



Financing mitigation: case for clean energy investments

The need

Investment and finance are two important components in the economic development of a country. The thirteenth session of the CoP (Conference of Parties) at Bali, held last year, outlined the Bali Action Plan, which acknowledges finance and investment, along with technology, as important enabling factors to promote both mitigation and adaptation to climate change. It calls for

*Enhanced action on the provision of **financial resources and investment** to support action on mitigation and adaptation and technology cooperation, including, inter alia, consideration of:*

***Positive incentives** for developing country Parties for the **enhanced implementation of national mitigation strategies and adaptation action** (Decision 1/CoP-13).*

The need for mitigating climate change is both urgent and inevitable, given the rising temperature and increasing cost of energy.

The world's primary energy needs are rising, and in the BAU (business-as-usual) scenario, these are projected to grow by 55% between 2005 and 2030, at an average annual rate of 1.8% per year (IEA 2007). In the same scenario, emissions will jump by 57% between 2005 and 2030 and will increase the concentrations of CO₂ and other GHGs (greenhouse gases), resulting in higher global temperatures and changes in climate, thereby increasing harmful impacts. Thus, the need for mitigating climate change is both urgent and inevitable, given the rising temperature and increasing cost of energy. These reductions can be ensured by promoting cleaner technologies, energy efficiency measures, and carbon sinks. However, the cost of funding these initiatives will be huge. The UNFCCC (United Nations Framework Convention on Climate Change) paper on investment and financial flows estimates



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additional investment and financial flows worth \$200–210 billion to reduce CO₂ eq emissions by 25% below the 2000 levels in 2030. It also concludes that the additional global investment and financial flows needed in 2030 to address climate change are large as compared to the funding available under the Convention and its Kyoto Protocol. Therefore, it is essential to find ways to channelize additional funding in existing financial mechanisms under the UNFCCC and Kyoto Protocol and promote investments in low-carbon interventions. The paper primarily discusses the pressing need for financing mitigation while outlining the extent and sources of finance and investment required for funding these actions. It places special focus on the energy sector and studies the investment needs in the sector in developing countries, key challenges in promoting investment in the sector, and the way forward.

Energy sector investments

The challenge is to meet this energy demand while staying on the path of low carbon development.

According to IPCC (Intergovernmental panel on Climate Change) Fourth Assessment Report, between 1970 and 2004, the energy supply sector was responsible for the largest growth in global GHG emissions (an increase of 145%), and the International Energy Agency predicts that the world energy demand, on an average, will rise by 1.6% a year between 2006 and 2030. Thus, this calls for a huge investment in energy infrastructure to prevent a supply squeeze.¹ However, the investment decisions taken today will affect the world's emission profile in the future, and in this context, it is crucial that these investments are planned carefully now. Therefore, the challenge is to meet this energy demand while staying on the path of low carbon development. IPCC report further states that over 70% of the increase in global primary energy demand between 2004 and 2030 will come from developing countries, and more than half of all the energy investment needed worldwide in 2030 will be in developing countries, given the rapid pace of economic development in these countries. China alone would need to invest about \$132 billion, 17% of the global total, and about \$283 billion (37%) would be needed by OECD (Organisation for Economic Co-operation and Development) countries (UNFCCC 2007).

Growing energy demand in developing countries, along with high level of vulnerabilities and lack of financial and technological capabilities, furthers the need for ensuring additional funding in the sectors important for achieving sustainable development.

Overview of finance and investment flows

The investment flow corresponds to capital cost of new physical asset, while the financial flow relates to mitigation activities not involving capital cost of assets. Financial mechanisms have been established under the Convention and its Kyoto Protocol to provide finance and investment for both mitigating and adapting to climate change. Sources of financial support to mitigation include the CDM (Clean Development Mechanism), JI (Joint Implementation), carbon funds, and GEF (Global Environment Facility). Table 1 provides an overview of sources of financial flows in 2006. It can be seen that the CDM and

¹ <http://www.thestreet.com/story/10447373/1/iea-warns-of-energy-supply-crunch.html?puc=_tscrss>

Table 1 Financial flows for climate change in 2006

Mitigation source	Amount (in million dollars)	Notes
Clean Development Mechanism	2006 \$5259	Value of trades during 2006
	2006 \$947 to 1.572	Value of estimated annual emission reductions for projects registered during 2006
	2006 \$1569 to 2602	Value of estimated annual emission reductions for projects that entered the pipeline during 2006
	2006 \$6939	Investment by projects registered during 2006
	2006 \$26 467	Investment by projects that entered the pipeline during 2006
Joint Implementation	2006 \$140	Value of trades during 2006
	2006 \$132 to 266	Value of estimated annual emission reductions for projects that entered the pipeline during 2006
	2006 \$6269	Investment by projects that entered the pipeline during 2006
Carbon funds	2006 \$6996	Subscribed capital at end of 2006
	2006 \$2110	Increase in subscribed capital during 2006
GEF (Global Environment Facility)	3326.6	Cumulative funding allocated since GEF inception for OPs (operational programmes)5, 6, 7, 11, EA STRM and joint OPs. Plot phase and three replenishment periods and six projects approved under the fourth GEF replenishment (GEF 4) as of June 2007 Targeted allocations as per GEF 4 to be spent between 2006 and 2010.
	990	

Source UNFCCC (2007)

The success of these to be part of the Convention or Protocol will depend on mutual agreement between all parties.

carbon funds are the two most important sources of financial support in the current regime. In addition to these sources, there will be a need for more funds. Allowances, levies, and taxes are some of the other forms of raising funds, which are being proposed currently. However, the success of these to be part of the Convention or Protocol will depend on mutual agreement between all parties.

As far as the investment is concerned, investment in energy supply infrastructure under the Reference scenario is projected to be \$762 billion in 2030, while in the Mitigation scenario, it is projected to be \$695 billion in 2030, owing to the increase in energy efficiency, which further reduces energy demand. Of the projected \$432 billion of annual investment in the power sector, about \$148 billion is predicted to shift to renewables like carbon capture and storage, or CCS, nuclear energy, and hydropower (see Table 2). The table shows investments in the energy

Table 2 Investment for energy supply under the Reference and Mitigation scenarios in 2030 (billion 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	15	-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

Source UNFCCC (2007)

With appropriate policies and incentives, a substantial part of the additional investment and financial flows needed could be covered by the currently available sources

sector under the Reference and Mitigation scenarios, that is, undertaking actions to bring down carbon emissions.

With appropriate policies and incentives, a substantial part of the additional investment and financial flows needed could be covered by the currently available sources. However, there will be a need for new and additional external sources of funds dedicated to mitigation. There is a need for designing additional financial mechanisms under the UNFCCC and Protocol and also to channelize more money through investments in clean energy and energy efficiency. Table 3 shows the additional investment and financial flows needed by developing countries. It can be seen that the energy sector dominates, demanding the largest funds, therefore, reemphasizing the need for careful planning and cleaner investments in this sector

Sources of finance

Sources of financing mitigation could range from bilateral and multilateral organizations to government and private sector organizations. According to the UNFCCC, it has been observed that in most of the regions, the majority of the investment is domestic, but foreign equity and debt are important sources in developed countries, while the ODA (Official Development Assistance) is an important source in LDCs (least developed countries). Much of the financing in

Table 3 Additional investment and financial flows needed from all sectors (private and public, domestic, and international) for key mitigation sectors in 2030 (billion dollars in 2005)

Sector	<i>Non-Annex I Parties</i>
Energy supply by low GHG emission options	77
Energy efficiency improvement	52
Non-CO ₂ gases	2
CCS for industry	11
Agriculture and forestry	34

Source UNFCCC (2007)

Much of the financing in developing countries, other than in developing Asia, comes from a combination of ODA and loans from multilateral and regional development banks.

developing countries, other than in developing Asia, comes from a combination of ODA and loans from multilateral and regional development banks. However, this situation is changing, particularly in the fast emerging markets of China, India, and Brazil, which are attracting increasing private investments in various sectors, especially in the rapidly expanding electricity sector. On the contrary, LDCs, such as those in sub-Saharan Africa, and smaller developing countries still attract limited private sector investment and continue to rely on the ODA and soft loans from IFIs (International Financial Institutions) such as the World Bank. Although ODA funds are currently less than 1% of global investment, the ODA represents a larger share of the total investments in LDCs (6%) (UNFCCC 2007).

As far as the renewable and energy efficiency sector is concerned, the largest share of investment and financial flows in the sector comes from the private sector. It can be seen from Table 4 that private investment is

Table 4 Sources of finance in clean energy

	Source	<i>Renewable energy</i>		<i>Energy efficiency</i>			Per cent total
		OECD	Developing	OECD	Developing	Total	
Total investment debt							
Private Sector	NEF	9 089	656	41	6	9 791	33.4
Multilateral	CRS	–	386	–	–	386	1.3
Total debt		9 089	10 415	40.8	6	10 177	–
Equity							
Total equity (private sector)	NEF	14 107	2 906	1 342	96	17 451	63.0
Grants							
Multilateral (GEF)	GEF	–	42	–	30	71	0.2
Bilateral	CRS	–	601	–	–	601	2.1
Total grants		–	642	–	30	672	–
Total investment		23 196	4 590	1 383	132	29 300	–
Private investment		23 496	3 562	1 383	102	28 242	96.4
Multilateral / bilateral		–	1 028	–	30	1 058	3.6

Source UNFCCC (2007)

by far the largest source of investment, and developed countries receive the largest share.

Box 1 shows a case study on multilateral funding to address climate change. The case is of recently launched World Bank CIF (Climate Investment Funds). It is argued that such a fund should not be confined to loans but should essentially provide grants and high concessional loans for undertaking demonstration projects and overcoming the incremental cost of a new technology.

Box 1 Multilateral funding source: the World Bank's Climate Investment Funds World Bank

The CIF (Climate Investment Funds) of the World Bank came into force on 1 July 2008, with funding to the tune of \$6.1 billion by donors. It is the source of interim funding, through which MDBs (multilateral development banks) will provide additional grants and concessional financing to developing countries to address climate change challenges. The CIF will enable a dynamic partnership between the MDBs and developing countries to undertake investments, which will help in achieving a country's development goals through a transition to a climate-resilient economy and a low-carbon development path.

However, a recent report by Sustainable Energy and Economy Network, Institute for Policy Studies, criticizes the CIF and argues that it is inadequately governed and usurps the role that many nations want the United Nations to play. By providing loans, it would indirectly force developing countries to pay for the industrialized world's pollution, thus increasing the already high level of indebtedness of developing countries and economic dependence on international donors.

The control over such funds should be established under the UNFCCC (United Nations Framework Convention on Climate Change) 'in order to ensure that they are used equitably and effectively, in accordance with the principle of common but differentiated responsibility, and that nations receiving financing are thoroughly involved in funds' design and implementation.'

In some of the developing countries, the biggest apprehension of private sector to invest in clean development projects is the high risk owing to policy changes and long payback period.

Channelizing energy investments – key challenges

The biggest challenge in promoting sustainable development in the energy sector is to find ways to increase the flow of funds from the public and private sectors along with financial flows from the Convention mechanisms. The huge upfront cost of implementing few technologies discourages investors at times. For example, investment in grid-connected SPV (solar photovoltaic) electricity has not moved fast in many regions due to substantial upfront. These challenges are more in LDCs, where the ODA is presently the most dominant form of finance and private investments, which need to be channelized. In some of the developing countries, the biggest apprehension of private sector to invest in clean development projects is the high risk owing to policy changes and long payback period. This highlights the importance of improving policy frameworks to attract private finance from domestic

and international sources and divert the flow from conventional technologies to climate-relevant alternatives.

Domestic environment in host country, too, plays an important role in investment decisions. It has been seen that renewable energy has flourished in countries with supportive policies such as feed-in tariffs, developed financial markets, and active private investors. For example, wind power in India has been successful due to the government's supportive policies in the form of tax benefits. Non-conducive policy environment in a country discourages investment in cleaner technologies by both national and foreign investors. Lack of clear guidance on future energy policy and monopoly structures with lack of purchase agreements or feed-in tariffs for independent producers result in market distortion and, thus, discourage the investors from undertaking large investments. This, along with lack of fiscal incentives for clean energy production and subsidies for conventional energy sources, further curbs the flow of money. Another challenge in smooth flow of finance is the non-presence of right policy support. Policies that encourage emission reduction and provide incentives for private sector participation need to be in place in countries. Many countries, particularly LDCs, are at present not getting their full share of potential clean energy investment because their existing policies and nonconducive business environment make them unattractive for any but the highest return projects.

The need for finance is not only for covering capital cost of infrastructure but for providing effective implementation of technology, of which capacity building is an important component.

Along with the above challenges, lack of capacity to absorb, sustain, and initiate R&D (research and development) of new technology further intensifies the problem. In some cases, insufficient human and institutional capabilities in the host country, for even identification of priority areas of intervention, have been observed. Therefore, the need for finance is not only for covering capital cost of infrastructure but for providing effective implementation of technology, of which capacity building is an important component.

On a different perspective, it has also been argued that to a large extent, technology transfer is also an investment problem. Finance is the backbone of development and commercialization of any technology, and there is a need for investment for dissemination of clean energy technologies. However, the challenge is how to make these investments more attractive (Crosbey 2008).

Way forward

Energy can make a substantial contribution to sustainable development. As discussed in the paper, huge demand for investment will come from developing countries, and technological advancement will be difficult to achieve, unless these countries are enabled to leapfrog dirty energy trajectories to shift to cleaner technologies. There is a need to scale up, shift, and optimize investment and financial flows to mitigate climate change. For a technology to realize its mitigation potential, the type and source of funding invested in its development must be appropriate, from its initial stage till maturity.

Table 5 outlines a list of the possible ways to enhance mitigation actions. It can be seen that along with the private sector, involvement of public sector is equally important at different stages of technology development. An increased public funding for R&D and demonstration

Table 5 Possible options, tools, and mechanisms available to enhance mitigation actions

	<i>Funding sources</i>		<i>Delivery</i>		
	<i>Private finance</i>	<i>Public finance</i>	<i>National policies</i>	<i>Convention</i>	
Scale up	Mitigation measures	<ul style="list-style-type: none"> More stringent targets for domestic and international carbon markets. Mitigation measures mandated or encouraged by national policies. 	<ul style="list-style-type: none"> Support mitigation measures not well addressed by carbon market because they face non-price barriers or need more financial support than that provided by the market price Scale up public finance support, especially in countries where private finance/carbon market is less successful. 	<ul style="list-style-type: none"> For facilitating measures that face non-price barriers, such as energy efficiency measures especially for buildings. For facilitating measures, that need more financial support than provided by the market price. 	<ul style="list-style-type: none"> Raise additional financial resources and agree on their distribution. Agree on means of providing private and public support for mitigation measures in developing countries. <p>Support technology transfer to developing countries</p>
	Technology development	Support all stages, especially technologies nearly commercially viable.	<ul style="list-style-type: none"> Finance RD&D when the private sector is not willing to invest (owing to high risk, long development times or 'public good' character). Early deployment support (for example, if infrastructure is crucial). 	Domestic carbon markets and other policies that create demand for technologies at the deployment and diffusion stages.	<ul style="list-style-type: none"> Agree on means to increase support for all stages of technology innovation in developed and developing countries. Send long-term signal (important for private sector innovation).
Shift	Mitigation measures	Shift from GHG - emitting to non-emitting technologies, especially in the power sector, and from purely project to more comprehensive approaches.	<ul style="list-style-type: none"> Domestic carbon markets and other policies that include a shift to low-emitting technologies. Reform subsidies for fossil fuels and agriculture that increase emissions. 	<ul style="list-style-type: none"> Agree on support for changes to national policies in developing countries. Agree on the actions needed to be measured, reported, and verified. 	
	Technology development		Shift support for R&D from GHG-emitting to non-emitting technologies.	Joint R&D efforts.	
Optimize	Mitigation measures	Use mix of market and non-market policies to attract private funds to the most cost-effective measures.	Use public funds to optimize risk-return profile of mitigation in order to attract and leverage private funds, for example, through public-private partnerships.	<ul style="list-style-type: none"> Optimize national policies to achieve the most cost-effective emissions reductions. Promote development of a robust financial sector to facilitate optimal financing mix, ensure coherence among different credit mechanism. 	<ul style="list-style-type: none"> Use convention funds to leverage additional funds and finance implementation of national policies. Agree on conditions for interplay between different finance mechanisms.
	Technology development		Use public funds to leverage private funds.	Agree on mechanisms to facilitate developing country contributions to technology development.	

GHG - greenhouse gas; R&D – research and development; RD&D - research, development, and development

Source UNFCCC (2008)

While finance is must for technology development, it is equally important to have right policy environment in the country to promote technologies that are nearly at the commercial stage and policies that reward emission reductions.

to leverage private finance is needed to accelerate technology development in all sectors. The role of MDBs and national government is also important in trust-building in a technology by promoting demonstration project and commercialization of new clean technologies. Public-private partnerships offer huge potential in sectors that are governed by the public sector but need financial and technological support from the private sector. For example, the municipal solid waste sector in India has potential for large emission reduction if such a partnership model is followed for project implementation. The pressing need is to spread the risk across private and public investors and insurance sector will have an important role in the same.

The required scales of investments in the energy sector are huge, and unless developed countries meet the costs of deployment of these technologies, it will be difficult to implement such measures. The funding of these cannot be based on loans or grants, and there is a need to find ways to compensate these costs. Developing countries will require substantial international financial support for the design, implementation, and enforcement of actions that address both mitigation and adaptation. Thus, it is also important that the present investment costs are facilitated through market-based approach. Therefore, international funds, multilateral financial institutions, and other sources of funding must be ready and adequately equipped to assist developing countries, in particular LDCs, in their current and future efforts to address climate change.

While finance is must for technology development, it is equally important to have right policy environment in the country to promote technologies that are nearly at the commercial stage and policies that reward emission reductions. Such technological advances can only become reality when all countries take quick policy decisions to promote transfer and develop nationally available technologies. Governments have to formulate policies and regulations that build confidence among private players. Regulatory framework will help to overcome the problem of distorted energy prices, which are currently influenced by unreasonable taxes and unplanned duty structure. The best way to persuade private players for investment is by providing clarity in pricing of energy products, market framework, government incentives, and subsidies.

At the domestic level, addressing policy and regulatory obstacles to clean energy investment may be one of the most important ways in which governments, MDBs, and donors can promote technology development and transfer (Crosbey 2008). It can be concluded that there are huge potential in the sector to help countries develop sustainably, given the barriers are taken care of quickly without losing time.

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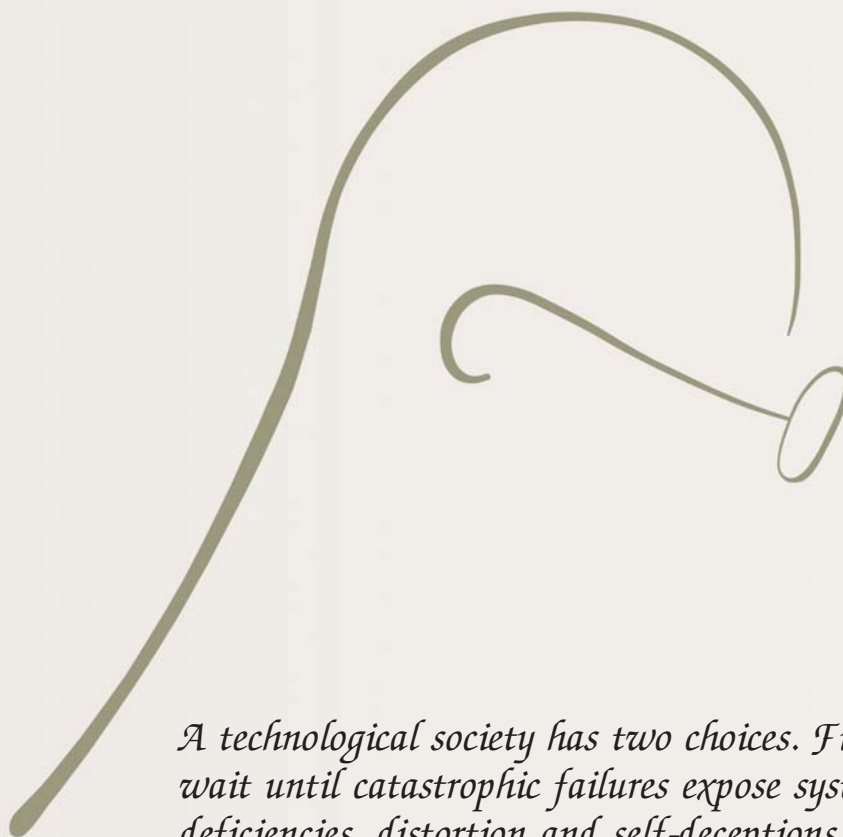
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A technological society has two choices. First it can wait until catastrophic failures expose systemic deficiencies, distortion and self-deceptions...

Secondly, a culture can provide social checks and balances to correct for systemic distortion prior to catastrophic failures.

Mahatma Gandhi

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