

IX. POTENTIAL FOR ENHANCED INVESTMENT AND FINANCIAL FLOWS

9.1. INTRODUCTION

719. This chapter provides an overview of the key findings of the paper and considers how future investment and financial flows can be shifted, optimized and scaled up to meet the needs for mitigation and adaptation to climate change.

9.2. KEY FINDINGS

720. The *estimated additional investment and financial flows needed in 2030* to address climate change is large compared with the funding currently available under the Convention and its Kyoto Protocol, but small in relation to estimated global GDP (0.3–0.5 per cent) and global investment (1.1–1.7 per cent) in 2030.

721. In many sectors the lifetime of capital stock can be thirty years or more. The fact that total *investment in new physical assets is projected to triple between 2000 and 2030* provides a window of opportunity to direct the financial and investment flows into new facilities that are more climate friendly and resilient. The investment decisions that are taken today will affect the world's emission profile in the future.

722. When *considering means to enhance investment and financial flows to address climate change in the future*, it is important to focus on the role of private-sector investments; as they constitute the largest share of investment and financial flows (86 per cent). Although ODA funds are currently less than 1 per cent of investment globally, ODA represents a larger share of the total investments in some countries such as the LDCs (6 per cent).

723. Particular attention will need to be given to *developing countries*, because although they currently account for only 20–25 per cent of global investments, their expected rapid economic growth means that they will require *a large share of investment and financial flows*.

724. With *appropriate policies and/or incentives*, a substantial part of the additional investment and financial flows needed could be covered by the currently available sources. However, *improvement in, and an optimal combination of, mechanisms*, such as the carbon markets, the financial mechanism of the Convention, ODA, national policies and, in some cases, *new and additional resources*, will be needed to mobilize the necessary investment and financial flows to address climate change.

725. The *carbon market*, which is already playing an important role in shifting private investment flows, would have to be significantly expanded to address needs for additional investment and financial flows. *National policies* can assist in shifting investments and financial flows made by private and public investors into more climate-friendly alternatives and optimize the use of available funds by spreading the risk across private and public investors. *Additional external funding for climate change mitigation and adaptation will be needed*, particularly for sectors in developing countries that depend on government investment and financial flows.

726. If the funding available under the *financial mechanism* of the Convention remains at its current level and continues to rely mainly on voluntary contributions, it will not be sufficient to address the future financial flows estimated to be needed for mitigation and adaptation.

727. Several *other options* for generating additional funds have been suggested. Some of these options, such as the expansion of the carbon market and the auction of allowances for emissions from international bunkers, could generate revenues commensurate with the additional needs.

9.2.1. OVERVIEW OF CURRENT INVESTMENT AND FINANCIAL FLOWS

728. As indicated in [CHAPTER III](#) and [TABLES 1–4-ANNEX V](#), most investment (75–80 per cent) occurs in Annex I Parties. Globally, corporations are responsible for about 60 per cent of total investment, but this varies from 50 to 75 per cent in different regions, with Africa at the low end and developing Asia at the high end. Households, individuals, farmers and small businesses are responsible for 26 per cent of global investment, ranging from 20 per cent in developing countries to 30 per cent in OECD countries. Governments are responsible for 14 per cent of total investment, ranging from 10 per cent in some regions to 25 per cent in Africa.

729. Globally, about 60 per cent of total investment comes from domestic sources, and about 20 per cent each from FDI and international debt. The domestic share ranges from 20 per cent in the EU to 90 per cent in Africa and the Middle East. ODA funds less than 1 per cent of investment globally, but this rises to over 2 per cent in Africa and over 6 per cent in LDCs.

730. In almost every sector and region, domestic sources account for most of the funds invested. FDI tends to be invested in mining, including oil and gas production;

manufacturing; and financial services. Only small amounts of FDI are invested in agriculture, forestry and construction. ODA is invested in energy and water supply in LDCs.

731. The Convention and its Kyoto Protocol have established mechanisms that provide investment and financial flows for adaptation and mitigation. These include the CDM, JI, the GEF, LDCF, SCCF, and the Adaptation Fund of the Kyoto Protocol. The [TABLE IX-59](#) provides an overview the current investment and financial flows generated by these mechanisms.

Table IX-59. Overview of current sources of financial flows relevant to climate change

Sources	Amount (in millions of United States dollars)	Notes
Mitigation		
Clean development mechanism	2006 USD 5,259	Value of trades during 2006
	2006 USD 947 to 1,572	Value of estimated annual emission reductions for projects registered during 2006
	2006 USD 1,569 to 2,602	Value of estimated annual emission reductions for projects that entered the pipeline during 2006
	2006 USD 6,939	Investment by projects registered during 2006
	2006 USD 26,467	Investment by projects that entered the pipeline during 2006
Joint implementation	2006 USD 140	Value of trades during 2006
	2006 USD 132 to 266	Value of estimated annual emission reductions for projects that entered the pipeline during 2006
	2006 USD 6,269	Investment by projects that entered the pipeline during 2006
Carbon funds	2006 USD 6,996	Subscribed capital at end of 2006
	2006 USD 2,110	Increase in subscribed capital during 2006
Global Environment Facility (GEF)	3,326.6	Cumulative funding allocated since GEF inception for operational programmes (OPs) 5, 6, 7, 11, EA, STRM and joint OPs. Pilot phase and three replenishment periods and six projects approved under the fourth GEF replenishment (GEF 4) as at June 2007
	990	Targeted allocations as per GEF 4 to be spent between 2006 and 2010
Adaptation		
GEF strategic priority "Piloting an Operational Approach to Adaptation (SPA)"	50 (over 3 years)	Pilot to be evaluated
Least Developed Countries Fund (LDCF)	160 (pledged)	
Special Climate Change Fund (SCCF)	67 (pledged)	Adaptation part only
Adaptation Fund (AF)	2006 USD 80 – 300	Estimated annual revenue during 2008 to 2012 from 2 per cent share of proceeds levy on CERs issued

Source: CHAPTERS VII and VIII.

Note: Activity under the clean development mechanism and joint implementation is relatively recent and growing rapidly, so data for 2006 are presented.

732. The financial mechanisms of the Convention, including the LDCF and SCCF, depend on replenishments through voluntary contributions from donors, and in particular, on how much Annex II Parties allocate to the financial mechanisms in accordance with their obligations in Article 4, paragraph 3, of the Convention. The target for GEF 4 is USD 990 million over 2006 to 2010. The LDCF and SCCF are replenished on an ongoing basis with total pledges to date amounting to USD 227 million.

733. The revenue received by the Adaptation Fund depends on the quantity of CERs issued and the price of CERs. Assuming annual sales of 300 million to 450 million CERs and a market price of USD 24 (range of USD 14–34) the Adaptation Fund would receive USD 80 to 300 million per year for 2008 to 2012.

734. The current and projected size of the international carbon markets is analysed in detail in CHAPTER VII and summarized in TABLE IX-60.

9.2.2. KEY FINDINGS ON INVESTMENT AND FINANCIAL FLOWS NEEDED FOR MITIGATION IN 2030

735. It is estimated that global additional investment and financial flows of USD 200–210 billion will be necessary in 2030 to return global GHG emissions to current levels (see TABLES IX-61–63). In particular:

- *For energy supply*, investment and financial flows would be reduced by about USD 59 billion for fossil fuel supply and by USD 7 billion for power supply owing to increased investment in energy efficiency and biofuels of about USD 158 billion. Investment in fossil fuel supply is expected to continue to grow, but at a reduced rate. About USD 148 billion out of USD 432 billion of projected annual investment in power sector is predicted to be shifted to renewables, CCS, nuclear energy and hydropower. Currently most of the power sector investment is made by government-owned or private, usually regulated, electric utilities, and is made domestically in most regions;
- *For industry*, additional investment and financial flows are estimated at about USD 36 billion. More than half of the additional investment is for energy efficiency, one-third for installation of CCS and the rest for reduction of non-CO₂ gases. Implementation of these measures is likely to require government policies, but the investment would come mostly from the private sector;
- *For buildings*, additional investment and financial flows amount to about USD 51 billion. Currently, commercial and residential energy efficiency investment comes from building owners and is financed domestically;
- *For transportation*, additional investment and financial flows amount to about USD 88 billion. Efficiency improvements for vehicles and increased use of biofuels are likely to require government policies, but the investment would come mostly from the private sector;
- *For waste*, additional investment and financial flows are estimated at about USD 1 billion. Capture and use of methane from landfills and wastewater treatment could reduce emissions by about 50 per cent in 2030, mainly in non-Annex I Parties;
- *For agriculture*, additional investment and financial flows are estimated at about USD 35 billion. Non-CO₂ emissions from agriculture production could be reduced by about 10 per cent at a cost of USD 20 billion in 2030. With a concerted international effort and an annual investment of about USD 15 billion, agroforestry could be expanded at a rate of about 19 million ha per year by 2030;
- *For forestry*, additional investment and financial flows are estimated at about USD 21 billion. An indicative estimate of the cost of reducing deforestation and forest degradation in non-Annex I Parties to zero in 2030 is USD 12 billion. The estimated investment and financial flows in 2030 to increased GHG removals by sinks through sustainable forest management is USD 8 billion and the estimated investment and financial flows needed for afforestation and reforestation is USD 0.1–0.5 billion;
- *For technology R&D and deployment*, additional investment and financial flows are estimated at about USD 35–45 billion. Government spending on energy R&D worldwide has stagnated, while private sector spending has fallen. Government budgets for energy R&D and support for technology deployment need to double, increased expenditures in 2030 are expected at USD 10 and 30 billion respectively.

Table IX-60. Current and projected size of the international carbon markets

Year	Market	Sales (2006 USD billion per year)	Quantity (Mt CO ₂ eq)	Average price and range (2006 USD/t CO ₂ eq)
Trading activity				
2006	Clean development mechanism (CDM)	5	475	11 (6 – 27)
	Joint implementation (JI)	<1	16	9
	European Union emissions trading scheme allowances	24	1,101	22 (5 – 40)
Compliance needs				
2010	Compliance by Parties to the Convention that are also Parties to the Kyoto Protocol with commitments inscribed in Annex B to the Kyoto Protocol (mainly CDM and JI)	10 – 15 (5 – 25)	400 – 600 excluding Canada	24 (14 – 34)
2030	Purchases by Parties currently included in Annex I to the Convention			
	Low estimate	10 – 15 (5 – 25)	400 – 600	24 (14 – 34)
	High estimate	100 (90 – 125)	4,000 – 6,000	24 (14 – 34)

Table IX-61. Investment for energy supply under the reference and mitigation scenarios in 2030 (billions of United States dollars)

Sector	Global			Non-Annex I Parties		
	Reference scenario	Mitigation scenario	Additional investment	Reference scenario	Mitigation scenario	Additional investment
Fossil fuel supply						
Coal	20	12	-8	13	8	-5
Oil	154	125	-29	85	69	-16
Natural gas	148	126	-22	58	47	-11
Total	322	263	-59	156	124	-32
Power supply						
Coal-fired generation	75	24	-51	40	13	-27
Oil-fired plants	2	1.5	-1	1	1	0
Gas-fired plants	39	36	-3	17	13	-4
Nuclear energy	15	40	25	3	14	11
Hydropower	37	59	22	28	46	18
Renewable	41	79	38	12	30	18
CO ₂ capture and storage facility coal-fired plants	-	40	40	0	21	21
CO ₂ capture and storage facility gas-fired plants	-	23	23	0	6	6
Transmission and distribution	231	130	-101	149	101	-48
Total	439	432	-7	251	245	-6

Abbreviations: Non-Annex I Parties = Parties not included in Annex I to the Convention

Table IX-62. Additional investment for emission reductions under the mitigation scenario for related sectors in 2030 (billions of United States dollars)

Sector	Additional investment	
	Global	Non-Annex I Parties
Industry		
Electrical equipment	10.8	3.8
Stationary fuel consuming equipment	8.7	3.1
CO ₂ capture and storage	14.1	11.0
Non-CO ₂ gases	2.0	1.2
Total	35.6	19.1
Buildings		
Electrical equipment	42	10.0
Stationary fuel consuming equipment	8.8	4.0
Total	50.8	14.0
Transportation		
Hybrid vehicles and efficiency improvement in vehicles	78.7	31.5
Biofuel	9.2	4.0
Total	87.9	35.5
Waste total	0.9	0.6

Abbreviations: Non-Annex I Parties = Parties not included in Annex I to the Convention

Note: Additional investments are calculated based on the capital costs of different measures to achieve the emission reductions projected for the mitigation scenario as compared with the reference scenario.

Table IX-63. Additional investment and financial flows under the mitigation scenario for forestry and agriculture in 2030 (billions of United States dollars)

Sector	Global	Non-Annex I Parties
Agriculture		
Non-CO ₂ gases ^a	20	13
Agroforestry	15	N.A. ^b
Grassland management	N.A.	N.A.
Forestry		
Reduced deforestation ^{a,c}	12	12
Forest management ^{a,d}	8	8
Afforestation and reforestation	0.12 – 0.50	0.1 – 0.4

Abbreviations: Non-Annex I Parties = Parties not included in Annex I to the Convention

Note: Additional investments are calculated based on the marginal costs of the measures to achieve the emission reductions projected for the mitigation scenario. Additional financial flows are calculated based on the marginal costs of the measures to achieve the emission reductions projected for the mitigation scenario.

^a Financial flows, minimum investments required.

^b Only global estimates are currently available.

^c Reducing emissions from deforestation in developing countries as defined in SBSTA Agenda Item 5.

^d Part of this investment might also be considered in Reduced deforestation.

Table IX-64. GHG emission reductions and additional investment and financial flows

	Global		Non-Annex I Parties			
	Emission Reduction Gt CO ₂ eq	Additional investment and financial flows in 2030 USD billion	Emission Reduction Gt CO ₂ eq	Additional investment and financial flows in 2030 USD billion	Per cent of global emission reduction	Per cent of global additional investment and financial flows
Power supply	9.4	148.5	5.0	73.4	53	49
Industry	3.8	35.6	2.3	19.1	60	54
Transport	2.1	87.9	0.9	35.5	42	40
Building	0.6	50.8	0.3	14.0	48	28
Waste	0.7	0.9	0.5	0.6	64	64
Agriculture	2.7	35.0	0.4	13.0	14	37
Forestry	12.5	20.7	12.4	20.6	100	99
Total	31.7	379.5	21.7	176.2	68	46

Note: The data should not be used to compare the cost per ton of CO₂e reduced by sector. The costs for reducing electricity use in buildings and industry are reported in those sectors, while the emission reductions are counted in the power supply sector. (see also TABLES IV-11 and -39).

736. Mitigation actions are expected to be more cost-effective in non-Annex I Parties. TABLE IX-64 shows that 68 per cent of the projected global emission reductions occur in non-Annex I Parties while only 46 per cent of the additional investment and financial flows are needed in non-Annex I Parties. This reflects mitigation opportunities associated with the rapid economic growth projected for large developing countries, the relatively inefficient energy use, and the prevalence of low cost mitigation opportunities in the forestry sector.

737. The entities that make the investment decisions are different in each sector, and the policy and/or financial incentives needed will vary accordingly. For example:

- Increased energy efficiency is best achieved through appropriate policies or regulations (the investments are internal and often incremental, and have short payback periods, but adoption is hampered by recognized barriers);
- Shifting investment in efficient motor vehicles needs incentives to:
 - Introduce hybrid vehicles such as vehicle purchase subsidies, regulatory standards and higher taxes on the least efficient vehicles;
 - Expand the use of biofuels such as larger R&D programmes and minimum requirements for biofuels in conventional fuel blends;
- Shifting investment in the power sector to CCS and low GHG emitting generation technologies will need both policies and financial incentives which make these technologies economically more attractive

than high GHG emitting technologies. This requires large R&D programmes, incentives for large scale demonstration plants, national or international policy frameworks, such as carbon markets, renewable portfolio standards or higher feed-in tariffs, loan guarantees to reduce the cost of capital, financial penalties on carbon emissions;

- Financial incentives will be needed to achieve significant reductions in emissions through reduced deforestation and forest management.

738. Currently most of the investment in mitigation measures is domestic; however, ODA plays an important role in Africa and the LDCs. With appropriate policies and/or incentives, a substantial part of the additional investment and financial flows needed could be covered by the current sources. However, there will be a need for new and additional external sources of funds dedicated to mitigation.

739. The share of the GEF, as an operating entity of the financial mechanism of the Convention, of total multilateral and bilateral funding between 1997 and 2005 is 1.6 per cent.

740. The carbon market and policies to promote renewables are already playing an important role in shifting investment flows. This is indicative of how quickly investment flows can respond to changes in policies and incentives.

741. It is estimated that the CDM project activities that entered the pipeline in 2006 will generate investment of about USD 25 billion, of which approximately 50 per cent represents capital invested in unilateral projects by host

country project proponents. Renewable energy and energy efficiency projects account for 90 per cent of the overall investment.

742. The supply of Kyoto units will be abundant compared with the level of compliance demand for the period 2008–2012. The voluntary market could represent about 15 per cent of the total carbon market.

743. The low estimate of compliance demand by Annex I Parties in 2030 is a market of USD 5–25 billion per year, which is basically a continuation of the current flow of projects. The high estimate of compliance demand is a market of USD 100 billion per year; to meet this demand, a large fraction of the potential emission reductions, from all existing and some new categories of projects, would need to earn emission reduction credits.

744. All Parties need to adopt *climate change policies*. International coordination of policies in an appropriate forum is often effective. Areas where international coordination would be beneficial include:

- Technology R&D and deployment;
- Energy efficiency standards for internationally traded appliances and equipment.

745. Funding from external sources will play an important role in helping developing countries formulate and implement national policies.

9.2.3. KEY FINDINGS ON INVESTMENT AND FINANCIAL FLOWS NEEDED FOR ADAPTATION IN 2030

746. The global cost of adaptation to climate change is difficult to estimate, largely because climate change adaptation measures will be widespread and heterogeneous. More analysis of the costs of adaptation at the sectoral and regional levels is required to support the development of an effective and appropriate international response to the adverse impacts of climate change. Nevertheless it is clear that a large amount of new and additional investment and financial flows will be needed to address climate change adaptation.

747. Estimated overall *additional investment and financial flows needed for adaptation in 2030* amount to several tens of billion United States dollars (see TABLE IX-65).

In particular:

- About USD 14 billion in investment and financial flows are estimated to be needed for *agriculture, forestry and fisheries* (AFF);
 - About USD 11 billion is estimated to be needed for production and processing, most of which is expected to be financed by domestic private sources;
 - About USD 3 billion is estimated to be needed for R&D and extension activities. Based on current trends, it can be expected that public sources of funding will need to cover a large part of this additional need.
- The additional investment needed in *water supply* infrastructure in 2030 is estimated at USD 11 billion, 85 per cent of which will be needed in non-Annex I Parties. About 90 per cent of the cost for all aspects of water resource use is currently covered by public domestic funding sources and 10 per cent by external public funding sources, and this pattern is unlikely to change significantly by 2030;
- The costs of treating the increased cases of *diarrhoeal disease, malnutrition and malaria* due to climate change are estimated at USD 5 billion in 2030. This need for additional financial flows will occur solely in developing countries and corresponds to the current annual ODA for health. The additional cost is likely to be borne mainly by the families of those affected. Where private individuals cannot cope with the additional cost of treatment, additional public financing will be necessary;
- The investment needed in 2030 for *beach nourishment and dykes* is estimated to be about USD 11 billion. About half of the global investment would be needed in non-Annex I Parties. Efforts to protect *coastal areas* from coastal storms and sea level rise are typically undertaken by governments. The necessary public resources for coastal zone adaptation are likely to be available in developed and some developing countries. However, deltaic regions, particularly the large coastal deltas in Asia and Africa as well as the small island developing States, may have significant problems in raising the required investment and financial flows to respond to sea level rise;
- The additional investment needed to adapt *new infrastructure* vulnerable to climate change is estimated at USD 8–130 billion, which is less than 0.5 per cent of global investment in 2030. The extra cost is likely to be met in the same manner as the overall infrastructure cost.

748. The change in investment and financial flows for adaptation that will need to occur in developed and developing countries varies by sector. *A significant share of the additional investment and financial flows will be needed in non-Annex I Parties (USD 28–67 billion). See TABLE IX-65.*

749. *Private sources* of funding can be expected to cover a portion of the adaptation costs in sectors (such as *AFF and infrastructure*) with privately owned physical assets, in particular in developed countries. However, public resources will be needed to implement policies or regulations to encourage the private investment of private resources in adaptation measures, especially in developing countries. Public domestic resources will be needed to cover adaptation costs related to climate change impacts on public infrastructure in all countries.

750. *Additional external public funding is likely to be needed for adaptation measures.* Such additional funding will be needed in particular for sectors and countries that are already highly dependent on external support, for example in the health sector in LDCs, or for coastal infrastructure in developing countries that are highly vulnerable to sea level rise. *Current mechanisms and sources of financing are limited and it is likely that new sources of funding will be required.*

751. *The funds managed by the GEF* that are available for adaptation projects, including the SPA of the GEF Trust Fund, the SCCF and the LDCF, amount to over USD 275 million. Since 2005 the GEF has provided USD 110 million for adaptation projects.

752. *The revenue received by the Adaptation Fund* under the Kyoto Protocol depends on the quantity of CERs issued and their price. Assuming annual sales of 300–450 million CERs and a market price of USD 24 (range USD 14 to 34),

the Adaptation Fund would receive USD 80–300 million per year for the period 2008–2012. Funding for the Adaptation Fund post 2012 depends on the continuation of the CDM and the level of demand in the carbon market. Assuming a share of proceeds for adaptation of 2 per cent continues to apply post 2012, the level of funding could be USD 100–500 million per year in 2030 for a low demand by Annex I Parties for credits from non-Annex I Parties, and USD 1–5 billion per year for a high demand. This will still be less than the amount likely to be needed.

753. *Bilateral contributions* for adaptation are estimated to have been in the order of USD 100 million per year between 2000 and 2003.

754. *National policies* could play an important role in ensuring that the use of resources for adaptation purposes, both public and private, is optimized. In particular, there is a need for:

- Domestic policies that provide incentives for private investors to adapt new physical assets to the potential impacts of climate change;
- National policies that integrate climate change adaptation in key line ministries;
- Local government adaptation policies in key sectors.

755. Although the additional investment and financial flows needed for adaptation described above are significant, *the value of the climate change impacts that those expenditures would avoid could be larger.* This study does not estimate the total value of impacts avoided by adaptation to climate change, so it does not determine whether benefits of avoided damage exceed the adaptation costs. Existing estimates of the future damage caused by climate change vary substantially; however, available studies yield two important common findings:

Table IX-65. Estimated additional investment and financial flows needed for adaptation in 2030 (billions of United States dollars)

Sector	Global	Non-Annex I Parties
Agriculture, forestry and fisheries	14	7
Water supply	11	9
Human health	5	5
Coastal zones	11	5
Infrastructure	8 to 130	2 to 41

- Damage increases with the magnitude of climate change. The more that the climate changes, typically measured as the increase in global mean temperature, the greater the damage;
- Investment needs for adaptation would almost certainly increase substantially in the latter decades of the twenty-first century. They will be particularly high if no mitigation measures are implemented.

756. On average, developing countries suffer more damage as a percentage of their GDP than developed countries, which implies that damages and benefits are not distributed evenly.

9.2.4. PRIORITIES IDENTIFIED BY DEVELOPING COUNTRY PARTIES IN THE UNFCCC PROCESS

757. In addition to the needs identified above, when tailoring incentives for financial and investment flows it is important to take into account priority areas for climate change mitigation and adaptation identified by non-Annex I Parties under the Convention process. Although these priorities have been identified in various contexts and do not constitute a comprehensive view of non-Annex I Parties priorities and needs, they complement the discussion of investment and financing needs.

758. In their INCs two-thirds of non-Annex I Parties reported energy supply measures as a priority, and a majority of the mitigation project proposals in the energy sector submitted by Parties in their INCs involve switching to renewable sources of energy. Other mitigation measures identified as priorities include switching to less carbon intensive fuels, installing more efficient industrial boilers, improving cooking stoves for the residential/commercial sector, promoting electric and compressed natural gas vehicles, reducing waste generation at source, making changes in cattle management practices and promoting forest conservation and restoration.

759. Adaptation measures related to water supply were reported as a priority in all regions. Measures proposed in this sector are aimed at increasing water supply, improving water management and improving flood, drought, and water level monitoring. Other adaptation measures identified as priorities by Parties include the development of resistant crop and livestock varieties and salt-tolerant fish species. Measures related to the prevention of soil erosion and to the integrated management of coastal areas were also highlighted, along with the need for early warning systems for extreme events and measures for flood prevention. Development of health infrastructure and

protection of tourism infrastructure were also identified as priorities. The need for an integrated approach to adaptation was emphasized by Parties.

760. With regard to the adverse impacts of response measures, measures prioritized by Parties include the development of low GHG emitting technologies, financial risk management such as commodity price hedging and economic shock funds, and the development of key infrastructure needed to diversify economic activity.

9.3. KEY FACTORS AND OPTIONS DETERMINING FUTURE INVESTMENT AND FINANCIAL FLOWS

761. The previous chapters illustrate that addressing climate change will require significant changes to in patterns of investment and financial flows. Such changes fall into three categories:

- *Shift investments and financial flows* made by private and public investors to more sustainable climate-friendly alternatives, for example, by redirecting investments from traditional energy supply sources and technologies to low GHG emitting ones;
- *Scale-up* international private and public capital dedicated to investments and financial flows in mitigation or adaptation activities or technologies, for example by expanding the carbon market, by increasing contributions from Annex II Parties or by identifying new sources of funding;
- *Optimize the allocation of the funds* available by spreading the risk across private and public investors, for example by providing incentives for private investment in the early deployment of new technologies or by improving the capacity of the insurance market.

9.3.1. SHIFT INVESTMENTS AND FINANCIAL FLOWS

762. Substantial shifts in investment patterns will be required to mitigate and adapt to climate change. About half of these shifts should occur in developing countries, which will require incentives and support for policy formulation and implementation.

763. Shifting investment is particularly important for the power supply. About USD 148 billion needs to be shifted from fossil-fired generation to renewables, CCS, nuclear energy and hydropower. Currently investment in the power sector is mostly domestic (about 70 per cent) with significant

international FDI and international borrowing in some regions. Shifting domestic investments into more climate-friendly alternatives may require national policies and/or financial incentives.

764. Investment in improved efficiency by energy consumers and biofuel (USD 158 billion) would reduce the investment required in energy supply by USD 67 billion in 2030. Such a shift will require appropriate policies to encourage consumers to implement energy efficiency measures.

765. Adaptation in the infrastructure and AFF sectors will require a shift in public- and private-sector investment patterns and associated production activities. In both sectors, investment in physical assets will need to be shifted towards assets that are less vulnerable to the adverse impacts of climate change. The shift can be characterized, for example, by a change in location, design, building material or primary input in the case of manufacturers. The optimal shift will occur only with adequate policies and incentives. In the case of poor populations, direct financial support may also be required.

766. Shifting investments into high-cost, low GHG emitting technologies poses additional challenges. Since the risks and costs are higher than those of conventional technologies, private investors need financial incentives or other arrangements to enable them to earn a comparable risk-adjusted return. This means it will be necessary, in particular in developing countries, to scale up funding (in the form of grants, concessional loans, promotional programmes, demonstration projects, etc.) to shift the investments (see CHAPTER IX.3.2 on scaling up funding).

9.3.1.1. SHIFTING PRIVATE INVESTMENTS AND FINANCIAL FLOWS

767. Private investors pursue opportunities to earn risk-adjusted returns that meet their investment preference. As a consequence of the increasing public and government attention to climate change, there has been an increase in private investment in the area – the opportunities to make a profit are clearer and more immediate. More attention is also being paid to the risks of climate change – the need to consider the impacts of climate change on the projected returns from proposed investments. While these shifts in private investment are most welcome, they are not sufficient to offset the much larger, continuing investments in traditional, long-lived, fossil fuel consuming, GHG emitting facilities.

768. *Governments* – primarily those at the national level – set the rules for the markets in which investors seek profits. If current market rules are failing to attract – or drive – private investors into lower GHG emitting, more climate-proof alternatives, there are a variety of steps governments can take to help address these market failures, including:

- *Overcoming policy-based barriers to entry* by:
 - (1) requiring regulated, monopoly providers (such as electricity grids) to provide access to and purchase power from providers that use lower carbon sources of energy on financially attractive terms;
 - (2) reducing or removing subsidies to dirtier, less efficient energy production and/or use (such as subsidies for fossil fuel consumption or production); and
 - (3) reducing or removing standards that inhibit implementation of lower carbon solutions (such as the building codes and energy efficiency or zoning codes and higher density, mixed use developments);
- *Making the polluter pay (internalizing externalized costs)* by:
 - (1) imposing GHG emission limits or performance standards on production operations and products (such as vehicle emission standards);
 - (2) imposing taxes or other charges on GHG emissions or fossil fuel use (such as a tax on coal use); and
 - (3) holding polluters liable for the climate damage they cause;
- *Paying the innovator (internalizing externalized benefits)* by:
 - (1) creating tradable rights to reward investments in reducing GHG emissions (such as a cap and trade regime);
 - (2) offering fiscal incentives for investing in lower carbon methods (such as production tax credits for renewable energy); and
 - (3) providing direct public support for lower carbon activities (such as funding for research and development);
- *Filling information gaps* by:
 - (1) requiring disclosure of data on GHG emissions from production operations or energy use by products;
 - (2) supporting voluntary efforts to make such data available; and
 - (3) directly providing data helpful to potential investors (such as on wind resources or investment incentives).

Box IX-16. Brazilian government initiatives to leverage private sector financing

PROINFA (the Brazilian Alternative Energy Sources Incentive Programme) was implemented in 2004 in order to diversify the Brazilian electricity generation portfolio. Phase A of the programme established a target 3.3 GW of installed capacity through wind, biomass and mini-hydro projects by the end of 2008. A further 3.3 GW is due to be added by 2012. The Brazilian National Bank

for Social and Economic Development (BNDES) earmarked USD 2.5 billion to finance up to 80 per cent of the total cost of contracted projects through indirect and direct loans with a maximum 12-year tenor. Eletrobras (Public Electricity Utility) guarantees power purchase agreement contracts for 20 years for projects using alternative sources and established generous feed-in tariffs.

769. Such policy mechanisms are being adopted by governments around the world – at the international level (Kyoto Protocol – carbon markets), regional level (EU support for renewable energy), national level (China’s renewable energy goal), state level (state and regional’ GHG cap and trade programmes in the United States) and local level (municipal procurement requirements for cleaner buses). Examples of developing countries applying these approaches in the renewable energy sector are provided in [TABLE 31-ANNEX V](#). These policy tools can also be used across many different sectors – as shown in [TABLE 32-ANNEX V](#).

770. By using these policy mechanisms to tilt the playing field toward lower carbon, more climate-proof investments, governments can encourage private investors to shift their investments to attractive opportunities in more climate-friendly assets.

771. The carbon markets and policies to promote renewables are already playing an important role in shifting investment flows. This is indicative of how quickly investment flows can respond to changes in policies and incentives.

772. Some of the existing *funding sources under the Convention and its Kyoto Protocol* are already providing incentives for the development and implementation of climate change related policies. The financial mechanism of the Convention may be used to support the development of such policies. The programme of activities in the CDM has the potential to promote the implementation of policies to a larger number of investors. The potential of these mechanisms would need to be enhanced significantly to leverage the needed shifting from private sector investments. See [BOX IX-17](#).

773. *Additional options* that could be considered at the intergovernmental process could include efforts to:

- Collect and disseminate the experience of governments, particularly those in developing countries, to use policies to increase private investment in climate-friendly approaches;
- Promote dialogue with investors on how policy approaches affect their investments and how they might be changed to increase their investment further.

774. *Multilateral Development Banks (MDBs)* can stimulate shifts of private investments in clean energy and more climate resilient development, for example, by providing guarantees for investment risks that private investors would not take. The IFC is developing “the Carbon Delivery Guarantee” to guarantee delivery of carbon credits from projects in developing countries, thus eliminating project delivery risk for buyers. Under the Clean Energy and Investment Framework, MDBs have been collaborating to develop proposals for partial risk (credit) guarantees to private lenders and bondholders to cover debt service payments for clean energy projects based on future carbon credit cash flows (World Bank, 2006).

775. MDBs can also promote demonstration projects or commercialization of new clean technologies.

776. As further elaborated below in the chapter on optimizing resources, sharing risks among private and public, domestic and external sources can also shift investment flows.

Box IX-17. Example of projects by the GEF supporting shifts in private financing

The **India Alternate Energy project** was started in 1991 by the World Bank and the GEF to promote commercialization of wind power and solar PV technologies in India. The project was designed to strengthen government policies to promote wind power through special tax incentives. In just a few years, 968 MW of wind farms were installed and operating in India, almost all commercial and privately operated. Highly favorable investment tax policies strongly influenced these commercial installations. The wind industry jumped from three companies to 26, many of them joint ventures. Technology development and exports accelerated and costs declined.

The GEF-sponsored **China Energy Conservation Project** implemented by the World Bank started in 1998 and established three pilot energy service companies (ESCOs) in Beijing, Liaoning, and Shandong to promote investments in energy efficiency projects through energy performance contracting. Currently the project is replicating the initial experience and promote the development of new ESCOs in China through the creation of a self-sustaining ESCO Association and by establishing a commercial loan guarantee program to provide partial risk guarantees to local financial institutions which lend to the ESCOs. By end of 2006, almost 1,500 energy efficiency projects had been completed, with total investments exceeding USD 550 million. These projects have resulted in the reduction of energy use by 2.8 million tons of coal equivalent a year. More importantly, the China Energy Conservation Project has been instrumental in promoting the market-based energy performance contracting mechanism in China and in creating an ESCO industry that has flourished rapidly. Membership in ESCO Association has grown rapidly and reached more than 200 by the end of 2006.

9.3.1.2. SHIFT OF PUBLIC INVESTMENTS AND FINANCIAL FLOWS

777. *Governments* also need to shift their own investments. Governments are responsible for 10–25 per cent of the investment in new physical assets. Most of those investments are driven by local development priorities, whether they are jobs, power, transport, education, health or other public benefits. For developing countries, in particular, shifting funding to climate change has to take social and development priorities into account.

778. The challenge is to shift more public investment into lower carbon, more climate-proof measures without sacrificing development priorities. Integrating climate change adaptation and mitigation considerations into national planning (such as considering investments in clean technology in energy planning or costs associated with climate change impacts in new infrastructure, such as bridges or roads) is part of the solution.

779. Targeted measures can also help shift public investment while contributing to development priorities, for example:

- Removing existing subsidies from fossil fuels and promoting cleaner and more efficient energy use;
- Removing existing subsidies from unsustainable land uses;
- Integrating energy efficiency into new government buildings and facilities.

See **BOX IX-18**.

Box IX-18. Examples of government funding to promote renewable energy

The government of China is supporting a wide range of renewable technologies, including small hydropower, biogas, solar hot water systems, photovoltaic and wind generation. It provides subsidies of about USD 125 million a year for household biogas systems, and is investing heavily in its Village Electrification Programme, aiming to provide electricity to 27 million people by 2010 at an estimated cost of USD 2.5 billion. India, too, has renewable energy programmes coordinated by the Ministry for New and Renewable Energy (MNRE). In 2005, the MNRE had a budget of USD 137 million, 35 per cent of which was destined for rural electrification. Egypt, Malaysia, Mexico,

the Philippines, South Africa and Thailand also have government funding programmes for renewable energy. In December 2006, Thailand's Ministry of Natural Resources and Environment set up a USD 300 millions fund to support small renewable energy projects under the Very Small Power Producers Programme.

780. The mechanisms of *the Convention and its Kyoto Protocol* and carbon markets can also play an important role. The CDM can, for example, provide an opportunity for governments to implement GHG emissions mitigation projects. The financial mechanism can assist developing countries in integrating climate change adaptation and mitigation into long-term national planning. See example in [BOX IX-19](#).

781. *Additional options* that could be considered in the intergovernmental process could include efforts to:

- Publicize examples of the co-benefits of investments in lower GHG emitting, more climate-proof projects;
- Shared experiences, particularly South – South, on the benefits and risks associated with shifting more investment into lower GHG emitting, more climate-proof projects.

782. *MDBs* can shift their own investments by integrating climate change risks and costs of adaptation and mitigation into their lending practices. The World Bank has estimated that 20 to 40 per cent of ODA and public concessional finance (USD 20 to USD 40 billion per year) is subject to climate risk and only a small portion of ODA takes this risk into account in project planning. The Bank is currently developing a climate risk assessment tool to assess development projects for their potential sensitivity to climate change.

783. Shifting MDB investment and financial flows to more climate-resilient and cleaner energy can complement and reinforce development goals. Examples of their recent initiatives include (World Bank, 2007):

- The African Development Bank is developing a Clean Energy Investment Framework that is to be combined with support to increase access to energy;
- The Asian Development Bank is supporting the development of sustainable transport systems in Asia and has developed a USD 1 billion annual Energy Efficiency Initiative through a proposed Asia Pacific Fund;
- The Inter-American Development Bank has launched a Sustainable Energy and Climate Change Initiative to promote renewable energy and energy efficiency, biofuels, access to carbon finance, and adaptation;
- The European Bank for Reconstruction and Development launched a Sustainable Energy Initiative to more than double its energy efficiency and cleaner energy investments to EUR 1.5 over the next three years;
- The European Investment Bank is supporting research, development and demonstration in renewable energy.

784. To promote further initiatives of this type from MDBs, it will be important to consider at the intergovernmental level means for:

- Developing country Party access to the new types of support being offered by the MDBs;
- MDBs to cover the additional costs of climate change in lending/support programmes to provide incentives for cleaner technologies and more climate-proof projects.

Box IX-19. Example of a clean development mechanism project activity implemented by a local government – São João Landfill Gas to Energy Project

The São João Landfill Gas to Energy is a project between the municipality of São Paulo and Biogás Energia Ambiental S.A. It is designed to explore the landfill gas produced in Aterro Sanitário "Sítio São João", which is one of the biggest landfills in Brazil. The annual average emission reductions over the crediting period is estimated 816,940 tonnes CO₂ eq emission reductions. The landfill is located in the metropolitan region of São Paulo, Brazil's biggest and heavily indebted city with liability today around

USD 9,2 billion. The administration of the city has been seeking partnerships and new ways to boost investment and improve life quality in the area. As a participant in this project, the municipality will receive 50 per cent of revenues to be earned through emissions reductions commercialization, an income to be used for new investments in landfill installations and rubbish dumps recovery.

9.3.2. SCALE UP FUNDING

785. A significant increase (USD 248 – 381 billion) will be needed in investment and financial flows to mitigate and adapt to climate change. Much of this will be required for adaptation (USD 49 – 171 billion), but substantial amounts are also required for mitigation measures (such as technology development and deployment (USD 35 – 45 billion), forestry (USD 21 billion) and agriculture (USD 35 billion)).

786. The capacity of national governments, in developing countries in particular, to increase pools of financing is limited. For private investment and finance, expansion of the international carbon markets or provision of other economic incentives to invest more in specific sectors, particularly in developing countries, will therefore be needed. For public investment, expansion of the climate-focused funding from Annex II Parties (in accordance with Article 4, paragraph 3 of the Convention), as well other potential sources of funding to address climate change, will be needed.

9.3.2.1. EXPANDED INTERNATIONAL CARBON MARKET

787. Although the international carbon market has generated a large amount of investment (about USD 30 billion including CDM and JI) for cleaner technologies in a very short period, its scale would need to be increased considerably to finance the additional investments needs for mitigation (USD 200 – 210 billion) in 2030.

788. Proposals to expand the international carbon market should consider the following factors:

- The increase in the demand is largely determined by the aggregate emission reduction resulting from limits on GHG emissions established at the national and international level and by the national policies implemented to comply with these limits;
- The increase in the investment flows to developing countries is limited by the potential and costs of eligible mitigation measures in those countries and requirements to maintain the environmental integrity of the system (additionality, preventing double counting, etc.);
- The carbon market directs investment to mitigation measures for which the revenue from the sale of credits has the biggest impact on profitability. The investment flows stimulated will differ across mitigation measures. Stimulating specific types of mitigation measures may require complementary measures or different mechanisms, as explained in the [CHAPTER IX.3.3](#) on optimizing investments and financial flows;
- Policy certainty is important for investors. A longer agreement increases the range of mitigation measures that are attractive investments.

789. Most proposals for expansion of the international carbon market for non-Annex I Parties focus on the CDM, increasing the supply of credits from countries with a non-binding target or none at all. The suggestions include both expansion of the types of projects eligible under the CDM and possible new mechanisms.

790. Suggestions for expansion of the CDM include:

- HFC-23 destruction projects at new HCFC-22 plants;
- CO₂ capture and storage;
- Tradable credits for reduced emissions from deforestation in developing countries (REDD);
- Tradable credits for sustainable development policies and measures (SD-PAMs);
- Sectoral CDM;
- Policy CDM.

791. Other options for REDD, SD-PAMs and sectoral targets propose financial or other incentives, rather than tradable credits.

792. Numerous new mechanisms, such as no lose targets, sectoral targets and REDD targets, have been proposed. The mechanisms would differ from the CDM in terms of the process for approving the target and/or issuing the tradable credits, or they would create tradable credits that are not fully fungible with CERs. The operational details of most of these proposed mechanisms remain to be developed. If Parties agree to any of these mechanisms, there would be a need for modalities to define baseline emissions and verify the actual emissions to determine the credits earned.

793. If the international market in 2030 involves an annual demand of 400–600 Mt CO₂ eq from non-Annex I Parties – the low estimate – the scope for expansion or new mechanisms is small.

794. If the international market in 2030 involves an annual demand of 4,000–6,000 Mt CO₂ eq from non-Annex I Parties – the high estimate – all of those options could be accommodated. To supply such a demand, a large fraction of the potential emission reductions, from all existing and some new categories of projects, would need to earn credits. It would probably require enhanced mechanisms to capture many of the reductions cost-effectively.

795. Experience with the CDM to date indicates that a market mechanism is very effective at identifying the most cost-effective mitigation measures. It is also clear that the stimulus provided by the market varies significantly across project types, owing to the inherent economics of, and the administrative, operational and management challenges raised by, each project type. For example, HFC-23 destruction projects have been more profitable and easier to implement than transportation efficiency projects.

796. Any market mechanism will provide a differential stimulus across eligible project types. Therefore there is merit in considering different mechanisms for different project types, whether reduced deforestation, CCS, SD-PAMs, or sectoral targets. That allows the methodology and administrative process to be tailored to the needs of the projects. The disadvantage of adopting different mechanisms for different project types is possible fragmentation of the market.

797. A consultative event with private sector investors held in London on 21 June 2007 revealed that expansion of global carbon markets is constrained primarily by the absence of long-term political certainty over the existence and stringency of the GHG reduction targets to post 2012.

798. Among the options that the COP might consider for the international carbon market are the following:

- Taking a long-term perspective (i.e. adopting policies with 20–30 year time horizons) to stimulate investments with significant sustainable development benefits;
- Strengthening existing governance institutions by making them more independent of political processes and more attuned to the needs of private carbon market actors;
- Addressing technology and country risks by supporting the development of risk guarantees and other risk sharing mechanisms;
- Reducing the transaction costs associated with project-by-project approvals where possible.

9.3.2.2. ADAPTATION FUND

799. The revenue generated for the Adaptation Fund by the share of proceeds depends on the quantity of CERs issued and the price of CERs. Funding for the Adaptation Fund for post 2012 depends on the continuation of the CDM and the share of proceeds and the level of demand in the carbon market. Assuming that the share of proceeds for adaptation continues to apply post 2012, the level of funding could be of USD 100–500 million per year for a low demand by Annex I Parties in 2030 for credits from non-Annex I Parties and USD 1–5 billion per year for a high demand.

800. In either case, the revenue generated for the Adaptation Fund would be small in relation to the estimated needs for adaptation. The Adaptation Fund could be further expanded with additional sources of funding.

9.3.2.3. FINANCIAL MECHANISM OF THE CONVENTION

801. The role of financial mechanisms as a source of funding has been mainly as a catalyst for adaptation and mitigation actions. While the funding for the climate change focal area in the GEF Trust Fund and in the LDCF and SCCF is small relative to the other sources of public investment in climate change, they have demonstrated the ability to catalyse larger investments (about 5 times as large). Other GEF focal areas (biodiversity, land degradation and international waters) also play an important catalytic role in financing adaptation and mitigation activities, such as the protection of ecosystems.¹³³

802. Funding from the GEF is available as a grant and can be used for higher risk, longer term projects (such as the commercialization of new technology) and project development costs for which other sources of funding are typically very difficult to obtain. The GEF can also play an important role in promoting capacity-building on the ground.

803. As mentioned in [CHAPTER VIII](#), replenishment of the GEF depends on voluntary contributions from donors and, in the case of the Convention, on how much Annex II Parties allocate to the financial mechanism in accordance with their obligations under Article 4, paragraph 3, of the Convention. The fourth review of the financial mechanism should start at COP 13 and as part of this review, the COP is expected to make an assessment of the amount of funds necessary to assist developing countries and provide an input to GEF 5.¹³⁴

804. If the funding available to the financial mechanism remains at its current level and continues to rely mainly on voluntary contributions, it will not be sufficient to address the future financial flows estimated to be needed for adaptation and mitigation. In that context, in addition to addressing the need for increased resources it will be key to define what role the GEF as financial mechanism of the Convention should play.

9.3.2.4. EXPANDED CLIMATE FUNDS FROM DONOR COUNTRIES

805. In addition to increasing their contributions to the financial mechanism of the Convention, Annex II Parties can increase their bilateral aid and contributions to multilateral funds to address climate change. According to information available in the fourth national communications of Annex II Parties, about USD 11.5 billion was made available to multilateral funds and USD 8.5 billion to bilateral funds between 2001 and 2003.¹³⁵

806. While ODA investments were only 0.23 per cent of global investment in year 2000, ODA plays an important role in countries with little capacity to leverage domestic and international private investments (rising to over 2 per cent in Africa and over 6 per cent in LDCs) and for technologies or project types where risks are still high for private sector investments (for example in sectors such as health, coastal zones and water supply, most of the financial flows needed for adaptation cannot consist of simple shifts of investment flows and will need to rely on additional external sources of financial flows).

807. Increased financial flows from bilateral donors and multilateral lenders to governments in developing countries for policy development and implementation in sectors that can mitigate and adapt to climate change is also important. Data on ODA, official aid and other lending to developing countries and countries in transition for policy and administration is summarized in [TABLE 34-ANNEX V](#). Funding for policies in the agriculture and energy alone accounts for half of the total flow to all nine sectors. Asia received over two-third of the total ODA for policy development and administration, while Africa and Latin America received 23 per cent and 31 per cent respectively.

¹³³Please refer to [CHAPTERS IV.2.5](#) and [V.2.4](#) of this paper.

¹³⁴Decision 2/CP.12.

¹³⁵Because the information in the national communication reports of Annex II Parties is limited, the exact amount of multilateral and/or bilateral contributions oriented to climate change activities is difficult to estimate. Detailed information can be found in the upcoming compilation and synthesis report of fourth national communications of Annex II Parties (in preparation).

9.3.2.5. OTHER POTENTIAL SOURCES OF FINANCIAL FLOWS

808. Other potential options to generate additional funds to address climate change could be considered, including possibilities originally suggested for other purposes (see TABLE IX-66). Brief descriptions of the options are provided in ANNEX IV.

809. Any of these options would, of course, require further analysis and agreement at the intergovernmental level. The main value of this list is to illustrate the availability of possible new sources of funds to address climate change that could generate revenues commensurate with the additional needs. Negotiations on a future regime could

consider, inter alia, new commitments, new funding options, and needs that would be funded by the Convention.

9.3.3. OPTIMIZE THE ALLOCATION OF THE FUNDS

810. In addition to shifting and scaling up funding, the allocation of available resources needs to be optimized. How the available funds are allocated across different projects depends on three major factors:

- *The sources of investment*, as public and private investors differ in their preference for risk and return over time;

Table IX-66. Illustrative options for raising additional revenue for addressing climate change

Option	Revenue	Notes
Application of a levy similar to the 2 per cent share of proceeds from the CDM to international transfers of ERUs, AAUs and RMUs	USD 10 to USD 50 million	Annual average for 2008 to 2012
	Depends on size of carbon markets post-2012	Any estimate for post 2012 requires assumptions about future commitments
Auction of allowances for international aviation and marine emissions	USD 10 to USD 25 billion	Annual average for aviation rises from 2010 to 2030
	USD 10 to USD 15 billion	Annual average for marine transport rises from 2010 to 2030
International air travel levy	USD 10 to USD 15 billion	Based on charge of USD 6.50 per passenger per flight
Funds to invest foreign exchange reserves	Fund of up to USD 200 billion	Voluntary allocation of up to 5 per cent of foreign exchange reserves to a fund to invest in mitigation projects determined by the investors to diversify foreign exchange reserve investments
Access to renewables programmes in developed countries	USD 500 million	Eligible renewables projects in developing countries could earn certificates that could be used toward compliance with obligations under renewables programmes in developed countries to a specified maximum, such as 5 per cent
Debt-for-efficiency swap	Further research needed	Creditors negotiate an agreement that cancels a portion of the non-performing foreign debt outstanding in exchange for a commitment by the debtor government to invest the cancelled amount in clean energy projects domestically
Tobin tax	USD 15 to USD 20 billion	A tax of 0.01 per cent on wholesale currency transactions to raise revenue for Convention purposes
Donated special drawing rights	USD 18 billion initially	Special drawing rights are a form of intergovernmental currency provided by the IMF to serve as a supplemental form of liquidity for its member countries. Some special drawing rights issued could be donated to raise revenue for Convention purposes

Abbreviations: CDM = clean development mechanism, ERU = emission reduction units, AAU = assigned amount units, RMU = removal units, IMF = International Monetary Fund

- *The technology/project* into which the investment is going, as opportunities vary in the risks they present, both generally (technology risk) and specifically (project risk);
- *The host country* of the investment, as countries vary in their attractiveness to investors (country risk).

811. Understanding the interplay among these factors and their implications with regard to how different sources of capital can be used to cover the risks facing different investments is critical to optimizing the use of the available funds.

9.3.3.1. OPTIMIZING SOURCES OF INVESTMENTS – OPPORTUNITIES FOR PARTNERSHIPS

812. Each type of investor – public or private – has its own preference for risk and reward over time. Each investment involves technology, project (sector and location), country and other risks. Different private investors are prepared to bear these risks if the expected return is commensurate. If the risks are too high or the returns are too low, public investment or financial support may be needed. Major differences in preferences for risk and return over time are shown in [TABLE IX-67](#).

813. Allocating investment risks across the parties/sources most willing and able to manage them is a key feature of successful investment in any sector. For example, an investment in a wind farm in a developing country could

involve equity investment coming from privately held or publicly listed companies; debt financing from the banks or bond markets; export credits and other insurance from public or private sources, and possibly public grants.

814. Investment partnerships to distribute the risks to the entities best able to bear them while providing each with a reasonable return over time is the key to optimizing the use of the funds available.

815. Some risks are best borne by the private investors involved (e.g. commercial risks). Some can be addressed by governments through the policy and investment frameworks they set. Still others can be taken by MDBs and other sources of public money.

816. The large number of different sources of capital, with varying preferences for risk and return, creates opportunities to bring different sources of capital together to cover the cost of any particular investment, in particular using the public sector’s focus on social returns to attract private investors to activities that generate both social and financial returns.

817. Understanding these drivers will be key in defining what new mechanisms need to be developed under the Convention and how existing mechanisms can better complement each other.

Table IX-67. Investment preferences

Investor capacity/preference	Direct public investment	Grants		Debt		Equity	
		Public	Private	Public	Private	Public	Private
Total pool	Large	Small	Small	Medium	Large	Small	Large
Returns sought							
Social	High	High	High	High	Low	High	Low
Financial	None	None	None	Low	Medium	Medium	High
Risks taken							
Project	Yes	Yes	Yes	Some	Little	Some	Yes
Technology	Little	Yes	Yes	Some	No	Yes	Yes
Country	Yes	Yes	Yes	Some	Some	Yes	Some
Duration of investment	1-100+ years	1 to 5 years	1 to 3 years	1 to 100+ years	1 to 10+ years	1 to 100+ years	3 to 7 years

Source: Gentry, B. 2007.

9.3.3.2. OPTIMIZING SOURCES TO TECHNOLOGIES AND PROJECTS

TECHNOLOGIES

818. While many of the *technologies* needed to help mitigate climate change are already available, new technologies still need to be developed, and both existing and new technologies will have to be installed in new locations. The risks associated with the state of development of a technology (technology risk) and the specific risks facing the project that deploys a technology (project risk) need to be addressed.

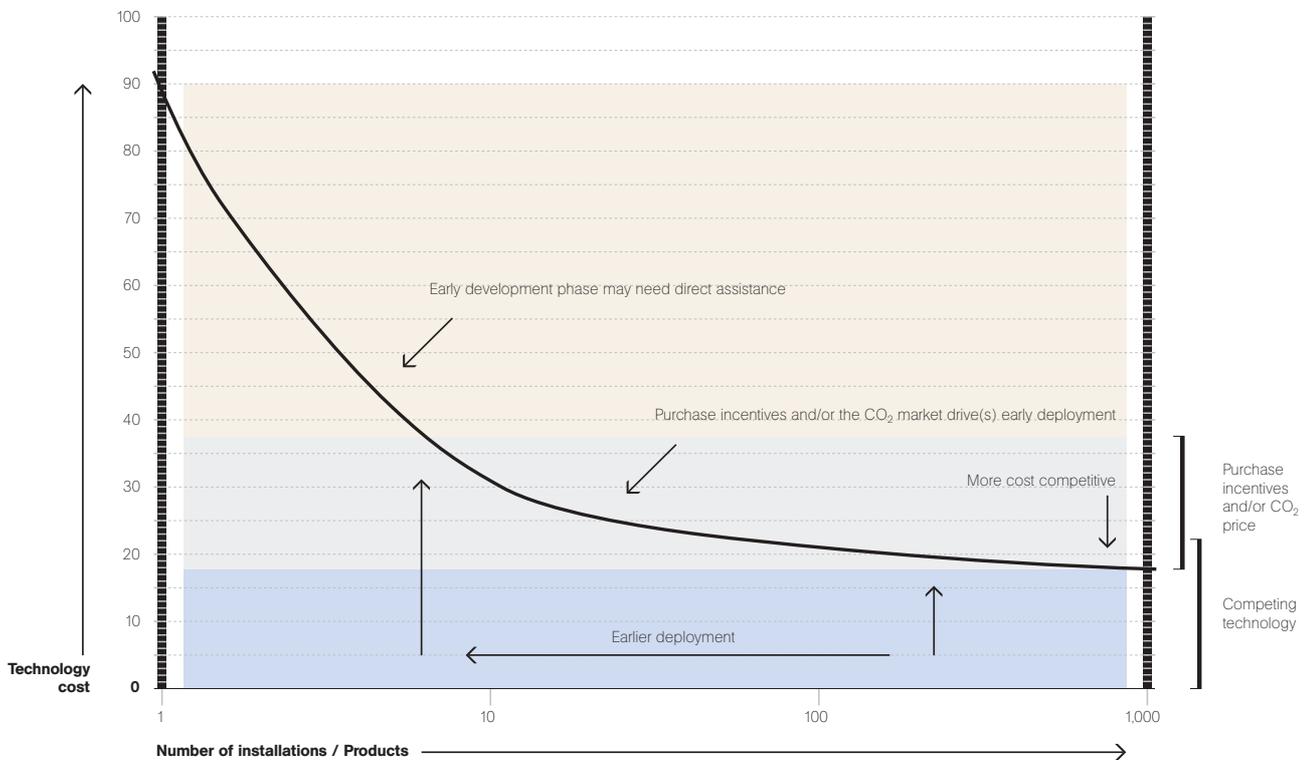
819. Each technology presents different risks at different points in its lifecycle. As shown in **FIGURE IX-41**, early stage technologies often require some form of public R&D funding before a private venture capitalist may step in for commercialization. Even proven technologies require purchase incentives to overcome the higher costs during early deployment.

820. *The process and financing of innovation varies radically across sectors.* For information technology and pharmaceuticals, for instance, the rapid technological change is largely financed by the private sector. However, private investors may not consider research into treatments for diseases whose prevalence may be increased by climate change to be a priority. Public funding might then be required for research into the treatment of such diseases.

821. *Public* funding makes a significant contribution to energy R&D. Since the early 1990s, private sector funding for energy R&D has declined, while public funding declined and then recovered to roughly the same level. Much higher levels of energy R&D will be needed to develop the technologies needed to mitigate GHG emissions.

822. Research for the agriculture sector also involves a mix of public and private investment. Governments provide more than 90 per cent of the funds in developing countries and less than half of the funds in developed countries.

Figure IX-41. Technology cost and financing curve



Source: Kirkman A et al., 2007.

823. The risks facing any particular technology change as it moves through its *lifecycle* – from research to development, demonstration and deployment. The sources of investment also change according to the life cycle. The returns to public investment in a technology shift from entirely social to both social and financial as it moves closer to commercialization and the private investment share of research investment typically increases.

PROJECTS

824. Efforts to install and operate a technology will face risks associated with the sector and the location (project risk).

825. *Different sectors* present different risks at the project level, for example:

- The major obstacles to private investment in water supplies include: the low rates of return; the capital-intensive nature of the sector; and the political sensitivity of the sector. Renewable energy projects linked to the electricity grid need long-term agreements for the purchase of their output;
- Although energy efficiency measures can be financed from the energy savings through performance contracts, most efficiency improvements are financed internally by the industry or building owner. As a result implementation of energy efficiency measures must overcome barriers related to the initial financial and availability of the appropriate technologies;
- Most of the abatement opportunities from methane capture in developing countries still face barriers related to lack of awareness of, and experience with, alternative technologies; poor economics at smaller landfills; and limited infrastructure for use of the captured gas use in some regions. Over 100 landfill gas projects have been proposed under the CDM, but the emission reductions achieved have been far lower than projected;
- Before large-scale implementation of CCS can occur, further technology development is required, mainly in CO₂ capture. Public funding will be needed for early installations to help reduce costs. Finally, the long-term liability issues will need to be resolved. The expectation is that the CO₂ will remain in the reservoir for thousands of years. The legal responsibility of entities operating CCS reservoirs must be clearly defined if they are to be able to attract the required investment.

826. *Vulnerable locations*: As the impacts of climate change become more obvious, particularly through extreme weather events, more investors are starting to ask how those risks can be shared. The damage caused by climate related events can be financed in various ways, from within the country or internationally. Funds can be provided by public finances, or the private sector, and within those through contractual arrangements like insurance, or informally through charitable relief. In the last resort, the damage may be taken as a loss of assets or income by the victims.

827. The increased risks due to climate change have led insurers to make major modifications to their risk profiling and coverage strategies. Catastrophic risk insurance has been treated as a yearly business, with premiums being reviewed every year based on the most recent experience. Insurers have also withdrawn from high-risk zones or areas recently struck by catastrophic events. Increasing insurance costs and declining coverage have led to protests by consumers and political interventions on their behalf.

828. As a result, interest is growing among *governments and MDBs* in using a wider range of risk management instruments, particularly catastrophe bonds and weather derivatives, to help address the macro-economic financial impact of disasters. This is because it has become clear that ex-post financing is inefficient for several reasons (e.g. tardiness, impact on other projects, uncertainty), while insurance also has some deficiencies, principally lack of continuity of coverage and terms. A particular example of this new approach is the Caribbean Climate Risk Insurance Facility (CCRIF) (see [BOX IX-20](#)).¹³⁶

829. As exemplified by the CCRIF, a public-private partnership seems to be an appropriate model for insuring climate risk in many developing countries – as public resources are limited and there are significant barriers to private investment. The most important attractions for the private sector are the prospects for a positive profit margin and scale.

¹³⁶Dlugolecki A. 2007.

Box IX-20. **Caribbean Catastrophe Risk Insurance Facility**

The Caribbean Catastrophe Risk Insurance Facility (CCRIF) is being established under the coordination of the World Bank to provide member states with index-based insurance (cat bonds) against government losses caused by natural disasters. It represents an important shift from disaster response to ex-ante disaster management and mitigation. Governments will purchase catastrophe coverage to provide them with a cash payment within one month after a major hurricane or earthquake. These funds are intended to meet a portion of the immediate liquidity problems that face governments in the aftermath of a disaster.

Pooling risk among 15 countries has enabled the premiums to be reduced by about 50 per cent from the aggregate value of the individual premiums, due to the benefit of non-correlated risks, even within a relatively small area like the Caribbean. The Facility will be created with the premiums from participating countries and substantial assistance from donors (USD 47 million). For poorer countries, the fees will be subsidized or contributed by donors. For tax efficiency, CCRIF will be domiciled in the Cayman Islands.

9.3.3.3. OPTIMIZING SOURCES BY HOST COUNTRY CAPACITY

830. Country risks play a major role in investment decisions by foreign investors and lenders. Different regions vary dramatically in the types of investment capital they attract and the returns expected. Many of these differences can be explained by the characteristics of the national investment markets involved. UNCTAD has developed an investment compass to help countries understand how they rate on factors relevant to investment decisions by foreign direct investors.¹³⁷ The key variables include:

- Resource assets, including human and natural (raw materials, resources) capital, as well as market size;
- Infrastructure, including both basic (transport, water, power) and telecommunications;
- Operating costs, reflecting items such as wages, rents and electricity tariffs;
- Economic performance and governance, including economic growth rates, current account balance, unemployment, country debt rating, rule of law and political stability;
- Taxation types and levels, along with investment incentives;
- Regulatory framework for foreign investors, including entry, operating and exit requirements.

831. A similar analysis by Ernst & Young ranks countries according how attractive they are to investors in renewable energy projects (Ernst & Young, 2007). The ranking criteria include measures of both natural and social capital, such as:

- The “Renewables Infrastructure Index”, covering items such as: electricity market regulatory risk; planning and grid connection issues; and access to finance;
- “Technology Factors”, including: power off-take attractiveness; tax climate; grant/soft loan availability; market growth potential; current installed base; resource quality; and project size.

832. Similarly, the mitigation or adaptive capacity of countries is now being measured by factors such as: economic resources; technology; information and skills; infrastructure; institutions; and equity. Such factors are increasingly being considered by private investors as they choose locations for their projects, as well as by national governments as they review their development and adaptation goals. Such differences in institutional structures and basic infrastructure increase the difficulties of adapting to climate change in many poor communities.

833. The result is a spectrum across countries, from those able to attract substantial investment from the global capital markets to those more dependent on domestic capital and ODA. A country that can tap a range of investment sources has many more options for financing a large clean power generating facility.

834. This spectrum of capacity means different roles for public and private capital across different countries. Countries with good access to global capital markets can focus public investment on priority areas and attract private capital for other investments. Countries with little or no access to private capital – locally or globally – need to use domestic and international public capital for a much wider range of investments.

Box IX-21. Example of possible assistance by MDBs in addressing country risks – The Multilateral Investment Guarantee Agency

As a member of the World Bank Group, the Multilateral Investment Guarantee Agency (MIGA) mission is to promote FDI into developing countries to help support economic growth, reduce poverty, and improve people's lives. Concerns about investment environments and perceptions of political risk often inhibit foreign direct investment, with the majority of flows going to just a handful of countries and leaving the world's poorest economies largely ignored. MIGA addresses these concerns by providing three key services: political risk insurance for foreign investments in developing countries, technical assistance to improve investment climates and promote

investment opportunities in developing countries, and dispute mediation services to remove possible obstacles to future investment. Since its inception in 1988, MIGA has issued nearly 850 guarantees worth more than USD 16 billion for projects in 92 developing countries. MIGA specializes in facilitating investments in high-risk, low-income countries – such as in Africa and conflict-affected areas.

9.3.3.4. WHAT CAN BE DONE TO IMPROVE THE COMPLEMENTARITY OF AVAILABLE FUNDS

835. As shown in this chapter it is important to optimize allocation of funding and factor in various preferences by different sources of funding for risks and returns. Some can be addressed by governments through the policy and investment frameworks they set and some can be taken by IFIs and other sources of public money.

836. *Governments* can increase the diversity of the sources of capital available through the policy and investment frameworks they establish. Attracting more private (domestic and foreign) investment to climate mitigation and adaptation projects means that they require less government funding, and ODA in developing countries can then be redirected to social needs. Policy and investment frameworks that can attract more private capital include:

- Tailored policies for different types of projects, such as secure access with fair prices for renewables supplying the electricity grid and mandatory energy efficiency standards for buildings, appliances and equipment;
- Policies that promote diversification of the domestic financial market; and
- Measures to make the country more attractive to foreign private investors.

837. In considering how to enhance existing sources of funding and what new sources could be developed, it will be important that *Parties*:

- Understand what roles different sources can play and how they can best complement each other. The sources of funding in the Convention and its Kyoto Protocol could be better focused and made more effective by considering where:
 - The investment markets are failing to deliver sufficient public and private investment; and
 - The global structure of the COP and the Convention provides a comparative advantage.
- Support and participate in the efforts to bring government officials, investors and NGO representatives together to find new financing and policy approaches to bringing more investment to addressing climate issues.

838. *MDBs* can play also play an important role in layering- in funding in areas where risks are likely not to be taken by other sources.

¹³⁷ <<http://compass.unctad.org/Page1.egml?country1=&country2=®ion=&sessioncontext=202061216&object=SC.app.objects.methodology>> (accessed July 19, 2007).

9.4. CONCLUSIONS

839. In developing options for long-term cooperative action for improving the potential of investments and financial flows to address climate change, it will be important to consider that:

- Future actions to address climate change have to consider measures to increase global investment and financial flows. This increase is large compared with the existing funding in the Convention and its Kyoto Protocol but is small compared with global GDP (0.3–0.5 per cent) and investments (1.1–1.7 per cent) in 2030;
- Needs for future investment and financial flows to address climate change are very different across sectors and regions. Solutions to provide the necessary incentives to address needs will require better use and complementarities of sources of available investment and financial flows;
- Changes in patterns in future investments and financial flows need a combination of actions by the intergovernmental process (including under the UNFCCC process and under other processes such as International Financial Institutions), national governments and private sector (including corporations and households);
- Solutions will also require a combination of:
 - Policy frameworks, national and international, that increase the economic and financial attractiveness of investments in clean energy technologies and emission reduction measures, such as carbon markets or feed in tariffs;
 - Incentives and assistance to developing countries in establishing environments to change investment and financial flows towards addressing climate change;
 - Policy frameworks, national and international, that regulate GHG emissions and promote their reduction;
 - Options for scaling up additional financial flows, from existing and new sources, that allow adequate and sustainable financing of developing country needs, in particular in areas such as adaptation, forestry and technology deployment;
- Collaborative efforts in R&D on low GHG emitting technologies and better understanding the costs and opportunities of adaptation and mitigation measures.

840. As the first ever effort to collect and present data on projected, climate-related investments under reference and mitigation scenarios, it is not surprising that this study encountered many gaps in the existing data. The questions of whether and how to fill any of these gaps should also be considered by the Parties.

841. The results of this analysis present the complexity of the systems involved – across investors, sectors, technologies, locations and other factors. This is to be welcomed, as a more nuanced view of the opportunities and barriers facing investments in a more sustainable climate future is important to making progress.

842. At the same time, Parties cannot be expected to engage in detailed investment analyses when negotiating the post-2012 climate agreement. Parties could negotiate an international framework that enhances international mechanisms, such as the international carbon market, the financial mechanisms of the Convention and its Kyoto Protocol, and other sources of funding, and encourages Parties to develop and implement national policies that shift private and public investment and financial flows toward lower GHG emitting and more climate proof options.

843. While it is important for the Parties to be aware of and consider the implications of these complexities in their deliberations, it is even more critical that some widely supported, relatively simple and actionable themes be developed around which the structure of the post-2012 agreement can be shaped. Doing so will give the investment community both the rules it needs to predict risks and returns, as well as the room it needs to innovate for realizing both financial and social returns.