80% would need to be borne by non-OECD countries (up to €24 billion/$30 billion).

As regards adaptation, the first World Bank study (2006a) estimates incremental costs of climate-proofing development to lie in the range of €8-32 billion ($10-40 billion) annually, about a third of which would need to be covered by public finance. More specifically, these costs include a mix of developing information and tools to reduce uncertainties associated with climate change impacts, improving disaster preparedness, implementing existing technologies, and developing new technologies and planning systems.

In the second study on the costs of climate change, the World Bank (2006b) noted that "it is not possible to make an accurate direct calculation of the additional costs associated with adaptation", partly because they depend on the effectiveness of mitigation efforts and partly because of a lack of experience in mainstreaming adaptation into development projects. It only noted that climate-proofing development projects could increase their costs by an estimated 5-20%.

Despite the difficulty to put a price tag on adaptation efforts, a series of other estimates have been published (see table 3). Oxfam (2006), for example, criticised the above World Bank (2007a) figure on the grounds that it only accounted for ongoing activities and had thus left aside costs of climate-proofing the existing stock of natural and physical capital. Similarly, the World Bank (2007a) had not considered costs faced by 'community-level actors' (households, communities, local NGOs) for the vast majority of their adaptation needs. Taking these and other factors into consideration, Oxfam concluded that annual costs of adapting to climate change in developing countries are likely to top €40 billion ($50 billion), "and will be far more if greenhouse-gas emissions are not cut fast enough".

UNDP (2007), on the other hand, brought forward one of the highest estimates with annual financial requirements of €68 billion ($86 billion) by 2015. This figure is composed of €35 billion ($44 billion) for climate-proofing development investments and infrastructure, €32 billion ($40 billion) for adapting poverty reduction programmes to climate change, and another €1.6 billion ($2 billion) to increase climate-related disaster response in order to prevent the diversion of development aid. UNDP notes that this figure corresponds to 0.2% of GDP in 2015 and to one tenth of what developed countries mobilise for military expenditure.

On the other side of the spectrum is an estimate of the Oxford Institute for Energy Studies (Müller, 2008), which calculated adaptation costs in non-Annex 1 countries to be in the range of €1.6-14 billion ($2-17 billion). This is the lowest of all estimates, derived from (extrapolated) National Adaptation Programmes of Action (NAPAs).

---

[5] Referring to the concentration of greenhouse gases in the atmosphere, measured in parts per million of CO2-equivalents (ppm CO2e). Current concentrations of CO2 are at 379 ppm (IPCC, 2007). A stabilisation of atmospheric greenhouse gas concentrations at 500-550 ppm CO2e is in line with the EU's objective to limit global average temperature increases to less than 2ºC compared to pre-industrial levels (see European Commission, 2007). However, at a concentration of 550 ppm, the probability of breaching the 2ºC-threshold is still as high as 80%.

Table 3. Summary of World Bank and Oxfam estimates of the financial impacts of climate change

Target	Source	Estimated annual costs	Explanation
Mitigation	World Bank, 2006a	€8-161/$10-200 bn*	Depending on target, pathway and growth in developing countries.
	World Bank, 2006a	€48/$60 bn*	Stabilisation at 550 ppm CO_2.
	World Bank, 2006b	€32/$40 bn*	Annually between 2006 and 2050. 50-80% borne by non-OECD countries (up to €24 bn).
Adaptation	World Bank, 2006a	€8-32/$10-40 bn*	Climate proofing development. 1/3rd public finance.
	World Bank, 2006b	"Not possible to make accurate calculation".	Climate-proofing may increase costs of development projects by 5-20%.
	Oxfam, 2006	€40/$50 bn*	Current needs. Incl. climate-proofing of existing stock of natural and physical capital, as well as costs faced by 'community-level actors'.
	UNDP, 2007	€68/$86 bn**	Annually by 2015. Climate-proofing development investment (€35/$44 bn), adapting poverty reduction to climate change (€32/$40 bn), strengthening disaster response (€1.6/$2 bn).
	Müller, 2008 (OIES)	€1.6-14/$2-17 bn**	Current needs for non-Annex 1. Based on extrapolations of LDC National Adaptation Programmes of Action (NAPAs).

* 2005 USD ** 2006 USD

2.3 Estimates based on future levels of GDP

The following studies were published between 2006 and 2008, and focus on the global costs of combating climate change in terms of future global GDP levels. They cover different time horizons (2030 and 2050) as well as different stabilisation targets (450-550 ppm CO_2e). A general overview suggests that costs increase with the stringency of the target and with extended time horizons.

The Stern Review (2006) estimates the economy-wide costs of stabilising the concentration of GHG in the atmosphere at 450 ppm CO_2 (500-550 ppm CO_2e) at around 1% of national and world product, averaged across the next 50 to 100 years. This estimate is based on the assumption of global emissions trading (i.e. least-cost abatement), and means that annual GDP in the mitigation scenario would be 1% lower through time than in the baseline scenario (i.e. the hypothetical 'no climate change' baseline).[6] These costs stand in contrast to the costs of global warming which could decrease global GDP in the year 2050 by 0-3% (compared to baseline levels of GDP) at global warming of 2-3ºC, by 5-10% at global warming of 5-6ºC, and by around 20% in the worst-

[6] The following example may help to understand the long-term effect on output: If current GDP was subjected to an assumed annual rate of growth of 2.5% until the year 2100 under the baseline scenario, this rate of growth would be reduced to 2.49% annually in the mitigation scenario. The mitigation level of GDP in 2100 would then be 1% lower then in the baseline. The same result is achieved when applying the original annual growth rate of 2.5% to current GDP that has initially been reduced by 1%. Baseline levels of output in the year 2100 would be reached only four to five months later under the mitigation scenario.

case scenario. The Stern Review thus concludes that “mitigation - taking strong action to reduce emissions - must be viewed as an investment, a cost incurred now and in the coming few decades to avoid the risks of very severe consequences in the future”.[7]

The UNDP Human Development Report 2007/2008 has a more ambitions stabilisation target than the Stern Review. It suggests that the annual average costs of stabilising greenhouse gas concentrations in the atmosphere at 450 ppm CO_2e would be around 1.6% of global GDP between 2007 and 2030.

The Swedish energy company Vattenfall suggested that limiting the concentration of greenhouse gases to 450 ppm of CO_2 by 2030 may cost only around 0.6% of global GDP if all low-cost opportunities are addressed. The study (Vattenfall, 2007) emphasised the role of measures with negative costs, i.e. where investments are more than compensated in the long-run by a decrease in the costs for energy. Such measures mainly relate to increasing energy efficiency and fuel efficiency in the buildings and transport sector. About 70% of the total savings potential of 27 Gt CO_2e[8] is not dependent on the development on new technology. Vattenfall estimates that negative cost abatement potentials could contribute 35-45% to total abatement potentials in industrialised countries. On the other hand, developing countries (excluding China) are estimated to account for more than 40% of the climate-protection potential. The industrial and power sectors represent less than 45% of the global 2030 potential.

The most optimistic cost projections have been brought forward by the European Commission (2007a) and by OECD (2008). In its Communication ‘Limiting Global Climate Change to 2 degrees Celsius – The way ahead for 2020 and beyond’ and the related Impact Assessment, the Commission estimated investments in low carbon technologies to amount to annualised costs of less than 0.5% of global GDP by 2030. Stabilising long-term GHG concentrations at around 450 ppm CO_2e is thus projected to have only limited impact on annual GDP growth rates,[9] given that the most cost-effective emission reductions are realised within a global carbon trading system. The latter is of the utmost importance, as emissions trading is projected to reduce global costs by three quarters (European Commission, 2007b). The OECD (2008) presented similar cost estimates as the Commission – given the same stabilisation target and time horizon. When projected until 2050, cost estimates by OECD (2008) increase to 2.5% of GDP.

Finally, IPCC (2007) estimated global macro-economic costs of stabilising emissions at around 450 ppm CO_2 to be 0.6% of global GDP in the year 2030 and about 1.3% of GDP in the year 2050. These costs represent least-cost trajectories and have been found to increase with the stringency of the stabilisation target. In the case of the aforementioned targets, average annual GDP growth rates would be reduced by a mere 0.1%.

[7] In a more recent statement, Lord Stern of Brentford (Sir Nicholas Stern became Lord of Brentford in December 2007 when he was appointed to the UK House of Lords) pointed out that new research showed that emissions were growing faster than anticipated in the Stern Review and that the absorptive capacity of the planet was less than originally anticipated. He thus concluded that climate change posed a bigger threat than had been previously thought (The Guardian, 2008). As a consequence, the stabilisation target needed to be revised downwards (i.e. to less than 500 ppm CO2e) which would increase costs to about 2% of GDP.

[8] There seem to be some inconsistencies in the Vattenfall report regarding the difference between CO2 and CO2-equivalents. While the greenhouse gas savings potentials are quoted in units of CO2-equivalents, targeted concentration levels are quoted in units of CO2.

[9] The Commission estimates that costs of 0.5% of global GDP “would reduce global GDP growth by only 0.19% per year up to 2030, a fraction of the expected annual GDP growth rate of 2.8%”.

Table 4. Estimates of the costs of global climate change in terms of future GDP levels

Source	Estimated costs in terms of global GDP	Estimated costs in terms of 2006 global GDP*	Explanation
Stern Review, 2006	1%	€385/$484 billion**	Costs by 2050. Stabilisation target: 450 ppm CO_2 or 500-550 ppm CO2e.
Lord Stern, 2008	2%	€771/$968 billion	Costs by 2050. Stabilisation target: below 500 ppm CO_2e.
UNDP, 2007	1.6%	€617/$774 billion	Average annual costs between 2007 and 2030. Stabilisation target: 450 ppm CO_2e, halving global GHG emissions by 2050 relative to 1990 levels.
Vattenfall, 2007	0.6%	€231/$290 billion	Costs of limiting GHG concentrations to 450 ppm CO_2 by 2030. Focus on least-cost opportunities.
European Commission, 2007	0.5%	€193/$242 billion	Investment in a low-carbon economy over the period 2013-2030. Stabilisation target: 450 ppm CO_2e.
OECD, 2008	0.5% in 2030 2.5% in 2050	€193/$242 billion in 2030, €0.923/$1.21 trillion in 2050.	Reduction of GDP below Baseline estimates in 2030 and 2050. Stabilisation at 450 ppm CO_2e, reducing GHG emissions by 39% by 2050 relative to 2000 levels.
IPCC, 2007	0.6% in 2030 1.3% in 2050	€231/$290 billion in 2030, €501/$629 billion in 2050	Average macro-economic costs for multi-gas mitigation in 2030 and 2050. Stabilisation at 535-590 ppm CO_2e (440-485 ppm CO_2).

* 2006 global GDP at current prices was around €38.5 trillion ($48.4 trillion). Source: IMF (2008). Values in USD exchanged into EUR with the average 2006 USD/EUR exchange rate of 1.2556 (Source: Eurostat).

** While Stern (2006) estimates 1% global GDP to be around $350-400 billion, this study refers to global GDP data from the IMF to make estimations by different sources more comparable.

3. Bearing the costs – Who should pay?

Given the above cost estimates and different approximations of public and private shares in these costs, it is possible to calculate a range of potential financial contributions of different governments to the fight against climate change. Drawing on the global studies presented above and on Behrens et al. (2008), we focus on four different methodologies to estimate various governments' shares in global costs. The first two approaches are purely based on the Polluter-Pays Principle (PPP). This principle establishes that "the polluter should bear the expense of carrying out […] measures decided by public authorities to ensure that the environment is in an acceptable state" (OECD, 1972). In the case of climate change, this principle would require those countries with the highest greenhouse gas emissions to contribute most to alleviate negative effects associated with climate change. In a first step, we hence propose to establish the EU's share of contribution to global costs according to its current share in global greenhouse gas emissions. In the year 2004, the global economy emitted about 49 billion tonnes of greenhouse gases (measured in CO_2-equivalent) (IPCC, 2007). The EU27's share was about 5.2 billion tonnes (UNFCCC, 2008a) or 10.6%. It could thus be argued, that given its current level of greenhouse gas emissions, and *without* taking into account historical responsibilities related with past emissions, the EU should bear about 11% of global costs to combat climate change.

In a similar approach, global emissions are allocated to industrialised and developing countries using the politically agreed categorisation of the UNFCCC by differentiating between so-called Annex-I parties[10] and so-called Non-Annex-I parties.[11] Some Annex-I parties are required to provide financial resources to enable developing countries to undertake emissions reduction activities under the Convention and to help them adapt to adverse effects of climate change. Following this logic, the financial ability of industrialised countries and the demands of numerous political actors, we assume for simplicity that all costs may have to be borne by all Annex-I parties. A second estimate of EU financial requirements can thus be derived from the EU's share in absolute GHG emissions of Annex-I parties. With total greenhouse gas emissions of 18.2 billion tonnes in this category of countries and the EU27 contributing to this amount with 5.2 billion tonnes in 2004, the EU could be required to come up with about 28.6% of global costs to fight climate change and its impacts around the world.

Responsibilities based on emissions are relatively simple to calculate. However, they do not take into account historical emissions, which are considered to be necessary to determine a more accurate measurement of responsibilities. The other two methodologies are based on indices, taking into account historical greenhouse gas emissions as well as the capability of a country to contribute to the overall costs.

One is based on the "Adaptation Financing Index" (AFI) developed by Oxfam (2007). This index estimates the share a country should contribute to financing climate change adaptation in developing countries based on their historic responsibility for climate change and their capability to help. The responsibility of a country is determined by its historic CO_2 emissions between 1992 and 2003, the capability by its score on the UNDP Human Development Index (HDI)[12] in 2004. A country is only considered "capable" if its HDI score exceeded 0.9 (countries below that threshold are not taken into consideration for calculation of the AFI). In the Adaptation Financing Index, responsibility and capability are given equal weight. While originally the index only accounted for the costs adaptation, it is equally useful as an indicator for allocating total costs. According to the index, only 17 EU member states are considered both responsible and capable, including all of the EU15 and Cyprus and Slovenia. It is suggested that these countries bear 31.6% of the global costs.

A similar index has recently been brought forward by the Heinrich Böll Foundation and Christian Aid (Baer et al., 2007). It acknowledges one of the foundations of the UNFCCC that combating climate change requires an international response based on the participation of all countries in accordance with their "common but differentiated responsibility" (see also UNFCCC, 1992). The global costs of mitigation and adaptation are shared by applying a so-called "Responsibility and Capability Index" (RCI), based on cumulative per capita emissions data (1990-2005) as a proxy for responsibility, and national wealth and wealth disparity data as a proxy for capability. According to the RCI, the EU27 has a share of burden of 26.6%. The RCI allocates no burden to LDCs, but (contrary to the AFI) takes into account emerging middle-income economies (e.g. China, Russia, Brazil) with 21.1% of total costs.

---

[10] Industrialized countries that were members of the OECD in 1992, plus countries with economies in transition (the EIT Parties), including the Russian Federation, the Baltic States, and several Central and Eastern European states.

[11] Mostly developing countries, including China, India, Brazil, etc.

[12] The HDI is the normalized measure of life expectancy, literacy, education, standard of living, and GDP per capita for countries worldwide, on a scale of 0 to 1.

The following table summarizes the above results and compares the EU27 relative share of global financial requirements with those of the USA, Japan, Russia, China, India, Brazil and Mexico. Since developing or emerging economies are not included in Annex-1 of the Convention, and since their HDI is below 0.9, they would only need to contribute in two of the four cases described above.

Table 5. Estimated shares of EU27 and other countries in global climate costs, in %

in %	PPP Global (2004)	PPP Annex-I (2004)	AFI	RCI
EU27	10.6	28.6	31.6	26.6
USA	14.7	39.6	43.7	34.3
Japan	2.9	7.7	12.9	8.1
Russian Federation	4.3	11.5	n.a.	2.3
China	8.4 (1994)	n.a.	n.a.	7.0
India	2.4 (1994)	n.a.	n.a.	0.3
Brazil	1.4 (1994)	n.a.	n.a.	1.6
Mexico	1.0 (2002)	n.a.	n.a.	1.4

Note: Figures in this table represent percentages of global costs related to climate change to be shouldered by the EU27 and other main global players. PPP refers to the polluter-pays principle, under which a country's share is calculated on the basis of its share in global emissions (PPP Global) or its share in emissions of Annex-I parties only (PPP Annex-I). The Adaptation Financing Index (AFI) and the Responsibility and Capability Index (RCI) take into account historical GHS emissions as well as the capability of a country to contribute financially.

Table 5 shows that dividing the costs only over Annex-I countries or according to the AFI results in the EU bearing a higher percentage of costs than in the other cases, where developing and emerging economies are also held accountable for financing mitigation of and adaptation to climate change. However, it should be noted that China's share of global emissions is probably understated due to lack of more recent data. Estimates show that the Chinese share could be above 16% (see Fujiwara/Egenhofer, 2008), reducing other countries' shares accordingly.

Having derived the EU's share in these estimates, we can show how much funding the EU may have to raise, based on estimates of global costs that we have presented above and on the methodology to assign the costs to different countries. As shown above, global cost estimates vary considerably depending on the timeframe chosen (2030 or 2050).

Looking at cost estimates up until 2030, the lowest estimates of the above studies were brought forward by the European Commission (2007) and OECD (2008), with annual costs of around 0.5% of total gross world product. IPCC (2007) and Vattenfall (2007) presented slightly higher estimates at around 0.6% of world GDP. UNDP (2007) presented the highest estimate with 1.6% of global GDP. Table 6 shows estimated EU annual costs until 2030 for different scenarios (i.e. European Commission, OECD, IPCC, Vattenfall, UNFCCC and UNDP) and for different global cost allocation methods. The numbers are based on the 2006 global GDP of around €38.5 trillion ($48.4 trillion).[13]

[13] Source: IMF (2008). Values in USD exchanged into EUR with the average 2006 USD/EUR exchange rate of 1.2556 (Source: Eurostat).

Table 6. Estimated annual share of EU27 in global climate costs until 2030, in billion €[14]

In billion €	EC, OECD (0.5%)	IPCC, Vattenfall (0.6%)	UNFCCC (mean: €253/$315 bn)	UNDP (1.6%)
PPP Global	20	25	27	65
PPP Annex-I	55	66	72	176
AFI	61	73	80	195
RCI	51	62	67	164

Note: Figures in this table represent average annual costs until 2030 (in €) to be shouldered by the EU27. The large variation can be explained with different global cost estimates as well as different methodologies to assign a share of the global costs to the EU27. PPP refers to the polluter-pays principle, according to which the share of a country is calculated on the basis of its share in global emissions (PPP Global) or its share in emissions of Annex-I parties only (PPP Annex-I). The Adaptation Financing Index (AFI) and the Responsibility and Capability Index (RCI) take into account historical greenhouse gas emissions as well as the capability of a country to contribute financially.

When extending the timeframe to 2050, global costs and thus also the EU27 share in global costs are considerably higher. Table 7 shows estimated EU annual costs in 2050 for different scenarios (i.e. Stern, IPCC and OECD) and for different global cost allocation methods. Again, the numbers are based on the 2006 global GDP of around € 38.5 trillion ($ 48.4 trillion).[15]

Table 7. Estimated share of EU27 in global climate costs in 2050, in billion €[16]

	Stern (1%)	IPCC (1.3%)	Stern (2%)	OECD (2.5%)
PPP Global	41	53	82	102
PPP Annex-I	111	143	220	276
AFI	122	158	244	305
RCI	103	133	205	256

Note: Figures in this table represent average costs in 2050 (in €) to be shouldered by the EU27. The large variation can be explained by different global cost estimates as well as different methodologies to assign a share of the global costs to the EU27. PPP refers to the polluter-pays principle, in which a country's share is calculated on the basis of its share in global emissions (PPP Global) or its share in emissions of Annex-I parties only (PPP Annex-I). The Adaptation Financing Index (AFI) and the Responsibility and Capability Index (RCI) take into account historical GHG emissions as well as the capability of a country to contribute financially.

---

[14] For simplicity we assume that costs in terms of GDP refer to annual costs. However, this is not entirely correct, as some GDP cost estimates (OECD, IPCC, Vattenfall and UNFCCC) refer to a reduction of GDP below baseline estimates in 2030 (i.e. GDP in 2030 would be, for example, 0.5% below baseline estimates). When normalised across the whole time period between 2006 and 2030, a 0.5% reduction of global GDP in 2030 translates into annual costs of 0.31% of GDP (at an assumed global growth rate of 3.6%). A 0.6% reduction of GDP translates into annual costs of 0.35%. These annualised costs, however, do not take into account discount rates and have thus not been factored into the above calculations.

[15] Source: IMF (2008). Values in USD exchanged into EUR with the average 2006 USD/EUR exchange rate of 1.2556 (Source: Eurostat).

[16] Again we assume that costs in terms of GDP refer to annual costs. However, all studies dealing with 2050 estimates refer to a reduction of GDP below baseline estimates in 2050 (i.e. GDP in 2050 would be, for example, 1% below baseline estimates). When normalised across the whole time period between 2006 and 2050, a 1% reduction of global GDP in 2050 translates into annual costs of 0.63% of GDP (at an assumed global growth rate of 3.6%). A 1.3% reduction of GDP translates into annual costs of 0.85%. A 2% reduction of GDP translates into annual costs of 1.28%, and a 2.5% reduction of GDP in 2050 translates into annual costs of 1.56%. As mentioned before, these annualised costs do not take into account discount rates and have thus not been taken into account in the above calculations.

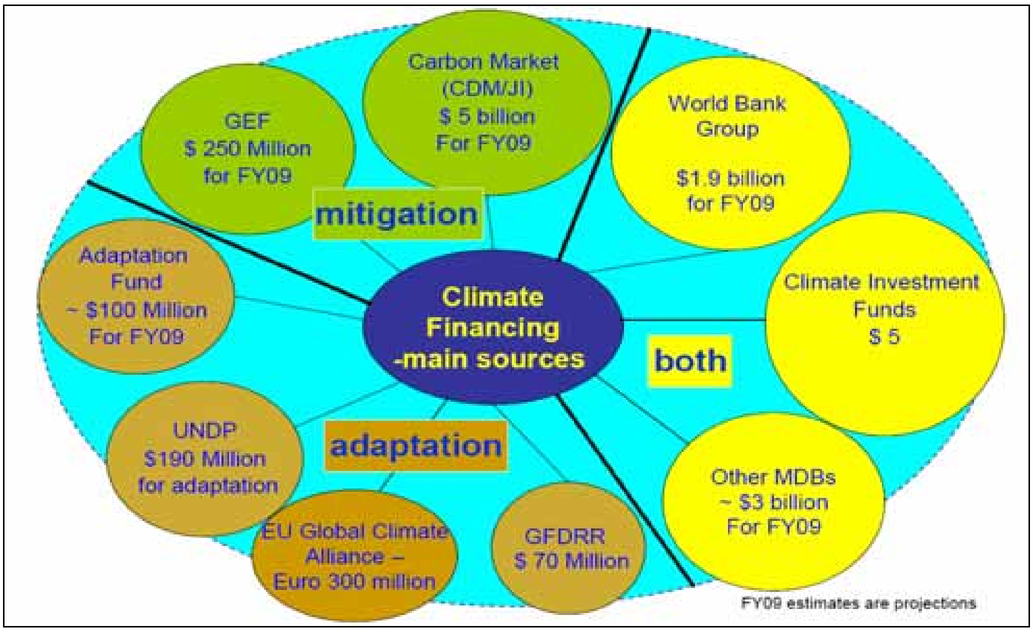
Between now and 2030, annual costs to be borne by the EU27 could range between €20 and €195 billion. More realistic estimates point to costs of more than €50 billion per year, due to the limited likelihood of a global burden sharing according to current emissions. In 2050, costs could be considerably higher, ranging from €41 and €305 billion. Again, it may be assumed that global burden sharing will not be realistic, increasing the minimum EU27 share in global costs to more than €100 billion.

Given estimations by UNFCCC (2007) and World Bank (2006a), it may be assumed that the share of public finance could be between 14% and one third. At an annual EU-wide share of €50 billion in 2030, governments of EU member states and the European Commission may need to contribute between €7 and €17 billion. In the highest case scenario in 2030, this contribution could increase to €27-64 billion.

4. Proposals to close the financing gap

There is a vast gap between current spending on climate change and estimated global costs. Figure 1 gives a summary of the main sources of current climate financing. Given that some of the sources indicated below will be spread over several years (e.g. EU Global Climate Change Alliance, Climate Investment Funds), it may be concluded that global climate financing will be around €6.6 billion/$10 billion[17] in 2009. This sum falls significantly short of the estimated financial requirements as stated above. In fact, the ratio between current and required spending is at least 1:10, somewhere close to 1:50 on average, and may be above 1:100 for the high-cost estimates.

Figure 1. Estimates of existing resources and financing instruments dedicated to climate change



Source: adapted from World Bank (2008). FY=Financial Year, CDM=Clean Development Mechanism, JI=Joint Implementation, GEF=Global Environment Facility, UNDP=United Nations Development Programme, GFDRR=Global Facility for Disaster Relief and Recovery, MDBs=Multilateral Development Banks.

[17] Financial data originally quoted in 2008 USD was exchanged into EUR using the forecasted average 2008 USD/EUR exchange rate (1.5208). Source: Eurostat.

Proposals to fill this financing gap are manifold. McKinsey & Company (2008) propose borrowing the necessary capital, e.g. from capital markets, "since the investment would benefit future generations". Indeed, they argue that this would not differ from financing projects of comparable magnitude in the past and refer to electrification, road- and railroad-building efforts in the early 20th century, which would not have gone forward without borrowing.

Behrens et al. (2008), on the other hand, argue that in the European case, most of the incremental costs to governments could be covered with auctioning revenues from the EU-ETS, which are estimated at more than €55 billion annually between 2013 and 2020 (at full auctioning, about €33 billion with auctioning only in the power sector) and up to €80 billion annually between 2021 and 2028 (at full auctioning). ETS revenues are currently set to be retained by member states, in order to be invested in emissions abatement and adaptation to climate change.

The UNFCCC plays a pivotal role in the discussions about a post-2012 financial architecture. The relevant body for negotiations is the so-called 'Ad Hoc Working Group on Long-Term Cooperative Action under the Convention' (AWG-LCA), which is in charge of implementing the Bali Action Plan. The outcomes of the negotiations are scheduled to be presented for adoption to COP15 in Copenhagen in December 2009.

Until September 2008, the AWG-LCA had met three times. At its first session, which took place in Bangkok, Thailand, from 31 March to 4 April 2008, the Working Group agreed on its work programme for 2008 and on organising workshops and other activities "to deepen understanding of and clarify elements contained in" the Bali Action Plan (UNFCCC, 2008b).

One of these workshops was held at the second session of the Working Group in Bonn, Germany, which took place from 2 to 12 June 2008. The workshop "Investment and financial flows to address climate change" dealt with the financial implications of climate change as laid out in chapter 2.1, followed by presentations of various Parties, including concrete proposals on how to increase global funding for mitigation and adaptation activities. The need for predictable and sustainable financial resources was agreed upon. Other proposed principles that should apply to the collection and disbursal of financial resources included equity, common but differentiated responsibility, the polluter-pays principle, adequacy, new and additional funding (i.e. additional to traditional ODA), grant funding, simplified access and priority access for the most vulnerable countries. Central to the discussion on the collection and disbursal of financial resources were governance issues such as accountability to the Conference of the Parties, balanced representation of all Parties, transparency and ease of access to the funding. Furthermore, several Parties noted that financial requirements for mitigation, adaptation and technology cooperation "could be met through funds under the Convention and market mechanisms while others can be met through enabling policies that influence private-sector investments" (UNFCCC, 2008b).

Specific proposals aimed at bridging the gap between current funding and estimated future financing needs were brought forward at the workshop by the Alliance of Small Island States (AOSIS), Mexico, China, Norway, Republic of Korea, Switzerland and India (see Box 1 for a summary of these proposals). Common to developing countries' concerns is the planned establishment of several funds outside the UNFCCC - in particular the World Bank. They argue that these funds should instead be placed under the authority and guidance of the Convention, and should be fully accountable to it. From a political point of view, this request makes sense for developing countries, as they hold the majority of the votes in the UNFCCC and would increase their influence over the use of available funds. In the IBRD, on the other hand, industrialised countries hold the majority of voting rights and thus control the use of resources.

Box 1. Summary of proposals brought forward at the second session of the AWG-LCA

- AOSIS proposed that a convention adaptation fund be established under the guidance and authority of the COP. AOSIS also proposed an insurance mechanism and a technology fund to fast-track development of renewable energy technologies;

- Mexico put forward a proposal for a World Climate Change Fund to finance mitigation, adaptation and technology transfer through financial contributions from developed and developing countries based on criteria such as emissions, population and GDP;

- China proposed scaling up funding from developed countries through a percentage of GDP (e.g. 0.5%) in addition to existing official development assistance to support an adaptation fund and a multilateral technology acquisition fund;

- Norway proposed that adaptation should be financed through auctioning a share of assigned emission allowances of Annex I Parties;

- Republic of Korea proposed a system similar to the CDM in which developing countries should earn credits for implementing nationally appropriate mitigation actions and that a market for such credits should be created by demand originating from deeper emission reductions commitments for Annex I Parties;

- Switzerland proposed a funding scheme based on common but differentiated responsibilities and the "polluter pays" principle. Resources generated by a global CO_2 levy of $2 per tonne (with an exemption for countries whose annual per capita emissions are less than 1.5 tonnes of CO_2) would flow into a multilateral fund for adaptation and insurance along with a national climate change fund;

- A new financing architecture proposed by India which consists of different financing streams to address specific requirements such as technology acquisition and a technology transfer fund, a venture capital fund for emerging technologies, and a collaborative climate research fund.

Other proposals included a levy on international air travel, extension of the share of proceeds to other mechanisms, a levy on bunker fuels etc.

Source: adapted from UNFCCC, 2008b.

In the third session of the WGA-LCA, which took place 21-27 August 2008 in Accra, Ghana, parties agreed to establish three contact groups, one of which deals with "delivering on technology and financing, including consideration of institutional arrangements" (see IISD, 2008). Several of the above proposals were presented in this working group alongside new proposals. The G77/China, for example, proposed a financial mechanism based on the principles of direct access to funding, new and additional resources, and predictability. The EU, on the other hand, stressed the role of existing mechanisms such as the CDM levy, as well as the importance of carbon markets and innovative financing instruments such as auctioning of allowances, levy on bunker fuels, etc. The EU further stressed the need for detailed proposals on a framework for technology transfer. While Brazil noted that funds should be raised in line with the 'polluter pays' principle and historical responsibilities (see AFI- and RCI-based methodologies above), Turkey commented on the provision of funds, which should based on the vulnerability of countries and their technological and financial capacity to address climate change (IISD, 2008). In general, it may be concluded that developing countries favour approaches that would require Annex-I parties to raise additional funding, while developed countries tend to focus on the role of the private sector in contributing to the financial requirements to combat climate change.

5. Conclusions

This paper summarised several estimations of the financial impacts of climate change. It showed that these estimates vary widely, depending on the targeted emissions reduction and the time horizon chosen. A comparison between the different estimates is not an easy task and subject to several levels of generalisation. However, if it is accepted that the resulting figures are merely an indication of future costs, albeit with a high degree of uncertainty, some useful conclusions can be drawn.

First, the global costs of combating climate change may be anywhere between 0.5% and 2.5% of global GDP by 2050. Based on the global GDP of 2006, this indicates annual global costs of between €200 billion and up to €1 trillion. As large as these numbers may sound, reductions of real GDP growth will be very small and baseline levels of output in 2050 (i.e. the future level of GDP without climate action) will be reached only few months later than in the mitigation scenario.

Second, industrialised countries will need to take the lead in climate mitigation. They will also need to shoulder considerably higher shares of the global costs than developing countries due to their economic capabilities and historic responsibilities for global warming. Depending on the methodology of allocating global costs to different countries, the EU27 may need to shoulder costs of more than €50 billion per year (up to almost €200 billion), of which between €7 and €17 may need to be financed by the public sector (€27-64 billion in the highest cost scenario).

Third, we tried to identify the gap between existing and required resources to fight climate change. The ratio between the two is anywhere between 1:10 to more than 1:100. The average of all cost estimates points to a ratio of around 1:50. Several proposals have been brought forward to close this financing gap. The 'Ad Hoc Working Group on Long-Term Cooperative Action under the Convention' (AWG-LCA) of the UNFCCC will deal with some of these proposals and will come up with recommendations for agreement at COP15 in Copenhagen in December 2009. These and other sources of money and delivery methods will further be discussed in Background Paper No. 2.

References

Baer, P., T. Athanasiou, S. Kartha, 2007, The Right to Development in a Carbon Constrained World – The Greenhouse Development Rights Framework, Heinrich Böll Foundation, Berlin

Behrens, A., forthcoming, Financial Impacts of Climate Change: An Overview of Climate Change related Actions in the European Commission's Development Cooperation, CEPS Working Document, CEPS, Brussels

Behrens, A., J. Núñez Ferrer, C. Egenhofer, 2008, Financial Impacts of Climate Change: Implications for the EU Budget, CEPS Working Document 300, CEPS, Brussels

European Commission, 2007a. Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions, Limiting Global Climate Change to 2 degrees Celsius – The way ahead for 2020 and beyond", COM(2007) 2 final, Brussels

European Commission, 2007b. Commission Staff Working Document accompanying European Commission (2007a), Impact Assessment, SEC(2007) 8, Brussels

European Council, 2007, Presidency Conclusions, Brussels, 8-9 March, Council Document 7224/1/07 REV 1, Brussels

Fujiwara, N., C. Egenhofer, 2008, Making the most of the G8+5 Climate Change Process – Accelerating Structural Change and Technology Diffusion on a Global Scale, Report of a CEPS Task Force, CEPS, Brussels

IEA, 2006, Energy Technologies Perspectives, OECD/IEA, Paris

IISD, 2008, Earth Negotiations Bulletin, Vol. 12 No. 380-383, 25-27, August 2008, International Institute for Sustainable Development, New York

IMF, 2008, World Economic and Financial Surveys, World Economic Outlook Database, April 2008 Edition, available at http://www.imf.org/external/pubs/ft/weo/2008/01/weodata/index.aspx as of 19 August 2008

IPCC, 2007, Climate Change 2007: Synthesis Report, IPCC, Geneva

McKinsey Global Institute, 2008, The carbon productivity challenge: Curbing climate change and sustaining economic growth, McKinsey Climate Change Special Initiative

Müller, B., 2008, International Adaptation Finance: The Need for an Innovative and Strategic Approach, Oxford Institute for Energy Studies, Oxford

OECD, 1972, 'Recommendation of the council on guiding principles concerning international economic aspects of environmental policies', Council Document No. C(72)128, OECD, Paris

OECD, 2008, 'OECD Environmental Outlook to 2030', Summary in English, OECD, Paris

Oxfam, 2007, Adapting to climate change – What's needed in poor countries, and who should pay, Oxfam Briefing Paper 104, Oxfam, Washington

Porter, G., Bird, N., Kaur, N., Peskett, L., 2008. New Finance for Climate Change and the Environment. WWF, Heinrich Boell Stiftung, Washington

Stern, N., 2006, The Stern Review on the Economics of Climate Change, Cambridge, Cambridge University Press

The Guardian, 2008, Cost of tackling global climate change has doubled, warns Stern. Pubished 26 June 2008. Available at http://www.guardian.co.uk/environment/2008/jun/26/climatechange.scienceofclimatechange as of 19 August 2008

UNDP, 2007, Human Development Report 2007/2008, UNDP, New York.

UNFCCC, 1992, United Nations Framework Convention on Climate Change, UN, New York

UNFCCC, 2008a, Greenhouse Gas Inventory Data, available at http://unfccc.int/ghg_data/ghg_data_unfccc/items/4146.php as of 29 August 2008

UNFCCC, 2008b, Report on the workshop on investment and financial flows to address climate change, Summary by the Chair of the Workshop, Ad hoc Working Group on Long-Term Cooperative Action Under the Convention, Second Session, UNFCCC, Bonn

UNFCCC, 2007a, Report on the analysis of existing and potential investment and financial flows relevant to the development of an effective and appropriate international response to climate change, Dialogue on long-term cooperative action to address climate change by enhancing implementation of the Convention, Dialogue working paper 8, UNFCCC. Bonn

UNFCCC, 2007b, Investment and Financial Flows to Address Climate Change, UNFCCC, Bonn

Vattenfall, 2007, Vattenfall's Global Climate Impact Abatement Map, available at www.vattenfall.com/climate as of 29 August 2008

World Bank, 2006a, "Clean Energy and Development: Towards an Investment Framework", Development Committee, World Bank, Washington

World Bank, 2006b, "An Investment Framework for Clean Energy and Development: A Progress Report", Development Committee, World Bank, Washington

World Bank, 2008, Towards a Strategic Framework on Climate Change and Development for the World Bank Group, Presentation by Michele de Nevers

Senior Manager, World Bank, Brussels, 29 May 2008

ECP Steering Group

About the European Climate Platform (ECP)

The ECP is a joint initiative of the Climate Policy Research Programme (Clipore) of the Swedish Foundation for Strategic Environmental Research (Mistra) in Stockholm and the Centre for European Policy Studies (CEPS) in Brussels. Established in 2005, the ECP aims to facilitate interaction within the policy research community, mainly but not exclusively in Europe. Its working methods consist of bringing together a select number of policy-makers, negotiators and experts to vigorously debate key topics in the area of international climate change policy and to widely disseminate its conclusions. The ECP actively seeks dialogue with policy-makers and other stakeholders while being dedicated to academic excellence, unqualified independence and policy relevance. The ECP is governed by a steering group, drawn from government and academia. For further information, see: http://www.ceps.eu/Article.php?article_id=484.

About the Climate Policy Research Programme (CLIPORE)

Clipore is an international research programme that aims to stimulate policy-oriented research that contributes to moving forward global efforts to combat climate change. A steady and integrated process of research and dialogue with stakeholders lies at the foundation of the Clipore programme: spawning, developing, sharing, scrutinizing and refining ideas. The programme is comprised of two large climate policy research projects, independent university positions and the Clipore Policy Forum. For more information see: http://www.clipore.org.

About the Centre for European Policy Studies (CEPS)

Situated in the nexus between academia, business and policy-making, CEPS performs a unique role as an independent analyst and critic of European policy. CEPS' core expertise is the conduct of policy research on European affairs including climate change and the broad dissemination of its findings through a regular flow of publications and events. (See: www.ceps.eu on CEPS in general and for a description of its energy, climate change and sustainable development programme: http://www.ceps.eu/Article.php?article_id=12).

Place du Congrès 1
1000 Brussels, Belgium
Tel: +32 (0)2-229 39 11
Fax : +32 (0)2-219 41 51
http://www.ceps.eu

Torslunda
179 96 Svartsjö, Sweden
Tel: +46 (0)8-560 40850
Fax: +46 (0)8-560 40851
http://www.clipore.org