Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development

English - Or. English

GENERAL SECRETARIAT

SG/SD/RT(2008)3
Unclassified

Round Table on Sustainable Development

DISCUSSION PAPER

WHAT ROLE FOR PUBLIC FINANCE IN INTERNATIONAL CLIMATE CHANGE MITIGATION

Richard Doornbosch and Eric Knight

This paper was prepared under the authority of the Chair of the Round Table on Sustainable Development at the OECD. The opinions expressed and arguments employed herein do not necessarily reflect the official views of the OECD or of the governments of its Member countries.

Eric Knight is a DPhil candidate at the Oxford University Centre for the Environment.

For further information, please contact Richard Doornbosch, Principal Advisor
Round Table on Sustainable Development, OECD Tel: +33 (0)1 45 24 14 57
E-mail: Richard.DOORNBOSCH@oecd.org

English - Or. English

ACKNOWLEDGEMENTS

This paper was written under the supervision Simon Upton and benefited greatly from his comments and suggestions. The authors would like to thank Preety Bhandary (UNFCCC), Jamie Brown (SEFI Public Finance Alliance, Jan Corfee-Morlot, Michael Grubb (University of Cambridge), Benito Müller (Oxford University), Nelly Petkova (OECD) for their input and ideas. We are grateful to Preety Bhandary, Jan Corfee-Morlot, Katia Karousakis (OECD) and Tamara Levine (OECD) for suggestions and comments on a draft of the paper. Finally we would like to thank Amelia Smith for editing and formatting of the paper.

The Round Table on Sustainable Development gratefully acknowledges financial support for this paper by the McCall MacBain Foundation.

TABLE OF CONTENTS

1. Introduction

1. The *OECD Environmental Outlook to 2030* suggests that limiting the global mean temperature increase to less than 3 degrees Celsius could be achieved at a loss of only about 0.1 percentage point of GDP per year on average (OECD, 2008).

2. Market-based instruments are forecast to play a dominant role in any effective strategy that minimises economic costs and enables equitable burden sharing, but in addition to these instruments, climate change negotiators are eying international governmental transfers to support developing countries in their mitigation efforts and encourage technology transfer.

3. The Bali Action Plan states that mitigation actions by developing countries should be "supported and enabled by technology, financing and capacity building" (UNFCCC, 2007). An increasing number of international institutions, funds and mechanisms are being proposed and established to achieve this taxpayer-funded objective.

4. This paper considers how public finance in developed countries can best be used to support climate change mitigation in developing ones. It begins by describing the role of public finance in climate change mitigation in relation to other instruments. Next, market failures and barriers to mitigation technologies that could be overcome by public finance are analysed. Current initiatives and proposals to raise and deploy public money to support international climate change mitigation are then mapped and assessed. Finally, guidance on how public finance might play a role in the post-2012 climate architecture is proposed.

2. The role of public finance in perspective

5. Climate change policies are likely to have a significant impact on public finances. On the revenue side, pricing carbon through taxes or auctioning emission permits will initially increase public finances, though there will be a (political) need to recycle these revenues into lowering other taxes to neutralise the negative economic and purchasing power impacts. On the expenditure side, investments will be needed to enhance the climate resilience of the economy and its physical infrastructure. Spending will also be warranted to support mitigation and adaptation efforts.

6. Though there is not necessarily a linkage between climate-related revenue streams and expenditure to support adaptation and mitigation, some politicians find it hard to insist on their separation. Decisions about the distributional impact of taxes or permits on the one hand, and the extent to which the expenditure of public money is needed to supplement (or modify) their intended price signals on the other, are quite distinct matters that should be addressed separately if the best use of scarce resources is to be made.

2.1 Finding the right policy mix for climate change mitigation – what role for government spending

7. A consensus seems to be emerging on the key elements of a cost-effective policy response for curbing greenhouse gas emissions: 1) market-based instruments that put a price on carbon (such as cap-and-trade systems and/or carbon taxes); 2) policies that support innovation and accelerate technology development; and 3) regulations and standards to overcome market barriers (in particular to achieve energy efficiency). The forestry sector is distinct from other sectors and is often treated separately. Policies that address the forestry sector, including deforestation, could therefore be seen as a fourth plank.[1]

8. Pricing carbon is seen by most economists as the single most important prerequisite for moving to a low carbon economy.[2] A uniform and global carbon price would help cut emissions at low cost, as it would simultaneously provide incentives for fossil energy producers to reduce emissions intensity, for consumers to conserve and for renewable energy producers to expand production and to invest in knowledge to reduce their costs (Fisher and Newell, 2007). A predictable carbon price will be a powerful incentive to boost private sector investment in innovative low emission technologies, as businesses will see opportunities and a growing market for low emission technologies driving more investments in research and development.

9. However, it is argued that this will not be enough to deliver the portfolio of technologies needed to produce steep emission reductions at low costs in the limited time available. The private sector will under-invest in R&D because it will be unable to reap the full benefits of its investments due to knowledge spillovers and the prevailing uncertainty about the future price of carbon. In addition, the long time periods and lumpiness of investments are such that they are often difficult to finance, even in efficient capital markets. Examples include carbon capture and storage from fossil fuel fired power plants and the development of a new generation of nuclear power plants. These market failures justify public spending on the overall innovation system and on specific measures aimed at low emission technologies.

10. Other market failures and barriers will also limit the efficiency of price instruments. This is particularly true for achieving higher energy efficiency in household and industry, where information about emissions and abatement options is costly or incomplete. Standards may be necessary to cut emissions in such situations at relatively low costs (household electricity standards, building codes, etc).

11. Deforestation accounts for up to 20% of total greenhouse gas emissions (IPCC, 2007) and may provide relatively cheap abatement opportunities. The key is to make conserving forest as profitable as it is to harvest. Research commissioned and cited by the Stern Review suggests that the opportunity costs of preserving forest may be only around USD 5 per tonne of CO_2 avoided up to USD 30 per tonne of CO_2. Large uncertainties remain, however, as to how to design the instruments to ensure that (avoided) carbon emissions in the forestry sector are properly priced.

12. An investment perspective could help tease out the relative importance of these four policy planks and suggest from where the investments for them should come. The incremental investments needed to place the energy sector on an emissions path consistent with limiting global temperature increase to below 3^{o} C would require, according to the International Energy Agency, additional annual investments of USD 1,100 billion for the period 2010 through 2050 (IEA, 2008).

13. The lion's share of these additional investments should be induced by a higher price on carbon (via taxes, cap-and-trade or other market instruments), whereas incremental investments in early deployment of new technologies that are not yet commercial – notwithstanding a carbon price – will be on the order of USD 150 billion. Only the latter type of investments typically require public funding.

14. Research carried out for the Stern Review indicates that the opportunity cost of forest conservation in eight forest-rich countries responsible for 70% of emissions from land use could be around USD 5 billion annually, although costs would rise over time. In the 2008 'update' Stern refers to global estimates for the opportunity costs of halving deforestation in the range of USD 3-33 billion annually.

2.2 Establishing incentives through domestic policy

15. According to forecasts, more than three quarters of the global growth in CO_2 emissions in the first half of the 21^{st} century will be in developing countries (IEA, 2007; OECD, 2008). Reducing emissions in developed countries alone will not only be more expensive, but will also be largely insufficient. Even if

emissions in OECD countries were to be reduced to zero in 2050 this would deliver only up to 40% of the emission reductions needed against a business-as-usual trajectory to limit temperature increases to less than 3° C (IEA, 2008).

16. Over half of the incremental investments (and costs) of a cost-effective climate strategy will have to be made in developing countries. However, the location of emission reductions does not prejudge who should pay for them. In due course, a global trading system would be an efficient way for developed countries to carry a relatively greater share of the financial burden.

17. Both sides could win by accepting international targets and allowing for trading. The gains for developing countries will be that the emission reduction costs will be smaller than what they can earn selling permits on the international market and the co-benefits associated with those cuts. Developed countries will gain because emissions cuts will be achieved more cheaply than in the absence of trading and because carbon leakages to developing countries will be prevented (Frankel, 2007). The distribution of these relative benefits will of course depend on the formula agreed upon to allocate the emission permits (targets).

18. Until trust between countries is sufficient to engender confidence in an agreement on equitable allocation of emissions rights, other mechanisms could be used to compensate developing countries for some of their mitigation action. In this respect, the Clean Development Mechanism – in which developing countries earn carbon credits for emission reductions below a project baseline that can then be sold to offset emissions in developed countries – has proven valuable. Stern (2008) uses a simple arithmetic example to illustrate this point: "*if developed countries cut emissions by 20-40% over 1990 levels by 2020, and even if only 30% of this (2-3 Gt CO_2-e) was purchased from an international emissions trading scheme at prices of USD 0-25/t CO_2-e, this would generate* [North-South] *flows of USD 20-75 billion a year*". This does not require targets for developing countries but is dependent on a broadening of CDM and an improvement in its *modus operandi* to reduce its transaction costs.[3]

19. As set out above, a cost-effective climate change policy will not be built solely around the introduction of market instruments. Innovation policies and standards, codes and policies that remove market barriers will be needed to complement the introduction of price signals. These might require very costly programmes that cannot be 'earned back' via fuel savings and other co-benefits. Investments in early deployment of key technologies such as carbon capture and storage in developing countries will need to be around USD 5 billion, according to the International Energy Agency (2008). Some of these investments are likely to be justified through the co-benefits they provide, but certainly not all. There is therefore a key role for international public finance in supporting them.

20. To be effective, international efforts to support emission reductions should not simply be layered on top of existing but insufficient national policies. The effectiveness of international climate change mitigation policies will depend to a large extent on the policy context of individual countries.

21. An obvious and pervasive example of counterproductive policies is badly targeted energy subsidies.[4] Global subsidies to the power sector alone have been estimated to exceed USD 200 billion per year prior to 2003. Preliminary work by the Global Subsidies Initiative (2008) estimates the size of global energy subsidies for fossil fuels and estimates could be on the order of USD 600 billion in 2006. As energy subsidies are mainly used to shield consumers from price hikes, these subsidies will rise almost proportionally with increasing energy prices. Only very recently have some countries begun increasing consumer energy prices to reflect higher prices on world markets. Subsidies that are broad-based or even universal transfer income to the relatively well off rather than targeting the poor, whose incomes are much more sensitive to higher prices on basic commodities such as energy. As a result, prices are distorted and

favour fossil fuel (i.e. low efficiency, high emission) technologies. Large emission reductions could be achieved if such subsidies were removed (Table 1).

Table 1: Emission reductions to be achieved by removing energy subsidies

Country	Subsidy	Savings opportunity as % of projected fuel demand in 2020
China	Liquefied petroleum gas (LPG)/Kerosene	21%
India	LPG/Kerosene	21%
	Electricity	14%
Russia	Electricity	9%
	Natural gas	43%

Source: McKinsey Global Institute analysis

22. Another example of counterproductive national policies is trade restrictions that prevent the adoption of climate-friendly technologies. The US and Europe have high tariffs on ethanol. Several countries, including China and several in North Africa, have relatively high tariffs on solar water heaters (above 20%). In Europe, some countries demand additional, national certification for solar water heating and cooling equipment, even if companies have received certification from a respected, Europe-wide independent certifying body. More generally, maintaining technical regulations that differ from international norms and standards can pose a barrier (OECD, forthcoming).

23. Comparing the implied carbon costs of national policies and regulations for promoting renewable and more efficient energy shows large differences. When the OECD (2004) compared abatement costs of different measures to promote renewable energy across 20 countries in the period 2002 and 2004 it found very large differences (Table 2), signalling opportunities to improve their costs effectiveness.

Table 2: Abatement costs of measures promoting renewable sources of energy

	Biomass	Photovoltaic	Dams	Geothermic	Wind	Wind
	Euros per tonne of CO2					Extra cost, per cent
Austria	341	1 454		114	134	212
Belgium						
Wallonia	63		125		125	168
Flanders	79	79	79		79	107
Czech Republic	64	153				
Denmark	149				91	147
Finland	20				52	89
France	86	328	155		154	264
Corsica		656				
Germany	195	1 217	118	163	167	264
Greece					60	62
Hungary					147	
Ireland	62		74		32	36

Italy	200	200	200	200	200	183
Luxembourg	63	1 285	63		63	100
Netherlands	87	87	87		87	103
Portugal	58	938	83		112	113
Spain	84	910	75		65	69
Sweden	25	25	25		73	121
United Kingdom	117	117	117	117	117	165
United States	39				39	48

Note: The extra column gives the difference between the price at which wind-based electricity is bought and the average wholesale price of electricity, in percentage terms. Abatement costs are calculated with the assumption that the displayed energy source is natural gas burnt in combined cycle turbines, because such plants represent the most profitable choice for additional investment in base or semi-base power generation.

Source: OECD, 2004

24. It is clear that public finance cannot be a substitute for the use of market instruments or reverse national policies that give the wrong incentives. The private sector will have to take on the majority of investments in low carbon energy technologies, and government climate change policies should guide and leverage these investments in the right direction by providing the correct price signals. Though the instances in which public finance will play the leading role are limited, public finance can and should be an important catalyst for policy change and leveraging private finance.

2.3 Market failures and barriers along the innovation chain

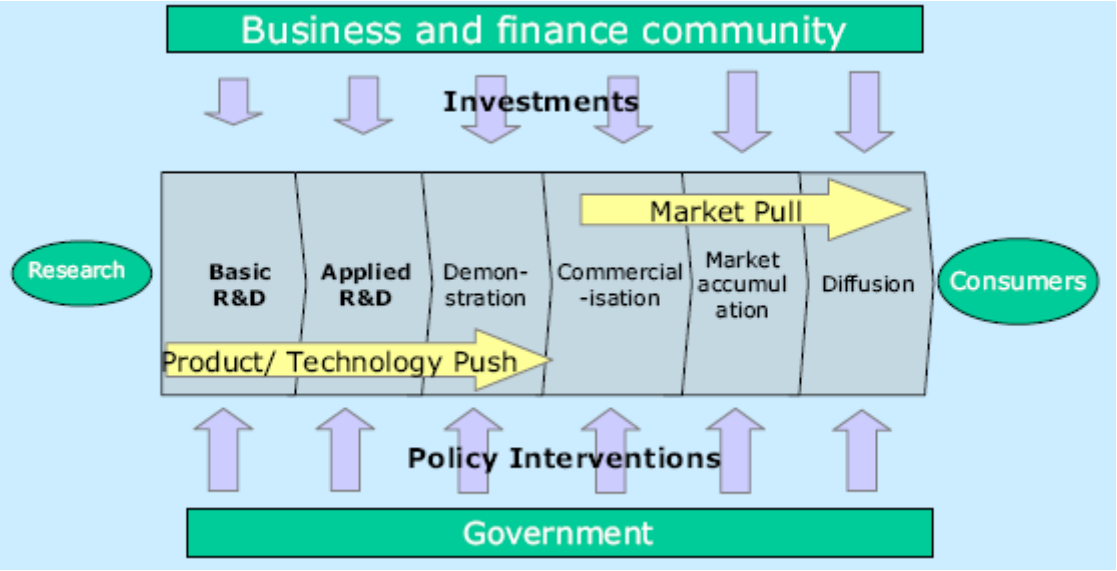
25. Achieving deep emission reductions relies on the development and deployment of new technologies across all sectors of the economy. The IPCC provides an overview of key mitigation technologies in energy supply, transport, buildings, industry, agriculture, forestry and waste management (IPCC, 2007). Many of these technologies are still under development or not (yet) commercially available on a wide scale. The question policy-makers around the world face is how to bring these technologies forward in time on a sufficient scale and at an acceptable cost.

26. Accelerating innovation requires well-designed policies and investments on the supply (technology push) and demand (market pull) side. Technology push policies focus on R&D programmes and demonstration projects of new technologies, whereas market pull is primarily a product of economic incentives through carbon pricing.

27. Over the past decade, government support has moved beyond the research, development and demonstration phase towards support for early deployment of new technologies. The driver for this development was the recognition that many seemingly promising technologies did not progress along the innovation chain towards commercialisation and diffusion. This has been called by Murphy and Edwards (2003) the 'valley of death'. The reasoning is that if public good and externality considerations are sufficient justification for government support in the R&D phase, it should also be rational for governments to ensure these investments have a chance of actually being deployed (Gallagher et al, 2006).

28. Figure 1 shows the main steps in the innovation chain from basic R&D to widespread diffusion of a technology, as first illustrated by Grubb (2004). Here the focus is on the early commercialisation and market accumulation phase, as this is the stage in which the role for public finance is most debated and has potentially the largest budgetary implications.

Figure 1. Main steps in the innovation chain



Source: Grubb (2004)

29. Policies aimed at the early deployment phase are complementary to economic incentives and will tend to lower the carbon price associated with a given level of emission reductions or increase the total reductions achieved by a given carbon tax. Newell (2007) provides an overview of the market failures that justify government intervention in this phase of the innovation chain.

30. First, consumers systematically undervalue energy efficiency or there is a split incentive between those who pay and those who receive the benefit (the so-called landlord-tenant problem).

31. Another important reason for governments to support early deployment comes from the knowledge spillovers. Production costs tend to fall with increased deployment as manufacturers and operators gain experience. This is true in many production processes, but in the electricity sector the early adopters cannot reap the full benefit of their investment or differentiate their products to demand a higher price from consumers (e.g. an electron is an electron). This contrasts with non-homogeneous products such as mobile phones, which some early adopters (consumers) are willing to buy at a premium price, thereby making it possible for the manufacturer to defray its investment costs earlier in the development process. The implication is that electricity companies will under-invest because of the spillover effects of collective learning.

32. Other examples of market failures that call for government intervention – and that might impact public finance – stem from information asymmetries in credit markets where new technologies have not yet established a track record and have difficulty finding investors, and incomplete insurance markets that make it difficult for the private sector to adequately cover liabilities (e.g. long term CO_2 storage).

33. Finally, the lock-in effect of high carbon technologies due to the lumpiness of infrastructure investments and risk aversion in the face of energy and carbon price uncertainty might justify government involvement. Delay of action could potentially prove very costly. Without early action, billions of dollars of conventional technology will be installed in buildings, infrastructure and power generation, casting a long emissions shadow over the future.

34. This can be illustrated by the rapid increase in the market share of coal-fired power plants in recent years. The IEA (2008) estimates that in the period through to 2030, USD 600 billion will be invested in replacing and expanding the capacity of coal-fired power stations around the world. To virtually decarbonise electricity supply as needed to avoid dangerous increases in emissions concentrations, this capacity must be retired early or large scale retrofitting with CCS will be needed. Early investment in developing new technologies might be a cost-effective way of avoiding this costly scenario.

How best to overcome the innovation market failures

35. National governments are struggling to find effective ways to stimulate innovation and overcome the 'valley of death'. A forthcoming OECD report on Environmental Policy, Technological Innovation and Patents uses patent data as one measure of innovation activities. It finds that, in addition to the important role of energy prices and public R&D spending, targeted support for renewable energy does induce innovation. Also, different support policies work better for some renewable technologies than for others depending on their characteristics. For instance, obligations and tradable certificates tend to induce innovation in wind power, probably due to the relative maturity of the technology. For other emerging technologies which are less competitive, such as concentrating solar power, investment incentives and guaranteed prices may be required to induce the necessary investments by minimising risks to private investors. Overall, only investment and other tax incentives had a wide influence on innovation across the range of renewable energy technologies examined.

36. An interesting initiative that attempts to improve the effectiveness of public and publicly backed sustainable energy financing initiatives by collaboration and exchange of best practices among practitioners is the UNEP Sustainable Energy Finance Initiative Public Finance Alliance.[5] Some early observations from its work are that effective financing mechanisms should fill an existing investment gap, increase private sector involvement and awareness and have the ability to be phased out over time, leaving a long term private sector financing solution in place. One key to improving project finance availability in all stages of technology development is risk management and transfer. Lenders and investors would be more willing to engage capital if more comprehensive insurance coverage were available to the sector. Insurance and risk mitigation instruments could ensure government funding only pays for the non-commercial top (incremental costs) without crowding out private investments (UNEP/SEFI, 2005).

Barriers for project development – no one size fits all

37. There are a number of market barriers that prevent widespread diffusion of new technologies for which technical and commercial feasibility have been proven. These barriers tend to be highly specific to the sector, technology and country concerned. It is beyond the scope of this paper to discuss these barriers in detail[6], though five categories of barriers stand out: barriers to commercial viability, macro-economic barriers, imperfect capital markets, barriers related to market structure and lack of absorption capacity.

38. The most significant barrier is the incremental cost of clean technologies. This is best addressed by implementing market instruments, but will require initial investments in capacity building to ensure that markets can work. Investments in a system of measurement, monitoring and enforcement must be made. In developing countries a credible validation and verification system will have to be put in place that meets the requirements of the UNFCCC.

39. As long as negotiations on a post-Kyoto architecture continue, carbon market participants are unlikely to invest in emission reduction projects that expire after 2012. Ensuring continuity in the market might imply setting up a funding mechanism by governments willing to invest in post-2012 carbon credits. Direct and indirect energy subsidies, as mentioned earlier, are also a huge obstacle to the economic viability of low emissions technologies.

40. In several developing countries important limits to investment persist, as described in the World Bank's annual *Doing Business* reports. Restrictions on foreign ownership will limit the scale of foreign direct investments. The same holds for unstable political regimes that will increase sovereign risk and scare off private investors.

41. Barriers to clean energy technologies also stem from imperfect capital markets in developing countries. The high up-front capital costs – and therefore long-term financing requirements – for nuclear power, for example, are often difficult for private investors to bear alone. On the opposite side, the small overall project size of some renewable and energy efficiency technologies create high transaction costs that make tailor-made projects too costly to finance.

42. In addition, local banking systems need to be made aware of existing opportunities. Multilateral funding is required to raise awareness of the opportunities and to develop a toolbox to be used by the offices that will validate and approve projects in host countries.

43. Non-economic barriers that are not exclusive to but appear to exist more widely in developing countries are: administrative hurdles, obstacles to grid access, poor electricity market design, lack of information and training, and the tackling of social acceptance issues. Here there is an opportunity for developing countries to learn from the regulatory mistakes made by developed ones.

44. For example, in many countries the electricity sector is regulated around centralised production by large facilities. Cleaner alternatives, such as more decentralised renewables that could reduce peak loads on the distribution network (solar PV in summer and combined heat and power in winter), are not rewarded by the tariff system (Neuhoff, 2006). In some cases there are mechanisms designed to accommodate the inflexible operation of nuclear power plants while not making use of the more flexible capacity of intermittent renewable generation.

45. In a similar vein, most electricity markets do not sufficiently accommodate the intermittent character of renewables. Most international transmissions are allocated in the day-ahead market, whereas accurate prediction of renewables is sufficient approximately four hours before final production. There is no technical reason why trading could not continue until this time, as transmission flows can be adjusted and power plants can change production. As a result, production is inefficient (Neuhoff, 2006). Another barrier in this respect is that decentralised producers are not permitted to feed overcapacity back to the grid. Conventional parties often have market power to prevent free entry into the market.

46. Furthermore, administrative frameworks are not yet tailored to low emission technologies. Spatial planning must accommodate wind farms and other small scale renewable energy projects which sometimes require multiple permit processes.

47. There is also a range of market barriers prohibiting the uptake of what appear to be economic opportunities for energy efficiency. Hidden and transaction costs, such as information and search costs and managerial time, cause many energy efficiency gains to go unexploited in small and medium-sized enterprises and households. Regulation and standards can help overcome these costs. Performance standards can, for example, remove inefficient products from the market and promote diffusion of more efficient alternatives.

48. Finally, another barrier often mentioned in relation to developing countries is their limited capacity to absorb new technologies. Technology is to a large extent tacit and implicit in the capabilities and skill set of a particular firm which is not easily replicated. There is a clear lack of concrete information on appropriate technologies/applications and their benefits. Technology transfer will require investments in

the institutional capacity in developing countries within governments, academic institutions and private companies to accommodate the internalisation of new technologies.

49. Work by the Carbon Trust (2008) points out that in the effort to address barriers across the innovation chain governments need to pay more attention to the overall process, as it is difficult to draw a line between them. As the barriers tend to be country and technology specific, this work needs to be tailored to local circumstances. However a common challenge for governments around the world and specifically in developing countries is that available funding for measures to address the phase between R&D and early commercialisation is insufficient.

3. International financial support for climate change mitigation in developing countries

50. International public finance institutions have begun to dedicate significant resources to overcoming barriers to project development in the area of climate change mitigation. However, these institutions face numerous challenges. Two of the most difficult are:

1. How to raise international public finance on an adequate scale and pace to address climate change;

2. How best to use international public finance to overcome barriers to the development and diffusion of new and existing low emission technologies.

3.1 How to raise international public finance on an adequate scale and pace?

51. The need for innovative funding mechanisms was a central conclusion of the Bali Action Plan negotiated at COP/MOP 13 in December 2007. The Bali Action Plan formed agreement on the need for '*improved access to adequate, predictable and sustainable financial resources … and the provision of new and additional resources*'. The text of the Bali Action Plan provides a set of politically agreed-upon criteria against which to evaluate the adequacy of existing and proposed mechanisms for raising public funding for climate change mitigation in developing countries.

52. The first set of criteria can be grouped under the label 'revenue raising capacity', referring to the volume of revenue which can be raised and its predictability over time. Whether a particular funding instrument is adequate in size and stable over time is evaluated against the relative merits of alternative funding instruments and the scale of the challenge. As discussed earlier, the investment required in developing countries in the early deployment of carbon mitigating technologies is estimated to be on the order of USD billion annually over the 2010 to 2050 period (IEA 2008). While private investments will have to bear the greater part of this, government-contributed revenue will be required, especially at the R&D and early commercialisation stages.

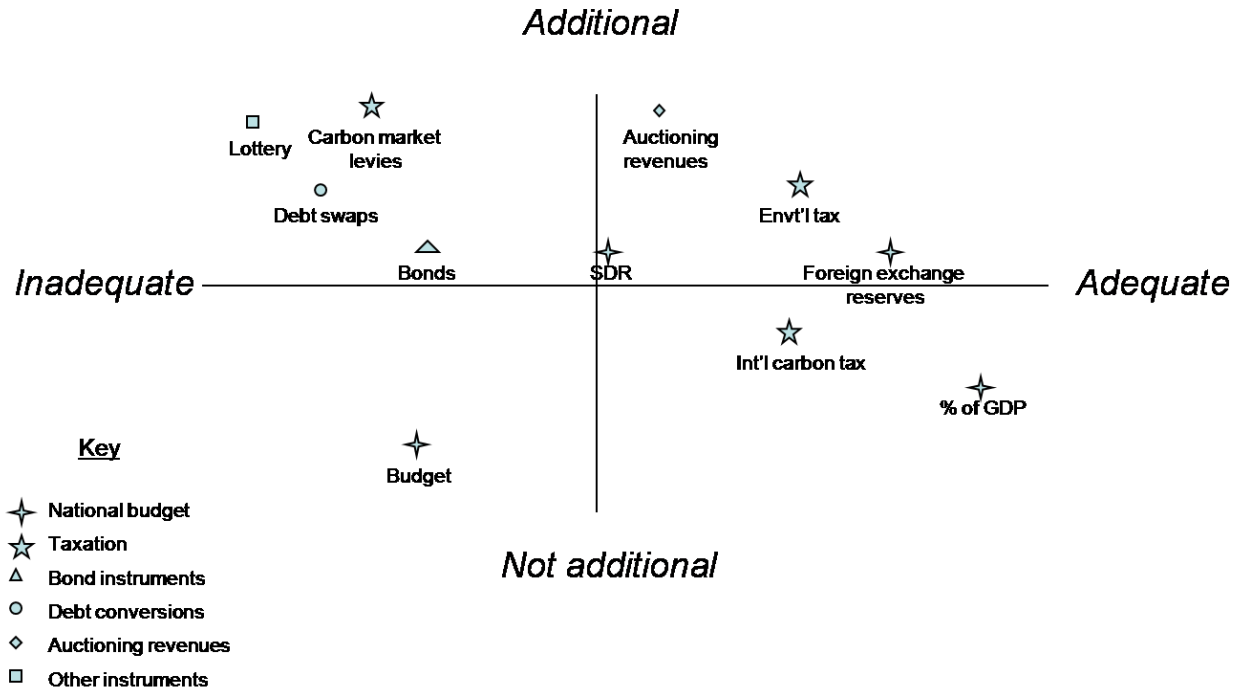
53. The proportion of international public finance which must come from developed countries is not discussed in this paper. However, Figure 2 sets out the capacity of different funding instruments to raise amounts of revenue on a scale from small to large.

54. As for the criteria 'new' and 'additional' it will be difficult to accurately assess which sources of finance are truly new and additional and which are, for example, redirected forms of ODA. This is of particular concern, as over-reliance on national budgets as a source of additional funding might create donor country fatigue, or may divert resources away from other ODA areas. Furthermore, governments may face political opposition if international funding contributions for climate change mitigation cut too deeply into domestic budget spending. In a political sense, therefore, 'new' and 'additional' revenue sources are defined as stemming from new revenue-raising instruments.

55. Admittedly, this is a partial way of looking at revenue generation and ignores the fact that what is raised on the one hand can be given back by lowering taxes and other levies on the other hand. For example, new emissions auctioning revenues are likely to be offset by lower corporate and income taxes to make them politically acceptable. For the purposes of this paper, 'new' and 'additional' revenue sources are those which can be distinguished from other domestic tax and non-tax government revenues and can be more easily isolated from discretionary decision making by national governments. Figure 2 compares existing and proposed funding instruments in terms of whether they constitute a 'new' and 'additional' source of public finance. Further details on each of the funding instruments in included in Appendix I.

56. A forthcoming paper prepared for the IEA/OECD Annex 1 Working Group highlights the difficulties of measuring and reporting support from developed to developing ones for climate change mitigation (OECD, forthcoming). The paper identifies the strengths and weaknesses of information sources and points out the many data gaps and inconsistencies in reporting. With respect to ODA, the OECD Creditor Reporting System (CRS) is potentially useful. Data is gathered and reported on an annual basis and screened against several policy objectives including biodiversity, climate change and desertification, which are referred to as "Rio Markers". For now this information remains incomplete, as multilateral institutions do not report on Rio Markers and the database only covers bilateral aid via these institutions.

Figure 2: Sources of international public finance: adequateness (size, predictability) versus new and additional



Funding from national budgets

57. International public finance institutions currently receive most of their funding for climate change mitigation projects from contributions from governments' national budgets. Major trust funds, such as the newly created World Bank Climate Investment Funds and the GEF Trust Fund rely on donor country pledges, especially the G8 and EU.[7] For example, 58% of the 4th replenishment to the GEF Trust Fund (for financial years 2007 to 2010) and 58% of the World Bank's IDA-15 replenishment (for the financial years 2008 to 2010) come from EU countries.

58. A key difficulty in adequately and predictably raising public funds through national budget contributions is the 'domestic revenue problem'. Governments are politically less willing to export funds which have been raised in a domestic context because that money is perceived by their constituents as national money. This can mean that sustaining the commitment to raise public funds can waiver when the domestic policy setting changes, for example after a change of government.

59. Amongst the new public financing instruments proposed in June 2008 to the second session of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA), China's proposal may suffer most from the 'domestic revenue' problem. China proposed that developed countries commit 0.5% of their total GDP to support projects addressing climate change in developing countries (approximately USD 185 billion annually). This amount is intended to be additional to existing ODA. The difficulty in achieving this target given the domestic revenue problem can be compared with the Monterrey ODA target of 0.7% of GNI. Although there has been a strong uptake by smaller countries, amongst the G7 the commitment has averaged 0.23% of GNI (Müller 2008). Given that China's proposal is additional to the Monterrey target, there may be political difficulties in persuading countries to commit to this unless a new international consensus is formed.

60. Mexico's proposal for a World Climate Change Fund represents a hybrid approach to fundraising because it intends to raise funds through instruments such as carbon auctioning revenues and air travel while making contributions from general country budgets a default source of funds should the annual USD 10 billion target not be achieved.[8] In this sense it remains uncertain how additional this Fund would be to existing ODA. What is new, however, is that Mexico proposes that both developed and developing countries volunteer to contribute to the Fund. Developing countries which choose not to contribute would be excluded from the Fund's benefits. Equity considerations would be managed by making funding a function of: 1) greenhouse gas emissions, 2) population, and 3) ability to pay, in this way ensuring that developing countries will receive more than they contribute to the fund and vice versa for developed countries.

61. Another proposal would be for countries to invest a small part of their foreign exchange reserves in funds aimed at investing in clean energy projects. Advantages to this proposal are that it might improve returns compared to investment in government treasury bills (mainly American) where exchange risk is high and yields are low, and would achieve diversification of investments. However, a major downside is the resulting lower liquidity of foreign exchange reserves, thereby making only about 5% of foreign exchange reserves a prudent investment size. At the end of 2007, global foreign exchange reserves totalled USD 6 trillion, so 5% would provide capital of USD 300 billion. There are equity concerns with this proposal, however, given that 76% or USD 4.6 trillion of reserves come from developing countries and that Asian countries generally have the largest foreign exchange reserve holdings.

62. Alternatively, Soros and Stiglitz (2002) have proposed that additional funds could be generated if the IMF issued a new form of Special Drawing Right (SDR) to developed countries which would be donated to a trust fund used for development purposes including clean energy and energy efficiency investment.[9] This proposal relies on developed countries not requiring the additional liquidity and the new SDRs not being inflationary. It would also require IMF member countries agree with 85% of the voting power to introduce a new SDR which could be used for this purpose. This may be politically difficult to achieve.[10] However, it is estimated that this could generate USD 18 billion with an initial issuance and an agreement about regular commitments thereafter.

International taxes

63. Another possible instrument which could generate earmarked revenues for climate change mitigation projects is international taxes or levies. The advantage of a genuinely international tax is that the

distortionary effects are spread across all economies. However, impediments to a global tax include political difficulties in agreeing on the rate of tax and the domestic revenue problem. It is also difficult to determine how new and additional these revenues would be, because although they have never been implemented, compromises which offset their revenue streams might be needed to make them politically feasible.

64. At the second session of the AWG-LCA in June 2008 Switzerland released the details of a proposed uniform global carbon tax in which all fossil fuel emissions would be taxed at USD 2/tCO_2, with a tax exemption for countries with per capita emissions less than 1.5 tCO_2 per inhabitant.[11] This effectively creates a differentiated tax rate between countries and regions, but may be susceptible to the domestic revenue problem because national institutions would collect the tax.

65. A global tax on airline travel and/or international bunkers fuels is less exposed to this problem, however, as it targets personal contributions to carbon emissions and is more likely to attach to individuals capable of paying. One proposal is the International Air Travel Adaptation Levy, which would levy the flight ticket price. Müller and Hepburn (2006) estimate that an average USD 6.5 per passenger per flight would generate USD 13 billion annually. Another proposal launched in 2006 is the International Maritime Emission Reduction Scheme, which would levy maritime fuel. A 5% tax (based on the current fuel price of USD 600/ton) would yield USD 4 billion in 2012 and USD 15 billion in 2020.

66. A hybrid approach of international airfare and maritime transport freight charges was proposed by the Tuvalu Adaptation Blueprint at COP/MOP 13 in Bali in 2007. Subject to certain exemptions, the Blueprint proposes the following levy structure: 1) 0.01% levy on international airfares and maritime transport freight charges operated by Annex II nationals; and 2) a 0.001% levy on international airfares and maritime transport freight charges operated by non-Annex I nationals. If these figures are multiplied by a factor of 100, Müller (2008) suggests that the Blueprint could yield USD 4 billion annually.

67. An alternative approach is to levy carbon market activities, such as the existing CDM adaptation levy, which collects 2% from CDM proceeds. This levy is unique in evading the domestic revenue problem, because the levy is collected from the private sector by an international institution. Currently, the volume of finance raised is relatively small: the World Bank estimates between USD 100 to 500 million will be raised up to 2012 (World Bank 2006). However, it might be possible to extend this levy to include other flexible mechanisms of the Kyoto Protocol, including Joint Implementation and International Emissions Trading. The key problem with this approach is that it taxes an emerging market activity which should be supported rather than discouraged.

Auctioning of Allowances

68. Another mechanism to generate revenue for climate mitigation projects is the auctioning of pollution permit allowances. A share of these auctioning revenues may be collected for investment in developing countries.

69. A number of proposals incorporate this idea. For example, at the second session of the AWG-LCA, Norway proposed that a small portion of Assigned Amount Units (AAUs) could be auctioned by an appropriate international institution.[12] Furthermore, a number of proposals for future carbon market regulation incorporate auctioning revenues. The European Commission has proposed in its climate change and energy package of 23 January 2008 that a share of auctioning revenues under the EU Emission Trading System (ETS) after 2012 be earmarked for climate change policies. Germany has pledged to auction 10% of their allowances under the European emissions trading scheme and earmark € 400 million annually, as of 2008, to finance additional climate mitigation actions both domestically and in developing countries. In

the United States, the Lieberman-Warner Bill had proposed to generate revenue from auctioning, though these revenues would have been invested domestically.

70. It has also been suggested in the São Paulo Proposal[13] that allowances for emissions from international aviation and maritime be auctioned. Assuming 100% auctioning, revenues on the scale of USD 22 billion could be generated in 2010, rising to USD 35 billion in 2030 (UNFCCC 2007). The allocation of this revenue could possibly be managed by an international institution such as the Conference of Parties to the UNFCCC. Although not adequate by itself, this revenue would constitute a new and additional source of public finance.

Bond issuance

71. The volume of finance which could be raised by bond issuances is significant, though the front-loaded nature of the International Finance Facility (IFF)-style proposals means that bonds would be repaid in the period 2015-2030. The IFF proposal was suggested by the UK in 2003 and involves the establishment of an independent international institution which issues bonds in its own name and provides upfront capital to developing countries to undertake development projects (e.g. for the period to 2015). Developed countries commit to make repayments on these bonds over a longer time period (e.g. for the period to 2030). An advantage is that these bonds would provide grant finance rather than loans to recipient countries. A successful example of this has been the International Finance Facility for Immunisation, which has raised USD 4 billion over the next 20 years for health projects in developing countries.

72. A benefit with bond issuances is that political commitments to public finance are crystallised over the 30-year term of the bond, thereby supplying a predictable source of funds. However, given that the burden of repayment falls on future governments, this may lead to problems of inequity. The ability of future governments to finance these bonds is also uncertain given the possible liquidity shortages which ageing OECD countries may face due to growing pension and social security burdens. An additional risk is that future governments may decide not to renew commitments in the form of new bond issuances.

73. Another proposed instrument is “climate bonds” which would be issued by a developing country to pay for climate change mitigation projects. This source of finance would only be additional if the climate bonds were structured so that they had better credit ratings than normal government bonds. As governments take on the risk of guaranteeing these bonds, it is unclear why their coupon rate for would be different from normal government bonds and therefore how they would constitute an additional source of finance. When bonds are raised through an independent institution such as the IFF, however, the institution’s credit rating may be better than that of the developing country, giving the bonds a more favourable credit rating. In this instance, bonds might provide an additional source of finance.

Debt swaps and other instruments

74. Debt swaps involve a donor country agreeing to relieve the debt obligation of a developing country in exchange for a smaller investment in beneficial development projects in that developing country. The motivation for developing countries to engage in debt swaps is the unlikelihood of their ability to repay their debt in full. Debt swaps have been used as an innovative financing instrument for environmental conservation projects and have catalysed investment in health projects.

75. While debt swaps have traditionally been negotiated bilaterally, the Global Fund for Fighting AIDS, Tuberculosis, and Malaria has experimented with debt swaps where the debtor developing country commits resources to an independent agency (such as the Global Fund) which subsequently takes responsibility for investing in in-country projects. The advantage is that the independent agency can

proactively broker political agreements and ensure that investment is made in cost-effective projects. The United Nations' *Investment and Financial Flows to Address Climate Change* (2007) suggests that multilateral development banks may be able to deploy this instrument for renewable energy and energy efficiency projects. This mechanism would be new and additional to the extent that debt swaps have not yet been deployed for the purpose of investment in climate change mitigation projects. However, the mechanism could be an unstable source of public finance over the long run, as the incentive for developed countries to swap debt diminishes as economic conditions in developing countries improve and they undergo structural adjustments.

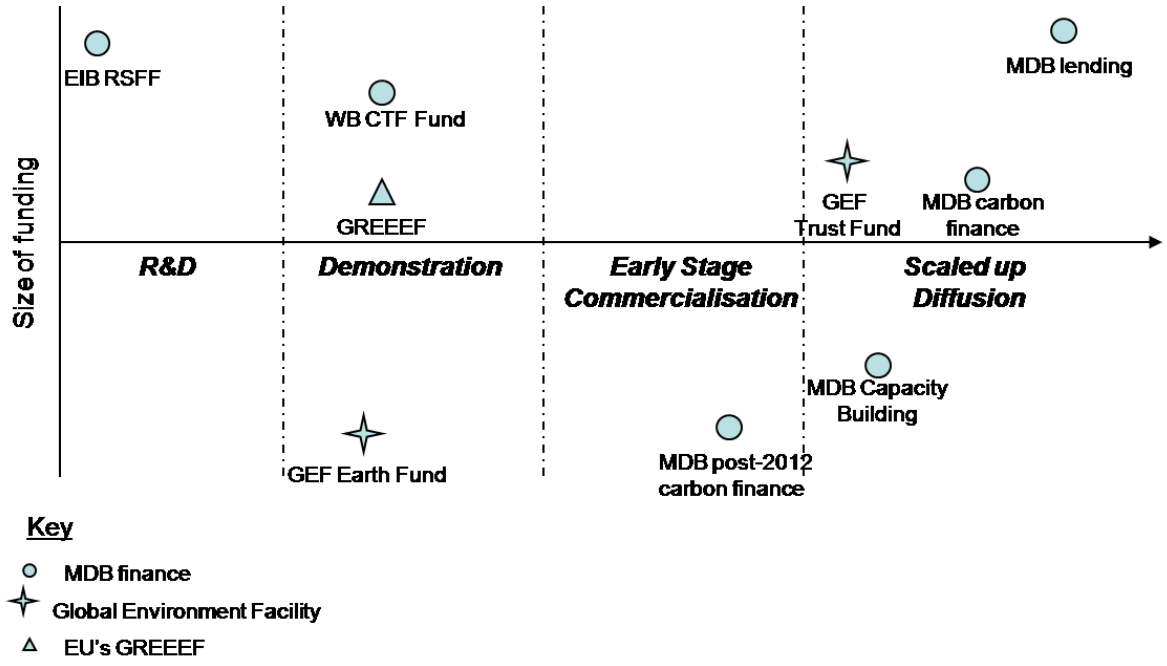
76. Finally, a global lottery, premium savings bonds and recovered stolen assets have also been proposed as instruments to raise funds for development purposes. These sources of revenue would be new and additional but it is difficult to anticipate the adequacy and predictability of revenues which would be generated.

3.2 How best to allocate international public finance to overcome barriers to the development and diffusion of new and existing low emission technologies?

77. Private finance that is leveraged by market instruments will provide the bulk of the investments in new and existing low emission technologies. However, as discussed in Section 3, private investors face numerous barriers along the innovation chain from R&D through to large-scale diffusion of new technologies (see Figure 1).

78. In particular, new technologies face the challenge of attracting finance after demonstration and in the early stages of commercialisation because of the high level of risk involved. Public finance must play a critical role in bridging this gap and support private investment in these new technologies. However, as Figure 3 illustrates, much of international public finance to date has been directed towards 1) demonstration of new technologies, and 2) scaling up the deployment and diffusion of existing technologies. Very little public international finance has made its way into R&D and early stage commercialisation of new technologies.

Figure 3: Current scale of international financing along the clean energy innovation chain



79. In this section international public finance mechanisms which are used to support countries in their mitigation efforts are discussed with reference to their primary activities and priorities, size of funding, and governance structures. Where possible, remarks on their effectiveness will be made. Further details on these mechanisms and other smaller mechanisms are provided in Annex II.

Existing institutions and mechanisms

A. Multilateral Development Banks (MDBs)

80. The major MDBs have adopted three main mechanisms to address climate change mitigation: capacity building, investment funds and lending, and carbon finance.

81. Turning first to capacity building and technical assistance, MDBs have a long track record in providing policy advice to developing country governments on energy market developments and removing market barriers. In particular, there has been a growing emphasis on advising developing countries on how to create an enabling environment for involvement in global carbon markets such as the Clean Development Mechanism. The African Development Bank's recent *Clean Energy Investment Framework for Africa* (March 2008) is particularly focused on the carbon markets, as there has been extremely limited public and private investment in Africa compared with other regions to date (see Table 3).

82. A gap in the technical assistance programs, however, is insufficient skills training for businesses trying to take technologies through the early deployment to commercialisation stage following R&D. Although the World Bank's Asia Alternative Energy Program and the Asian Development Bank's (ADB) Clean Energy Financing Partnership Facility are both aimed at project identification and preparation and provide assistance to small businesses, they both focus on scaling up existing technologies rather than addressing the unique challenges of new ones.

83. Secondly, MDBs have provided large amounts of finance through a variety of innovative financial instruments – concessional loans, grants, guarantees, and other exotic products – to support investment in emission reduction projects in developing countries. However, only a portion of this investment (27%) had climate change mitigation as its main objective in the period 2001-2007. In many cases, investment has been made in energy generation and efficiency projects where emission reductions might have been a co-benefit. Although it is often difficult to clearly distinguish between the various objectives for investment, Table 3 provides an indication of the size of low carbon investments made by MDBs.

Table 3: MDB and GEF Investment in low carbon technologies (USD millions)

Annual average 2001-2007

	Category	*WB*	*EBRD*	*ADB pub*	*ADB private*[1]	*IADB*	*AfDB*	*EIB*	*GEF*[2]	*Total*
Climate Specific	Renewable energy	331	14	111	448	222	73	674		1,872
	Energy efficiency	154	146		40	112	8	619		1,079
	Subtotal	*485*	*160*	*111*	*488*	*333*	*81*	*1,293*	*825*	*3,775*
	% Institution's total	**45%**	**32%**	**16%**	**23%**	**56%**	**79%**	**18%**	**100%**	
Non-Climate Specific	Generation	142	197	79	1,598	79	11	1,379		3,485
	Efficiency	450	135	485	36	178	11	4,550		5,846
	Subtotal	*593*	*333*	*564*	*1,634*	*257*	*22*	*5,929*		*9,331*
	Institutional Total	**1,078**	**493**	**675**	**2,122**	**590**	**103**	**7,222**	**825**	**13,106**

[1] ADB supports private investment through its Private Sector Development and Finance activities.

[2] Fourth Replenishment of the GEF Trust Fund 2006-2010

Source: Adapted from World Bank (2006); Table E.1 Baseline of IFI Low Carbon Investment

84. The concern with climate change mitigation being an incidental outcome of MDB investment is that it becomes difficult to predict whether MDBs are on track to reach the scale of clean energy investment needed in developing countries – though it is fair to say that MDBs have increased the scale of dedicated finance to climate specific projects since 2006. The World Bank recently launched the Climate Investment Funds, in which one fund, the Clean Technology Fund, is specifically aimed at financing the demonstration and diffusion of large-scale climate change mitigation projects. The Fund is capitalised at USD 4.5 billion for the next three years and is governed by a Trust Fund Committee composed of donor and recipient country representatives. Projects and programs are proposed by MDBs for financing and, if approved, the MDB is responsible for executing the project.

85. The Fund places emphasis on projects which can create a new enabling and regulatory environment, have a strong demonstration potential, and work with national government and private sector partnerships. However, it appears that technologies which have already been demonstrated but face the 'valley of death' challenge of financing for early deployment and commercialisation may have difficulty receiving support under the Fund. This is because Investment Plans presented to the Trust Fund Committee are critically assessed on their "implementation potential" including whether "policies and capacity to support technology adoption are present or can be developed in the short term" (World Bank, 2008). This would exclude technologies in the 'valley of death' scenario, where the barrier to be overcome is often lack of support from domestic policies and financiers.

86. The European Investment Bank (IEB) had the largest lending portfolio focused on clean energy investment between 2001-2007 with total lending to renewable energy projects reaching USD 2 billion in 2007 alone. The IEB has focussed on providing finance to small to medium-size enterprises in Europe as well as projects falling within the EU ETS under the Climate Change Financing Facility (EUR 1 billion for

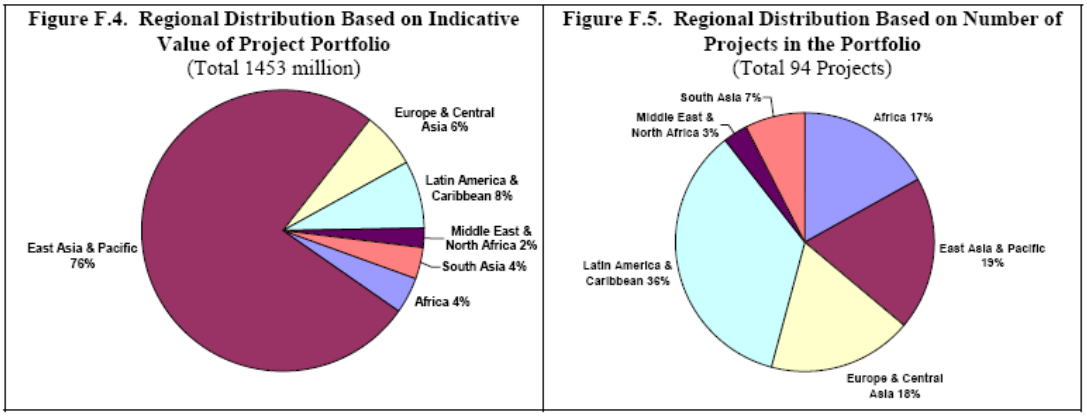
the period 2005-2008). It has also made significant targeted investment in efficient transport (EUR 8 billion in 2007). Particularly innovative is the Risk Sharing Finance Facility (RSFF), which has been set up to provide debt financing for private companies and public institutions engaged in R&D and early deployment. The RSFF involves a credit risk sharing arrangement between the EU and EIB which allows it to provide finance to unproven technologies and high risk investments. It aims to leverage up to EUR 10 billion for loans and guarantees. This initiative might be well placed to address the 'valley of death' scenario, but eligible projects must be located within EU member states or European affiliated countries. The EIB's mandate is in this way different from that of other MDBs that are more explicitly guiding investments from OECD to developing countries.

87. The Asian Development Bank (ADB) recently increased its lending activities on climate change mitigation projects to USD 1 billion annually. In addition, it recently launched a new initiative to raise USD 1.2 billion for investment in five private equity funds focussed on renewable energy and energy efficiency projects in China and Southeast Asia. The ADB is contributing USD 100 million in seed capacity with the remainder being private capital. The ADB has selected a fund manager to manage each of the five funds. A key aim of this project is to build experience and confidence amongst fund managers about the viability of private equity investment in clean energy projects in Asia.

88. The European Bank for Reconstruction and Development EBRD plans to administer EUR 1.5 billion in lending for clean energy projects in Europe and Central Asia between 2006 and 2009. As part of this, the EBRD is pursuing the Sustainable Energy Initiative, which has a particular focus on energy efficiency. A unique aspect is its provision of credit lines to households and small companies through local Eastern European banks. This allows on-lending for projects which would otherwise be too small to benefit from MDB funds.

89. Finally, the third mechanism which MDBs have utilised to mobilise clean energy investment in developing countries is carbon finance. The World Bank is the largest manager of carbon finance (USD 1.8 billion to date), and co-manages funds with the EIB and EBRD. Carbon finance provides an invaluable revenue stream for renewable energy and energy efficiency projects that would not otherwise receive private sector support, and therefore helps address the barriers to deployment and diffusion. However, the bulk of the World Bank's carbon finance activities have been on pre-2012 activities mainly under the CDM and JI and therefore apply to existing technologies under recognised CDM and JI methodologies. Only one fund – the Post-2012 Carbon Credit Fund – capitalised at EUR 100 million and co-managed by the EBRD, prioritises post-2012 activities. The majority of the World Bank's carbon finance investment has gone to East Asia and the Pacific (76%), compared with second place recipients Eastern Europe and Central Asia (8%) and Latin American and the Caribbean (6%).

Figures 4 and 5



Source: World Bank (2006)

90. Although the other MDBs also manage carbon finance, they are increasingly moving towards finance for post-2012 carbon activities. Post-2012 carbon finance is less likely to crowd out private investment because private carbon fund managers are less willing to bear the risks for purchasing carbon emission reductions from projects post-2012 in the absence of a clear regulatory framework. The EIB and ADB have recently introduced carbon funds focused on post-2012 mitigation activities capitalised at USD 100 million (ADB's Carbon Future Fund) and EUR 100 million (EIB's Post-2012 Fund).

B. Global Environment Facility

91. The GEF is one of the main international institutional arrangements catalysing clean energy investment. Although its governing council is composed of donor country representatives, the implementing agencies responsible for the selection and management of projects are UNEP, UNDP and the World Bank. The other MDBs and specialised agencies of the UN are brought in to assist whenever they are well placed to contribute to a project's execution.

92. The GEF Trust Fund received USD 3.13 billion for the period 2006 to 2010. As this funding is too small to invest in large demonstration projects, the GEF focuses on removing market barriers to replicating demonstration projects, and creating enabling environments (GEF 2006). A positive feature of the GEF's funding policy is that it covers the incremental costs for projects which would not otherwise receive private sector finance. Furthermore, it recognises the importance, discussed above, of fostering public-private partnerships in project development. The GEF Earth Fund, created in May 2008, primarily focuses on public-private co-operation. However, this initiative, which is both implemented and executed by the World Bank, is only capitalised at USD 200 million and is split between numerous environmental interest areas.

93. As in the case of the MDBs, a possible shortcoming of the GEF is in the area of R&D and early deployment. Given the strict eligibility criteria for GEF projects – all projects must be "sustainable and replicable" – new technologies which have not yet been proven commercially might not be supported by the Fund. A very small portion (USD 10 million) of the Special Climate Change Fund is dedicated to technology transfer, but it remains unclear how this is spent and, in any case, the size of funding is insubstantial.

C. Global Energy Efficiency and Renewable Energy Fund (GEEREF)

94. The GEEREF is a new public financing institution proposed by the European Commission. The governance structure proposed would establish the GEEREF as an independent public entity but in close collaboration with an international financial institution such as the EBRD or EIB. The latter institution would suggest projects and private sector fund managers would be hired to execute and manage investments within regional sub funds. EUR 100 million seed capital would be provided by the European Commission to raise EUR 1 billion for the Fund. Investments would be made under "patient capital" terms whereby the flexibility of the financing terms would vary on a case-by-case basis. The GEEREF would focus on the demonstration and deployment of energy efficient and renewable energy technologies with a proven technical track record. Therefore, although it is possible that early commercialisation of new technologies might fall within the ambit of the Fund, this is not a specific focus.

D. Bilateral mitigation support

95. Bilateral support for mitigation is estimated to be USD 2 to 5 billion annually in the 2001 to 2003 period (UNFCCC, 2007). This estimate is based on national communications to the UNFCCC. However, it includes financial contributions to the GEF and multilateral institutions. This estimate could be broadly compared with Table 2. Excluding the investments by the IEB – that will mainly be targeted at Eastern

Europe – the total climate specific investments by the multilateral development banks were roughly USD 2.5 billion a year in the 2001 – 2007 period. This means that most bilateral financial support for mitigation is likely to be channelled via the MDBs.

Examples of non-climate change institutional arrangements

96. In order to identify the most effective mechanisms for the delivery of public finance for clean energy investment in developing countries it is useful to consider successful mechanisms in other fields. Two mechanisms are briefly considered below:

A. Multilateral Fund to the Montreal Protocol

97. The Multilateral Fund was established in 1991 to reverse the production of ozone depleting substances. It has raised USD 2 billion over the life of the Fund, which is significantly less than the scale of finance required for climate change mitigation, but is proving sufficient for the Multilateral Fund's intended purpose. The Montreal Protocol which the Fund services has been proposed by scientists as a good model for climate change mitigation, as its flexible design enables phase-out commitments for CFCs and HCFCs to be set over a long time frame. Furthermore, the size of these commitments is periodically reviewed based on the latest scientific evidence, thereby fostering strong consensus between developed and developing countries. The Fund is governed in a similar fashion to the GEF Trust Fund in that the implementing agencies are the World Bank and specialised UN agencies (the World Bank is responsible for dispersing 45% of the funds). The funds are deployed to cover the incremental costs of investment in new and existing technologies in developing countries, where technology transfer is focused on the best available environmentally safe alternative technology. A panel of experts – the Technology and Economic Assessment Panel – advise on the best available technologies. The Fund then assists with deploying these technologies, for example through the purchase of patents and skills training.

B. Global Fund to fight AIDS, Tuberculosis and Malaria

98. The Global Fund has raised USD 4.7 billion since 2001 for projects and programs to fight AIDS, TB and Malaria. It is an independent entity and structures projects around public and private partnerships in the countries of interest. To this extent, it exemplifies the emphasis on public-private partnerships for carrying out projects as is increasingly evident in World Bank, GEF, ADB, and GEEREF activities. The Fund focuses on proven technologies which can be scaled up. Funding is results-driven and explicitly excludes programs where capacity building is a sole focus. Although it is mainly focussed on deployment and diffusion, it has developed advanced market commitments with some pharmaceutical companies whereby it guarantees the purchase of new drugs once they have been developed, therefore supporting early deployment and commercialisation of new technologies.

Proposed international public financing mechanisms

99. As discussed, existing international mechanisms have been strong in the areas of capacity building, carbon finance and access to finance for the deployment and diffusion of existing clean energy technologies. However, a significant financing gap is evident at the R&D and early commercialisation stages. Given the risk aversion of private sector finance in entering the market at this early stage, new public finance mechanisms are needed to overcome the 'valley of death' scenario.

100. Recently, several international mechanisms have been proposed which might overcome this gap in public finance. These are considered below.

A. Proposals to second session of AWG-LCA in June 2008 following the Bali Action Plan

101. A Multilateral Climate Change Fund and a Venture Capital Fund were proposed by various member states at the second session of the AWG-LCA. These funds would be administered as new subsidiary bodies under the Conference of Parties to the UNFCCC. Amongst the specific priorities of these institutions, China and India have emphasised the importance of venture capital to target new and promising technologies which have not been taken to market. Parties have also argued in favour of fast-tracking the development of certain renewable energy technologies (UNFCCC, 2007).

B. UK Carbon Trust proposal for innovation diffusion centres

102. The UK Carbon Trust has advocated in favour of a new international institutional arrangement involving five centres coordinated under a single umbrella organisation. These centres would focus, among other things, on 'incubating' and accelerating new technologies which are yet to be commercialised by testing their commercial and technical viability. Emphasis would be placed on providing business development skills to new business start ups in developing countries, and investing more funding in applied R&D. The expected funding required for these five centres is between USD 1 billion to USD 2.5 billion in total over the next five years. This model is based on the Carbon Trust's current operations within the UK. A similar model for so-called distributed innovation centres has been proposed by the Clean Energy Group where the umbrella organisation would be an international institution like the World Bank or a UN agency.

C. The World Bank's proposed Clean Energy Financing Vehicle

103. The World Bank has proposed the need for a Clean Energy Financing Vehicle to fill the gap in financing of nearly USD 10-15 billion annually. The Vehicle would envisage receiving funding from G8 and G+5 countries and would be an independent entity managed under an existing MDB. Amongst the Vehicle's priorities would be finance and support for commercialisation of new technologies, and to mitigate technology risk faced by private sector financiers.

4. Implications for a Post-2012 Financial Architecture on Climate Change Mitigation

104. This paper began by asking how developed countries might best support and enable mitigation actions in developing countries. What constitutes good public spending on climate change mitigation and how should this relate to discussions on a post-2012 global agreement on climate change? A key premise is that good public spending should be leveraging and complementing, not crowding out, private investments. From this perspective it was argued that public finance should be used to:

- help catalyse policy change and remove distortionary policies such as fossil fuel energy subsidies;
- provide technical assistance and improve the absorption capacity of new technologies;
- remove market barriers and regulatory risks;
- lower transaction costs; and
- support innovation and development of new technologies.

105. Most of these elements are being addressed by the current patchwork of existing and proposed mechanisms, though no mechanism exists to ensure a balanced distribution of resources. Existing mechanisms seem strong in the areas of capacity building and deployment of existing technologies via carbon markets; however, a significant gap is evident for resources targeting the R&D and early

commercialisation stage. In addition, more attention should be paid to the overall process in order to ensure promising technologies move along the chain towards widespread diffusion.

106. Several studies have attempted to analyse the incremental investments and costs needed to stabilise emissions on a level consistent with avoiding dangerous interference with the climate system. The IEA (2008), for example , estimates that incremental investments of around USD 1,100 billion annually until 2050 would be needed on both the energy supply and demand side to cut emissions globally by 50 percent against a business-as-usual trajectory. Whereas the UNFCCC (2007) reports additional investment and financial flows of USD 200-210 billion are needed to return emissions to current levels by 2030. Around half of all investments are likely to be made in developing countries in a least cost scenario. The understanding is that most of these investments should be leveraged by market instruments and only a limited role is seen for public finance instruments. An indication of what that role might be can be gauged by looking at the investments needed for early deployment, which is estimated by the IEA to be around USD 150 billion annually over the 2010 to 2050 period. As these are non-commercial investments they will need a substantial amount of public funding.

107. Although market instruments could provide a crucial role in providing financial flows from developed to developing countries, the negotiations on a post-2012 climate framework are crucially dependent on reaching agreement on public support for technology, capacity building and finance. A problem in this respect is the fact that at present no adequate measure of the level of government expenditure on climate change mitigation exists. The data are incomplete and fragmented. For example, the investments being made by the multilateral banks are incomplete and not externally monitored (OECD, Forthcoming).

108. Interestingly, despite the importance of funding in current negotiations, most public north-south investments are *not* being made under the governance of the UNFCCC. This is not a problem in itself given the uncertainty about what would constitute good public spending on climate change mitigation. In such an uncertain situation it may be desirable to trial and evaluate a broad set of approaches over a period of years in order to establish best practices. However, it is important that lessons are being learned and reviewed in order to acknowledge the efforts being made so that common ground between the parties can be found.

How to ensure expenditure is efficient and effective?

109. The golden rule of public funding suggests that governments should support only those investments that are economically efficient but *not* financially viable (OECD, 2007). When providing public funding, governments should ensure that these subsidies do not distort competitiveness and should seek to encourage restructuring of, and innovation in, industry by supporting investments that result in the purchase of more low emission technologies and practices.

110. However, it will not always be possible to ensure this golden rule is being applied. It will be difficult to evaluate the effectiveness of capacity building and innovation support as the outcomes will be largely unknown given the inherent uncertainty that necessitated government intervention in the first place. Measures can be taken, however, to ensure funds are being spent efficiently.

111. An instrument that could be used is reverse auctioning, in which a subsidy is awarded to the private party willing to execute a project at the lowest cost. This could be a particularly useful way of supporting innovative technologies, though it would require a rather high level of sophistication on the part of governments in terms of defining the ‘projects’ to be auctioned. The OECD (2007) *Handbook for Appraisal of Environmental Projects Financed from Public Funds* provides some interesting guidelines for publicly managed environmental funds.

Where should funding come from?

112. Economic textbooks suggest taxes should be raised in a way that minimises distortions to the decisions made by consumers and producers. As taxation directly interferes with people's choices and preferences their imposition is seen to be domestic sovereign right reflected in the popular slogan 'no taxation without representation'. For this reason, international taxation is prohibited under international regulation.

113. At the same time it has proven difficult for the international community to meet commitments and targets to transfer a portion of domestic tax revenues for global public goods. Many countries are struggling to live up to the Monterrey ODA target of 0.7% of GNI. The domestic revenue problem as labelled in this paper means that governments are politically less willing to use domestic tax revenues for international public goods.

114. Hybrid approaches are therefore being proposed. Although international taxation is not possible at present there is nothing standing in the way of limits and trading that could effectively cap emissions in international sectors not currently exposed to carbon constraints. Emission permits could be auctioned and used for international climate change mitigation and adaptation. This was advocated in particular by Climate Strategies in its paper prepared for the 2008 G8 Hokkaido Summit. In the Mexican proposal referred to earlier this would be complemented by country budgets as a default source of funds should the target not be met, thereby increasing the predictability of the revenue stream.

115. Such a hybrid approach would seem to be a practical way forward but would need serious discussion amongst ministers of finance with respect to the pros and cons of earmarking an international revenue stream. An argument for using an indirect tax by auctioning emission permits to international aviation, for example, is that it adheres to the 'polluter pays' principle and the earmarking provides a clear link for the public between payment and avoiding damage to the environment. In addition it would provide for an annual and permanent source of revenue. Combining this with country budgets as a default source of income could increase the predictability of the revenue stream, though at some cost to the polluter pays principle.

The Way Forward

116. Conceptually the easiest way of dealing with mitigation support to developing countries would be a global governance system with sufficient power to oversee the effective and efficient use of funds. In reality there are many uncertainties as to what would constitute good public spending beyond the criterion that it should complement and leverage private finance. This might be a reason to favour multiple approaches to provide flexibility and room for manoeuvre.

117. A pledge and review model for public support for technology, finance and capacity building seems therefore appropriate and could possibly fit within the approach taken in the Bali Action Plan (i.e. measurable, reportable and verifiable action and support). Such a decentralised approach would acknowledge all efforts being made but at the same time place considerable emphasis on correctly monitoring and reporting the public funds being invested through different mechanisms and institutions.

118. In the present context this is not yet possible. Investments will need to be made in monitoring, reporting and verifying information (OECD/IEA, forthcoming). Criteria need to be set to ensure that the data is of sufficient quality and money being spent is not reported more than once. Finally, a pledge and review system – nor any system, in the absence of an international tax regime – cannot guarantee that sufficient funds are being mobilised. A multilateral agreement to use earmarked revenues would go a long way towards securing adequate public funds for climate change mitigation.

ENDNOTES

[1] For an overview of the instrument choice and the economics of climate change see the background note prepared for the meeting of the OECD Council at Ministerial Level, 4-5 June 2008 drawing on the work of the WP1 of the EPC and the WPGSP of the EPOC.

[2] See for example GAO (2008).

[3] See also Doornbosch, Gielen and Koutstaal (2008). In a global trading system the total value in 2020 of the allowances bought by Annex I countries from developing countries is about USD 70-80 billion for an 'importation' of 3.6 Gt. Obviously this depends on the permit allocation implied in this scenario which is based on per capita emissions.

[4] An energy subsidy is any government policy that lowers the cost of production, raises the price received by producers or lowers the price paid by consumers.

[5] See www.sefalliance.org.

[6] For a detailed barrier analysis see the IEA's *Energy Technologies Perspectives 2008*.

[7] A trust fund is a legal arrangement whereby the legal owner of property (trustee, here donor countries) holds and uses property for the benefit of another party (beneficiary, here developing countries).

[8] For details of the proposal see China's presentation at 'Workshop on investment and financial flows to address climate change', UNFCCC Website, available at *http://unfccc.int/meetings/ad_hoc_working_groups/lca/items/4427.php*

[9] Special Drawing Rights are a form of intergovernmental currency issued by the IMF usually to maintain stability in the foreign exchange market.

[10] This may be politically difficult to achieve as it has never been done (Reisen 2004).

[11] See Switzerland's proposal at *supra* note 3.

[12] See Norway's presentation, *supra* note3. AAUs are an accounting unit under the Kyoto Protocol equal to one tonne of CO2e which can be traded among Annex I countries to meet their emission reduction requirement.

[13] The Sao Paolo proposal was put forward by the BASIC Project that supported the institutional capacity of Brazil, India, China and South Africa to undertake analytical work to determine what kind of national and international climate change actions best fit within their current and future circumstances, interests and priorities. BASIC has created a multi-national project team linking over 40 individuals from 25 research and policy institutions, the majority based in BASIC countries. *See* www.basic-project.net.

APPENDIX I: EXISTING AND PROPOSED SOURCES OF INTERNATIONAL PUBLIC FINANCE

Sources of finance	Description	Example/Proposal	Estimated revenue raising capacity
A. Funding from national budget			
• Percentage of GDP by developed countries	Developed countries commit to increase their ODA for climate change mitigation projects to a fixed percentage of GDP on an annual basis.	- Developed countries commit to 0.5% of GDP for climate change projects, additional to existing ODA. Proposed to AWG-LCA by China at SB28.*[1] - Monterey ODA target of 0.7% of GNI.	- USD 185 billion p.a. (China proposal). - USD 270 billion in 2007 (Monterey ODA).
• Budgetary contributions by developed and developing countries	Pledges by donor countries of a certain budgetary contribution.	- GEF Trust Fund 4th replenishment received pledges from 32 donor countries. - World Bank Climate Investment Funds received pledges from G8 countries. - World Climate Change Fund relies on pledges as a default source of finance, so a hybrid mechanism. Proposed at second session of AWG-LCA by Mexico.*	- USD 3.13 billion between 2006 and 2010 (GEF Trust Fund) - World Bank Climate Investment Funds received approximately USD 5 billion: (US give USD 2 billion over 3 years; UK gives USD 1.58 billion over 3 years; Japan gives around USD 1 billion). - No less than USD 10 billion p.a. (Mexico proposal).
• Investment of global foreign exchange reserves	Countries could invest a small part of their foreign exchange reserves in funds which would invest in energy efficiency, renewable energy and other mitigation projects. Original proposal focused on Asian countries.	- Proposed in the *Towards a New Asian Development Bank in a New Asia* (ADB 2007).*	- Contributing 5 per cent of the reserves to funds would provide USD 300 billion based on 2007 figures.
• Special Drawing Rights	IMF would allocate new SDRs to all member countries. Developed countries could make their new SDRs	- Originally proposed by George Soros and Joseph Stiglitz in run-up to the 2002 United Nations	- USD 18 billion donated initially then an annual

[1] * indicates this idea has been proposed but not yet implemented.

	available to approved international non-governmental organizations to meet specific MDGs or on climate mitigation projects in concert with a post-2012 agreement.	International Conference on Financing for Development to meet the MDGs. Adapted to climate change in *Investment and Financial Flows to Address Climate Change* (UNFCCC 2007).	amount of donated SDRs to be agreed thereafter (UN 2007).
B. Taxation and levies			
• Uniform global tax on carbon emissions	Uniform global carbon tax on all fossil fuel emissions, with a negotiated basic tax exemption. Taxes could be collected domestically but distributed internationally.	- Switzerland proposed a USD 2/tCO2 with a 1.5tCO2 tax exemption per an inhabitant to second session of AWG-LCA.*	- The current plan would raise USD 48.5 billion per annum (2010): 48% from developed and 52% from developing countries (Müller 2008).
• International environmental tax	Variety options for an international environmental tax. For example: - A per capita tax on flight emissions levied on the flight ticket price. - A global bunker fuel levy throughout the maritime and aviation industries. - A hybrid levy on both international airfares and maritime transport freight, differentiated between developed and developing countries. Tax collected by an international authority under the UNFCCC.	- IATAL proposal to Leading Group on Solidarity Levies to Fund Development for an international aviation tax.* - Global bunker levy proposed by the Marine Environment Protection Committee of the IMO in Denmark.* - Hybrid levy proposed as the Tuvalu Adaptation Blueprint at COP/MOP 13 in Bali 2007. Current levy structure is: (1) 0.01% levy on international airfares and maritime transport freight charges operated by Annex II nationals (2) a 0.001% levy on international airfares and maritime transport freight charges operated by non-Annex I nationals.*	- An average levy of USD 6.5 per ticket would generate around USD 13 billion annually. (IATAL proposal) - A levy of USD 30/t of maritime fuel (equivalent to 5% of current fuel price) would generate USD 15 billion in 2020.* (MEPC proposal) - Tuvalu Adaptation Plan currently expected to generate USD 40 million. Müller (2008) indicates that USD 4 billion could be generated annually if figures multiplied by factor of 100.
• Levies on proceeds of the carbon market	Percentage of revenue generated under carbon market taxed and earmarked for climate-related projects. There are a number of proposals to extend the levy to JI and IET under the Kyoto Protocol	- 2% levy already exists under the CDM Adaptation Share of Proceeds. Levy also deducted for administrative expenses of Executive Board.	- World Bank estimates CDM adaptation levy will generate USD 100 million USD 500 million at current prices up to 2012 at current prices.
• Tax on	A currency transaction tax charged on international	- Proposed by James Tobin.*	- Estimates between USD

currency transactions (Tobin tax)	currency transactions. There are various criticisms regarding the operation of this tax, including the impact on volatility of currency markets. This was not proposed specifically in relation to climate mitigation projects, but for development purposes generally.		50 billion to USD 200 billion depending on tax rate (UNFCCC 2007).
C. Auctioning of emission allowances			
• Percentage of revenues generated from auctioning emission allowances	Entities are required to purchase emission allowances through a market auctioning process. A percentage of the auctioning proceeds are dedicated to climate mitigation projects in developing countries.	- Norway proposed to second session of AWG-LCA to auction a small portion of AAUs.* - São Paulo Proposal suggests auctioning of allowances for international bunker fuels. This would be regulated under international agencies.* - European Commission proposes in its climate change and energy package of 23 January 2008 that a share of auctioning revenue in post 2012 EU ETS being earmarked for climate change policies.* - Lieberman-Warner Bill had proposed using auctioning revenues for climate change project investments domestically.	- The Norwegian proposal has not been priced. Assuming 2% of auctioning proceeds set aside at current prices, this could generate USD 14 billion annually (Müller 2008). - São Paulo Proposal could generate USD 22 billion in 2010, rising to USD 35 billion in 2030 (UNFCCC 2007).
D. Bond issuance			
• Developing country-issued bond with carbon credit repayments	Developing countries (Asia, Africa, Latin America) would issue bonds to capital markets. Investors would receive returns in the form of carbon emissions when bonds mature (presumably under whatever scheme emerges after 2012). The bonds would be guaranteed by the issuing governments. The developing governments would have an incentive to develop national emission targets (for example, to 2020) to guide investors on the volume of carbon emissions expected.	- Proposed by Yvo de Boer.* - This idea is similar to future-flow securitization which has been proposed in Sub-Saharan Africa. The borrower typically pledges future foreign-currency receivables such as oil, remittances, credit card receivables, etc (Ketkar and Ratha 2005).	- Carbon bond proposal is not yet priced.
• Independent agent issued bonds with donor country repayments	An independent finance facility would issue bonds to the international capital markets against legally binding pledges for future repayment of ODA from donor (developed) countries. It is envisaged payback guarantees would also include revenue generated through the carbon market, airlines taxes etc. This is described as front-loaded financing because capital is delivered up front and repaid over time.	- Proposed by the European Commission for climate change related projects in the form of the EU Global Climate Financing Facility.* - The UK proposed the International Finance Facility in 2003 to meet the MDGs by 2015. It would seek annual commitments of USD15-16billion such that it would issue bonds in its own name and seek repayments from donor countries to 2030.*	- The EU's Global Climate Financing Facility could raise between EUR500 million and EUR1 billion annually. - IFFIm has anticipated raising USD4 billion over the next 20 years.

		- This has been implemented in the International Finance Facility for Immunisation.	
E. Debt Conversations			
• 'Direct' debt swap between two countries	Under debt swap programmes, creditors (developed countries) agree to cancel a portion of debt owed to them by developing countries in exchange for the developing country making a particular commitment. cancelled in exchange for a commitment by the debtor government (developing countries) to convert the cancelled amount into local currency for investment in clean energy projects.	- Debt swaps have been brokered by WWF for environmental conservation projects for over 15 years. - *Investment and Financial Flows to Address Climate Change* (UNFCCC 2007) indicates that direct debt swaps could become an important instrument used by multilateral development banks for renewable energy and energy efficiency projects.*	- Subject to agreement between the parties.
• 'Indirect' debt swap with independent intermediary	Creditors (developed countries) forgo repayment of a portion of debtors' sovereign debt on the condition that the beneficiary (developing) country invests an agreed-upon amount in a global fund in the form of cash or promissory note. The global fund then invests in development projects in the developing country.	- This approach has been adopted by the Global Fund to fight Aids, Tuberculosis, and Malaria through the Debt2Health program. It is distinct from direct debt swaps because the investment is made by the independent global fund. - This model might be applied for climate change funds.*	- The Global Fund has executed one indirect debt swap between Germany and Indonesia to date worth EUR50million.
E. Other Ideas			
• Global lottery	Lotteries could be established where the profits are donated to development projects. Lotteries could either be national or a single global lottery sold worldwide and run by a single organisation.	- The Crisis Management Initiative has proposed a global lottery along the model of national lotteries contributing to a single cause. Public finance from these sources would clearly be new and additional.* - The proposal for a global lottery sold worldwide is proposed in Addison and Chowdury (2003). *	- The global lottery proposals have not been priced, but the global gross lottery profit in 2001 was USD62 billion.
• Global premium savings bond	A premium bond is a standard savings bond where the principal is not at risk. However, the rate of return is determined by a random prize drew, thus imitating a lottery. These bonds can be issued by an international organisation in a basket of major currencies, such as the IMF's Special Drawing Rights.	- UK, Bangladesh and Ireland have national premium savings bonds. However, under this proposal (Addison and Chowdury 2003), the premium savings bonds would be issued by an international body and profits would be donated to, for example, climate mitigation projects. This source of finance is clearly new and additional.	- A global premium savings bond has not been priced.
• Recovery of stolen assets	Recovery of stolen assets and flight capital could be used to finance climate change mitigation projects.	- World Bank and the United Nations Office of Drugs and Crime have launched the Stolen Assets Recovery initiative.	- The cross-border flow of the global proceeds from criminal activities, corruption, and tax evasion

			are estimated to be more than USD 1 trillion annually.

APPENDIX II: EXISTING AND PROPOSED INTERNATIONAL MECHANISMS FOR ALLOCATING PUBLIC FINANCE FOR CLIAMTE CHANGE MITIGATION

Program	Activities	Priorities	Objective	Governance	Geography	Size of funding
Existing International Mechanisms						
World Bank Group						
• Climate Investment Funds	- Grants; concessional loans; risk mitigation instruments. - Aimed at scaling up low-carbon technologies.	- Large-scale projects. - Utilise private sector or public-private partnerships. - Capacity for demonstration projects. - Focus on power sector, transportation, energy efficiency.	- Demonstration - Deployment/ Diffusion	- Trust Fund Committee composed of 8 donor countries and 8 recipient countries. Administered through World Bank.	- Developing countries.	- **USD 4.5 billion** contributed to Clean Technology Fund 2008-2012.
• Carbon finance funds	- Manages carbon funds and facilities purchasing project-based GHG emission reductions.	- Funds focus on CDM and JI. - Forestry sector focus. - Two facilities commencing on post-2012 period reductions.	- Deployment/ Diffusion	- Funding from both OECD governments and private contributions. - Administrated through Carbon Finance Unit of World Bank .	- Developing countries, but 76% of contracted carbon credit purchases from East Asia and Pacific.	- Funds approximately capitalised **USD 1.8 billion** (excluding funds under development).
• Various capacity building activities	- Policy advice, technical assistance, advice on sustainable energy development.	- Focus on transport strategy - Technical assistance on entering carbon markets.	- Capacity building	- Sustainable Development Network coordinates World Bank work on sustainable development.	- Developing countries.	- Not specified.
• Bank lending	- Lending for projects with climate change theme – investments made for development purposes without assuming climate change.	- Most lending in energy sector to power: 55% of total commitments (1990-2005). - Renewable energy received 12% of total commitments (1990-2005); energy efficiency 3.9% of total commitments (1990-2005).	- Deployment/ Diffusion	- Bank's lending administered through IBRD, IDA, MIGA, and IFC.	- Developing countries.	- **USD 3.4 billion** in FY01-07 specifically on renewable energy and energy efficiency projects.
Asian Development Bank						

• Clean Energy Financing Partnership Facility	- Small grants; technical assistance; capacity building.	- Small scale investment projects. - Demonstration projects.	- Demonstration - Capacity building	- ADB selects projects on basis of technical viability, scalability, and market applications	- Asian developing countries.	- **USD 250 million.**
• Carbon Market Initiative	- Purchasing GHG emission reductions under the CDM; providing technical assistance to projects eligible under CDM.	- Technical support - New focus on post-2012 carbon emission reductions (Carbon Future Fund).	- Deployment/ Diffusion	- Administered by ADB	- Asian developing countries.	- **USD 150 million** for period to 2012. - **USD 100 million** for period post 2012.
• Various capacity building activities	- Technical assistance; information dissemination; policy advice.	- Removing barriers to renewable energy and energy efficiency projects. - Policy advice on transport sector (Sustainable Transport Initiative) in accordance with ADB's focus under Clean Energy Investment Framework.	- Capacity building	- Administered by ADB.	- Asian developing countries.	- Not specified.
• Private Equity	- Investment in clean energy projects	- Scaling up use of existing technologies. - Focus on energy efficiency and renewable energy.	- Diffusion/ Deployment	- Private sector managed funds with ADB seed capital.	- Asian developing countries esp. China and South Asia.	- Aim is to raise **USD 1.2 billion** across five private sector funds.
• Bank lending	- Concessional loans; risk mitigation instruments; grants.	- Focus on renewable energy and energy efficiency.	- Diffusion/ Deployment	- Administered by ADB.	- Asian developing countries.	- **USD 1billion** annually on clean energy projects. - **USD 4.2 billion** in FY01-07 (combination of both direct lending as well as facilitated private sector lending.)

European Investment Bank						
• Carbon market activities	- Purchase of project-based GHG emission reductions.	- Focus on projects under CDM and JI. - Advanced funding for CDM and JI projects. - Post-2012 carbon finance.	- Diffusion/ Deployment	- Manages Multilateral Carbon Credit Fund with EIB and Carbon Fund for Europe with World Bank. - Post 2012 Carbon Fund self-administered.	- Central Europe to Central Asia.	- **EUR 365 million** in total (EUR 165 million MCCF; EUR 100 million CFE; EUR100 million Post-2012).
• Bank lending	- Long-term loan finance to companies mitigating GHG gases.	- Climate Change Financing Facility focused on EU ETS projects: **EUR 1 billion** for 2005-2008. - Large focus on efficient transportation.	- Diffusion/ Deployment	- Administered by EIB.	- Europe.	- **EUR 8 billion** in efficient transport in 2007. - **EUR 2 billion** on renewable energy lending in 2007. - **USD 9 billion** in climate change investment in FY01-07.
• Risk Sharing Finance Facility	- Loans and guarantees for technology innovation	- New technology innovation where high levels of risk eg unproven markets, complex technologies. - Not climate change specific.	- R&D	- Partnership between EIB and European Commission	- EU member states.	- EIB and EC each contribute EUR 1 billion to leverage up to **EUR 10 billion.**
European Bank of Reconstruction and Development						
• Sustainable Energy Initiative	- Investment in energy efficiency projects.	- Industrial sector energy efficiency is EBRD's focus under Clean Energy Investment Framework.	- Diffusion/ Deployment	- Administered by EIB's Climate Change and Energy Efficiency Team.	- Central and Eastern Europe.	- Anticipates investment of **EUR 1.5 billion** over 2006-2008.
• Carbon market activities	- Purchase of project-based GHG emission reductions.	- Renewable energy, energy efficiency, forestry projects all eligible.	- Diffusion/ Deployment	- Manages Multilateral Carbon Credit Fund with EIB. Also purchases credits with funds from the Netherlands.	- Central Europe to Central Asia.	- **EUR 225 million** in total (EUR 165 million MCCF; EUR 60 million for Dutch Fund).

African Development Bank						
• Capacity building activities	- Technical assistance; knowledge dissemination	- Renewable energy and energy efficiency projects	- Capacity Building	- Developing framework through bilateral and multilateral collaborations esp. with World Bank.	- Sub Saharan Africa.	- Not specified
• Carbon market activities	- Capacity building.	- Help countries participate in CDM.	- Capacity Building	- Developing framework through bilateral and multilateral collaborations esp. with World Bank.	- Sub Saharan Africa.	- Not specified
• Bank lending	- Lending activities to encourage investment for access to energy and avoided deforestation.	- Total investment required to achieve AfDB scenario of access to reliable and clean energy across Africa by 2030 is USD 547 billion, that is USD 23.8 billion annually.	- Diffusion/ Deployment	- Administered by AfDB and other MDBs.	- Sub Saharan Africa.	- Total contributions from all MFIs in Sub Sahara Africa estimated to be **USD 2 billion annually**. - World Bank urges amount increased to USD 4 billion annually.
Inter-American Development Bank						
• Sustainable Energy and Climate Change Initiative	- Access to finance for projects mitigating GHG emissions; technical assistance.	- Renewable energy; energy efficiency; biofuels.	- Diffusion/ Deployment	- Administered by IADB and other MDBs.	- Latin America and Carribean.	- **USD 30 million** plus additional funding for bank loans
Global Environment Facility						
• Trust fund	- Provides funding for incremental costs through grants, loans, risk sharing instruments etc. - Capacity building.	- Removing barriers which prevent replication and demonstration projects. Does not invest in demonstration projects themselves. - Providing access to finance.	- Diffusion/ Deployment - Early Deployment	- GEF Council composed of member country representatives. - Implementing agencies are: UNEP, UNDP, and World Bank - Executing agencies are MDBs, IFAD, FAO, and UNIDO.	- Developing countries.	- Committed USD 2 billion between 1991 and 2005. - 4th (current) replenishment received **USD 3.13 billion** for period 2006 to 2010.

• Special Climate Change Fund	- Capacity building; information dissemination.	- Mainly adaptation activities (USD 57 million). - Remainder for technology transfer although it is unclear how this is used (USD 10 million).	- adaptation - Technology transfer	- GEF Council composed of member country representatives. - Implementing agencies are: UNEP, UNDP (small grants), and World Bank - Executing agencies are MDBs, IFAD, FAO, and UNIDO.	- Developing countries.	- **USD 67 million** mainly for adaptation, although a small portion for technology transfer.
• Earth Fund	- Provides range of instruments: grants; concessional loans; equity; guarantees.	- Focused on new technologies and business models. - Emphasis on replicability of projects - Focus on public private partnerships - Highly leveraged with private finance.	- Diffusion/ Deployment	- Fund managed operationally by GEF Secretariat. IBRD is Implementing Agency and IFC is Executing Agency.	- Developing countries.	- Approximately **USD 200 million** raised as at April 2008.
Global Energy Efficiency and Renewable Energy Fund (GEEREF)						
• Trust fund	- Low cost risk capital provided for proven technologies.	- Priority to renewable energy and energy efficiency projects with commercial application - Focus on projects with proven technology.	- Diffusion/ Deployment	- Proposed by European Commission, to be operated as regionally based public/private professionally managed funds.	- Developing economies.	- **EUR 1 billion** (leveraged from EUR 100 million grant).
• Asian Pacific Partnership for Clean Energy and Development	- Demonstration of new clean energy technologies.	- Focus groups on a variety of key clean energy technologies	- Demonstration	- Administered by task groups led by partner countries: Australia, US, Canada, China, Japan, India and Korea.	- AP6 partner countries	- **USD 100 million** for period 2006-2011 with further commitments from US uncertain.
Non-funding Existing International Mechanisms						
United Nations organisations						
• UNEP	- Policy advice; research; small loans.	- Renewable energy and energy efficiency projects. - Rural Energy Enterprise Development (REED) focuses on supporting new businesses in Brazil, China and Africa. - Sustainable Energy Finance Initiative (SEFI) to inform financiers.	- Capacity building - Enabling environment	- Managed within UNEP.	- Developing & transition economies.	- **~USD 150-200 million** for all activities including energy related.
• UNIDO	- Networks; policy	- Energy efficiency and GHG emission	- Capacity	- Managed by	- Developing	- **USD 18 million**

National Cleaner Production Centers	advice; capacity building; information dissemination.	abatement projects.	building - Enabling environment	UNIDO/UNEP with local country support.	economies.	mainly funded by Austria and Switzerland.
• UN Expert Group on Technology Transfer	- Knowledge dissemination and support, for example, on technology needs assessments.	- Stimulating technology transfer.	- Enabling environment	- Established under COP to UNFCCC and reports to SBSTA.	- Developing & transition economies.	- **USD 400,000.**
International NGOs						
• Clean Technology Initiative	- Networks; capacity building; information dissemination.	- Overcoming market barriers to renewable energy and energy efficiency.	- Capacity building - Enabling environment	- Series of panel discussions e.g. Private Financing Advisory Network	- Global.	- **EUR 800,000.**
• Renewable Energy & Energy Efficiency Partnership	- Policy advice; networks; information dissemination.	- Overcoming barriers to renewable energy and energy efficiency.	- Capacity building - Enabling environment	- International steering committee with contributions to international policy dialogues through experts.	- Developing & transition economies.	- Not specified.
• Renewable Energy Policy Network for the 21st Century (REN21)	- Policy advice; networks; information dissemination.	- Supporting deployment of renewable energy.	- Capacity building - Enabling environment	- International steering committee with contributions to international policy dialogues through experts.	- Global.	- Not specified.
Successful Non-Climate Change Related International Funding Mechanisms						
Multilateral Fund to Montreal Protocol						
• Multilateral Fund	- Access to finance (e.g. concessional lending); technical assistance; capacity building.	- Reverses production of ozone depleting substances. - Covers incremental costs.	- Diffusion/ Deployment	- Implementing agencies: World Bank, UNEP, UNDP, and UNIDO. - World Bank responsible for disbursing almost half of the total funding (45%).	- Developing countries.	- **USD 2 billion** over life of Fund (since 1991).
Global Fund to fight AIDS, Tuberculosis and Malaria						
• Global Fund	- Access to finance for projects which fight	- Funding is conditional on results. - Eligible projects should be able to be	- Diffusion/ Deployment	- Independent governing council, but support from	- Developing countries.	- **USD 4.7 billion** has been raised

	aids, tuberculosis, and malaria. - Explicit aim for projects not to have capacity building as a sole focus.	scaled up. - Complement existing regional and national programs. - Proven and effective interventions. - Focused on creating partnerships within projects. - Advanced market commitments on some drugs.	- Early stage commercialisation	in-country public/private/NGO partnerships to carry out projects.		2001 to 2008 (public and private donations) - Assists negotiate some debt swaps.
International Finance Facility for Immunisation						
• IFFIm	- Provision of front-loaded debt to projects and programs which prevent deaths where vaccines are available.	- Focused on providing sustainable and predicable cash flows.	- Diffusion/ Deployment	- Managed by two independent boards. - World Bank (IBRD)is Treasury Manager for IFFIm. - Relies on public private partnerships to implement operations (GAVI Alliance).	- Developing countries.	- USD 4 billion raised to date from bond issuances from donor countries.
Proposed International Funding Mechanisms						
Proposals discussed at second session of AWG-LCA in June 2008 following Bali Action Plan						
• Multilateral technology acquisition /cooperation fund	- International funding mechanism which promotes technology cooperation and creates enabling environments for private investment.	- Disseminate existing technologies. - Purchase licences of patented technologies (Brazil). - Provide incentives to private sector (China). - Support R&D. - Remove barriers. - Fast-track development of renewable technologies (AOSIS).	- Early stage commercialisation - Diffusion/ Deployment	- Proposed mechanism to be managed as a new subsidiary body under Conference of Parties to UNFCCC (China).	- Developing countries.	- See Annex I above.
• Dedicated Venture Capital Fund	- Venture capital finance dedicated to clean energy projects.	- Focused on promising new clean energy technologies which have not yet been market proven (China and India).	- Early stage commercialisation	- Support venture capital based on public private partnerships (China).	- Developing countries	- See Annex I above.

Proposal discussed by World Bank in *Clean Energy and Development* (World Bank, 2006)						
• Clean Energy Financing Vehicle	- Blend up front grants and carbon finance. Funding could be provided on concessional basis with repayment from carbon finance credits.	- Buy down cost of new technologies and energy infrastructure. - Mitigate technology risks. - Fund efficiency improvement of existing assets. - Strategically advance research in new clean technologies for commercial application.	- Early stage commercialisation - R&D	- Modalities of execution could include public private partnerships. - Output-based aid approach.	- Developing countries.	- Gap of USD 10 – 15 billion annually identified.
UK Carbon Trust's proposal for Low Carbon Technology and Innovation Diffusion Centres						
• Innovation Diffusion Centres	- Centres focused on overcoming early stage commercialisation of new technologies and market barriers.	- Applied R&D. - Acceleration of promising technologies. - Business development advice to start ups. - Deployment of existing energy efficiency measures. - Early stage funding for low carbon ventures. - Capacity building. - Policy advice on market barriers.	- Early stage commercialisation - R&D - Diffusion/ Deployment	- Five diffusion centres located in developing countries with an umbrella governing council.	- Developing countries.	- Total investment of between **USD 1 billion to USD 2.5 billion** over next 5 years.
Clean Energy Group's proposal for a "hub and spoke" distributed innovation centre						
• "Hub and spoke" innovation centre	- Distributed innovation strategy based on "hub and spoke" model	- At least five funding tools could be used to spur technological innovation within the "spokes" or technology nodes of this new organisation: o Commissioned projects o Competitive projects o Open innovation, challenge and prize tools o Information technology o Policy and finance development	- Early stage commercialisation - R&D - Diffusion/ Deployment	- "Hub and spoke" model where a central management comes from an independent non-profit global institution under the auspices of World Bank, UNFCCC, or IEA. - Regional and national partnerships built to carry out projects within a particular technology specialisation.	- Developing countries	- Not specified

REFERENCES

Addison, T. and Chowdhury, A. (2003), A Global Lottery and a global premium bond', UNU WIDER Discussion Paper, available at http://www.wider.unu.edu/publications/working-papers/discussion-papers/2003/en_GB/dp2003-080/

African Development Bank (2008), Clean Energy Investment Framework for Africa, ADB/BD/WP/2007/148/Rev.1

Asian Development Bank (2007), Toward a New Asian Development Bank in a New Asia: Report of the Eminent Persons Group to The President of the Asian Development Bank, Manila, Philippines

Climate Strategies (2008), Energy and Climate, Opportunities for the G8, paper prepared for Cambridge Centre for Energy Studies

Fisher, C. and R.G. Newell (2007), Environmental and Technology Policies for Climate Mitigation, Discussion Paper 04-05, Resources for the Future, Washington, USA

Gallagher, K.S., J. P. Holdren and A.D. Sagar (2006), Energy-Technology Innovation, Annual Review of Environment and Resources, 31(1):193–237

GAO (2008), Experts opinion on the Economics of Policy Options to Address Climate Change, report 08-605 to Congressional Requesters, Washington, USA

Global Environment Facility (2006), GEF Strategy to Enhance Engagement with the Private Sector, GEF Council Meeting June 6-9, 2006, Agenda Item 23, GEF/C.28/14

Global Subsidies Initiative (2008), Getting to the Bottom of the Well: A proposal to Reveal the Scale, Pattern and Impacts of Subsidies to Fossil Fuels, unpublished

Grubb (2004), Technology Innovation and Climate Change Policies: An Overview of Issues and Options, Keio Economic Studies, Vol. 41, No. 2, pp. 103 - 132

IEA (2007), World Energy Outlook, Paris, France

IEA (2008), Energy Technologies Perspectives, Scenarios & Strategies to 2050, Paris, France

IPCCC (2007), Summary for Policymakers. In: Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A.Meyer (Eds)], Cambridge University Press, Cambridge, United Kingdom and New York, USA

Ketkar, S. and Ratha, D (2005), Recent Advances in Future Flow Securitization, The Financier, Vol 11/12

Müller, B. (2008), ' International Adaptation Finance: The Need for an Innovative and Strategic Approach', Oxford Institute for Energy Studies, EV42

Müller B. and Hepburn, C. (2006), 'IATAL — an outline proposal for an International Air Travel Adaptation Levy', Oxford Institute for Energy Studies, EV 36

Murphy, L and P. Edwards (2003), Bridging the Valley of Death: Transitioning from Public to Private Sector Financing, National Renewable Energy Laboratory, Golden, USA

Newell, R.G. (2007), Climate Technology Deployment Policy, Issues Brief 10, Resources for the Future, Washington, USA

OECD (2007), Handbook for Appraisal of Environmental Projects Financed from Public Funds, EAP Task Force, Paris, France

OECD (2008), Environmental Outlook to 2030, Paris, France

OECD (forthcoming), Facilitating Trade in Selected Climate Change Mitigation Technologies in the Energy Supply, Buildings and Industry Sectors, Joint Working Party on Trade and Environment, Paris, France

OECD/IEA (forthcoming), Measurement, Reporting and Verification for Mitigation Support: Finance, Technology, and Capacity Building, draft Annex 1 working group paper

Presentations at 'Workshop on investment and financial flows to address climate change', June 2008, Second session of AWG-LCA, SB 28

Reisen, H. (2004), 'Innovative Approaches to Funding the Millennium Development Goals', OECD Development Centre Policy Brief No. 24

Soros, G. and Stiglitz, J. (2002). 'Soros on Globalization. Appendix on special drawing rights proposal'. New York & London

Stern, N. (2006), The Stern Review on the Economics of Climate Change, Cambridge, United Kingdom

Stern, N. (2008), Key Elements of a Global Deal on Climate Change, the London School of Economics and Political Science, London, United Kingdom

UNEP/SEFI (2005), Public Finance Mechanisms to Catalyze Sustainable Energy Sector Growth, UNEP DTIE, Paris, France

UNFCCC (2007), Bali Action Plan, Decision -/CP.13, Bonn, Germany

NFCCC (2007), Investment and Financial Flows to Address Climate Change, Bonn, Germany

World Bank (2006), Clean Energy and Development: Towards an Investment Framework, Washington DC