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Financing Integrated Development and Climate Strategies

Outcomes of workshop organized as part of the Development and Climate programme 27 and 28 September, 2004, New Delhi, India

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Abstract

Financing Integrated Development and Climate Strategies

Climate Change is often seen as a threat to development. In the development and climate programme, the starting point is not climate but instead development priorities. The idea is that objectives of development and poverty eradication must be met but with strategies that aim for climate friendly and climate safe development. The workshop on Financing Integrated Development & Climate strategies explored this development-first approach by looking into the possibilities of attracting investments, which are required to make a proper transition towards a sustainable development pathway. The workshop identified five approaches to improve financing of integrated development and climate strategies, which can be used by policy makers and the private sector.

Keywords: Climate Change, development, financing, pathways, investment

Rapport in het Kort

Financiering van geïntegreerde ontwikkelings- en klimaatstrategieën

Klimaatverandering wordt vaak beschouwd als een bedreiging voor ontwikkeling. In het onderzoeksprogramma ‘Development and Climate’, is het vertrekpunt niet klimaat, maar de ontwikkelingsprioriteiten van landen. Uitgangspunt is dat de doelstellingen van ontwikkeling en armoedebestrijding gerealiseerd moeten worden, maar met klimaatvriendelijke en klimaatveilige ontwikkelingsstrategieën. De workshop ‘Financing Integrated development and Climate Strategies’ verkende de mogelijkheden voor deze zegen. ‘development first’ benadering, door te kijken naar de mogelijkheden om investeringen aan te trekken om de transitie te maken naar duurzame ontwikkelingspaden. De workshop heeft vijf benaderingen geïdentificeerd om de financiering van geïntegreerde ontwikkelings- en klimaatstrategieën te verbeteren, die van belang zijn voor overheidsbeleid en de private sector.

Trefwoorden: Klimaatverandering, ontwikkeling, financiering, ontwikkelingspaden, investering

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Prof. Heller and Prof. Shukla for writing the workshop paper - which provided a very useful starting point of the discussions and last but not least we want to acknowledge the Ministry of Housing, Spatial Planning and Environment for funding this part of the Development and Climate Programme.

Executive summary

There is a variety of national and international financial mechanisms that could be used to help shift development pathways towards more sustainable climate solutions. As part of the Development and Climate programme, a workshop was organized that looked especially into the possibilities for financing integrated development and climate strategies.

Principal aim of the Development and Climate programme is to identify development pathways that are sustainable and facilitate the delivery of positive climate outcomes. The objectives of the programme are to:
- Explore national and regional development strategies that address climate change;
- Identify promising policy options and projects that facilitate the transition to long-term sustainable development, including policies addressing climate change;
- Explore through a series of three international workshops how national and international policies can support the implementation of sustainable development and effective climate change policies. This workshop on finance was the first of those meetings.

The goals of the workshop were to:
1. to portray the positive aspects of an integrated development and climate approach;
2. achieve a broader perspective on development and climate finance mechanisms;
3. identify and elaborate possibilities for (inter)national policy making that help financing integrated development and climate strategies.

Climate change is often seen as a threat to development. In the development and climate philosophy the starting point is not climate change, but development priorities (‘development first’). The idea is that objectives of development and poverty eradication must be met, but with development strategies that aim for climate safe and climate friendly development, i.e. development that leads to a low vulnerability to climate change and/or to low GHG emissions. In general terms the following approaches to policy making are suggested to realize this:
- mainstream climate concerns into the evolving political and economic conditions in developing nations;
- concentrate on the policy and programme options in play in mainstream agencies to change business as usual development;
- emphasize the critical importance of organizational and political barriers to sustainable change;
- assist in forging coalitions between mainstream public agencies and private actors that can frame sustainable markets.

At the meeting it was explored how these approaches could be further operationalized in relation to financing development and climate in an integrated manner. Finance was chosen as a key theme of this workshop because of the investments that will be required to make the transition to more sustainable development pathways and the fact that mainstream development finance and climate finance are often not looked at in an integrated manner.

It was concluded that early integration of development and climate could result in more cost-effective solutions for mitigation and adaptation. Too many development and investment projects are still leading to mal-adaptation to climate change because no climate impact assessment is made. The added value of integrated development and climate initiatives was illustrated by the positive examples presented by both large scale investors as well as investors focusing on local scale projects. Mainstreaming efforts could result in the adoption of non-climate policies with ancillary climate benefits that would create a context in which the development of lower GHG emitting systems or climate adaptation measures are taken to reduce the vulnerability of people to climate change could be financed through regular investment channels. Mainstream financing will not always be sufficient, so there is also a need for incremental resources (public or private, national or international).

The meeting indicated that ODA, FDI, specific climate finance or national public budgets alone will often not be sufficient to realize integrated development and climate goals and that therefore mobilizing domestic savings through local banks is also required. To bring together enough funds for financing integrated development and climate initiatives and to cover the different risks related to new projects, a bundling of public and private financial flows will be necessary. Investors and banks indicated during the workshop that there is a lack of bankable projects that contribute to making development more sustainable. From their perspective this is a larger problem than the existence of a 'finance gap'. This would imply that there are more opportunities to get integrated development and climate initiatives financed, than perhaps is perceived to be the case. It also became clear that financing integrated development & climate strategies can not be seen independent of improving key enabling factors for investment in the countries, such as reliable legal and banking system. This needed for both mobilizing domestic and international financial resources.

The workshop identified and further elaborated the following five approaches to improve financing of integrated development and climate strategies:

- National policies to attract new private capital. This can be done by developing new markets, provide an enabling environment for investments, inform private and public sector about risks and opportunities of climate change and help bundling public and private financial flows to cover different parts of the risks.
- National policies to free public money (such as subsidies) that than can be used for other purposes and/or improve the quality of public investment.
- Integration of Development & Climate approach in ODA, especially via budget-based ODA.
- International Financial Institutions to integrate climate in poverty reduction strategies and finance because of positive development effects.
- Creation of a multilateral climate trust/climate fund that can help to influence the choice of the development pathways of countries.

Contents

1. Introduction

There is a variety of national and international financial mechanisms that could be used to help shift development pathways toward more sustainable climate solutions. As part of the Development and Climate programme[1], a workshop was organized that looked especially into the possibilities for financing integrated development and climate strategies.

This meeting was the first of a series of three international policy workshops that will be organized to explore how national and international policies can support the implementation of integrated development and climate strategies.
The meeting took place in New Delhi, India on 27th and 28th September 2004 and was organized by the Indian Institute of Management (IIM, Ahmedabad) and the Netherlands Environmental Assessment Agency (MNP-RIVM, Bilthoven).

The theme of this first workshop was financing of climate safe and climate friendly development, especially in the sectors energy and water/food. The workshop explored existing and alternative national and international policies and financial mechanisms that can contribute to the implement-tation of integrated development and climate strategies in countries. In line with the philosophy of the Development and Climate programme, the workshop started off on the basis of input from country studies carried out within the programme. Building on experiences from Bangladesh, Brazil, China, India, Senegal and South Africa, implications for national and international policy making on financing integrated development and climate strategies were explored.

The aim of the workshop was to:
1. to portray the positive aspects of an integrated development and climate approach, i.e. taking action to address climate change is not a threat to development activities rather it is an opportunity;
2. achieve a broader perspective on development and climate finance mechanisms, beyond climate specific finance;
3. identify and elaborate possibilities for (inter)national policy making that help financing integrated development and climate strategies.

The workshop was inaugurated by *Dr. Prodipto Ghosh, Secretary of the Indian Ministry of Environment and Forests*. Dr. Ghosh identified three key propositions in the debate on development and climate:
1. Key developing countries will contribute a major share of greenhouse gases (GHGs) in coming years; therefore, they must be in some way assisted, persuaded to traverse sustainable development growth paths;
2. Need to de-link development and growth from increasing GHGs; less GHG intensive growth paths are possible;
3. Further aggressive targets for GHG abatement in industrialized countries will reduce GHG growth; the question is whether these targets will impose unacceptable economic costs for developing countries and influence the developing countries through trade links.

He also stated that in the Indian context policies for sustainable development are based on several policy objectives and not specifically GHG abatement. The existing policies in India to address climate issues include the Energy Conservation Act, promoting renewable energy and promoting public transport such as metro systems.

[1] More detailed information about the Development & Climate programme can be found on the website www.developmentfirst.org

2. The Development & Climate Programme

Following the inaugural lecture, introductions to the Development & Climate programme was given by *Dr. John Christensen (UNEP Risoe Centre on Energy, Climate and Sustainable Development (URC, Denmark)* and *Dr. Bert Metz (MNP/RIVM, the Netherlands)*.

Climate change is often seen as a threat to development. In the development and climate philosophy the starting point is not climate change, but development priorities ('development first'). The idea is that objectives of development and poverty eradication must be met, but with development strategies that aim for climate safe and climate friendly development, i.e. development that leads to a low vulnerability to climate change and to low GHG emissions. The consequences in terms of green-house gas emissions of different development pathways and the element of 'choice' in it for a country are illustrated for China in figure 1. Whether China goes the 'Japan' or the 'US way' will have major consequences for China and the world.

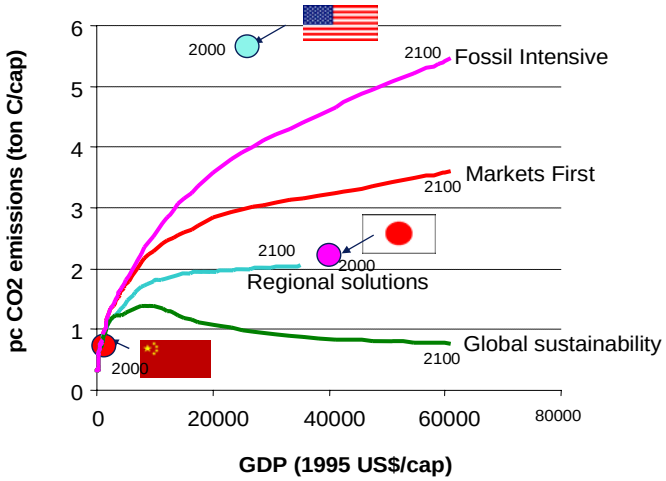

Figure 1: Four different development paths for China (source RIVM/ERI, 2001; IMAGE/TIMER calculations)

Principal aim of the Development and Climate programme is to identify development pathways that are sustainable and facilitate the delivery of positive climate outcomes. The objectives of the programme are to:

1. explore national and regional development strategies that address climate change;
2. identify promising policy options and projects that facilitate the transition to long-term sustainable development, including policies addressing climate change;
3. explore how national and international policies can support the implementation of sustainable development and effective climate change policies.

The first two objectives are in the process of being realized by country case studies in Bangladesh, Brazil, China, India, Senegal and South Africa. Together these countries cover a wide variety of situations. The country case-studies focus on two priority areas in development for these countries:

- energy supply for development and access to energy;
- food security and fresh water availability and the interrelated aspects of land use and forest management.

The third objective will be met through a series of three international policy workshops, largely based on the outcomes of the country studies. The line of reasoning in the programme is thus explicitly bottom up.

Building on experiences from the country studies the dialogues explore implications for national and international policy making.

The overall aim of this international dialogue is to contribute to developing innovative national and international (long term) development and climate policies within and beyond the climate regime. One of the ideas behind this policy dialogue is that besides through climate policies, it also will be necessary to further explore a 'non-climate' track of policy making that is about achieving policy coherence and mainstreaming climate concerns in other policy areas (see Kok and de Coninck (eds), 2004).

Dr. Christensen stressed the rationale for taking a long term sustainable development perspective in the programme. It is in line with the principles and ambitions of the UNFCCC and there is a need for a meaningful involvement of all countries in the climate regime. Climate concerns are mostly overshadowed by more immediate development priorities, especially in developing countries. However, many development priorities are climate friendly and a more integrated approach to development and climate would lead to much more cost-effective mitigation and adaptation.
Some of the findings[2] from Phase I of the programme, which was carried out from 2002 until 2003, were:

- Potential exists for joint development and climate benefits. Implementation requires technological innovation, institutional development and targeted finance.
- National case studies in a number of countries demonstrate that many dedicated development policies and activities make ('unintended') positive climate contributions
- These examples can in many cases be replicated and contribute to making development patterns gradually more sustainable
- Integration of climate and broader SD concerns early in the policy process (path change) is cost-effective both from a development and climate perspective.

The Development & Climate programme helps with the positioning of the development agenda and climate change concerns in international debates. The fact the programme looks at a 'non-climate' route for international policy making is important part of the unique programme approach.

Dr. Bert Metz further elaborated the link from national country studies to international policy making. The results from the Development & Climate programme can be of relevance for inter-national processes such as the Millennium Development Goals (MDG) implementation, the Commission on Sustainable Development (CSD). Development assistance and the international development lending programmes can also be made aware of the findings of the Development & Climate programme as well as giving input into ongoing the UNFCCC activities (SBSTAs and COPs).

[2] Phase I reports from the 6 country studies can be found at http://www.developmentfirst.org/countrystudies.htm

3. Financing the Climate-friendly Development Pathway

For setting the context and the discussion of the workshop, an input paper titled '*Financing the Climate-friendly Development Pathway*' was written and presented by two members of the Development and Climate Programme, Prof. Heller (Stanford, USA) and Prof. Shukla (IIM-A, India). The paper that builds on their '*Beyond Kyoto'* (Paper Pew Centre, 2003) is summarized below[3].

Climate change interfaces with diverse societal and natural processes and consequently with development processes. Development and climate intersect along two broad dimensions.
First, development activities emit greenhouse gases (GHG) that are driving forces of climate change. In spite of the historical record that attributes current GHG concentrations to the emissions of now developed nations, the impact of rising emissions from key development sectors including energy and transport, especially in fast growing developing countries like China and India, will become increasingly important components of planning for global stabilization of greenhouse gas concentrations. This point is illustrated by figure 2.

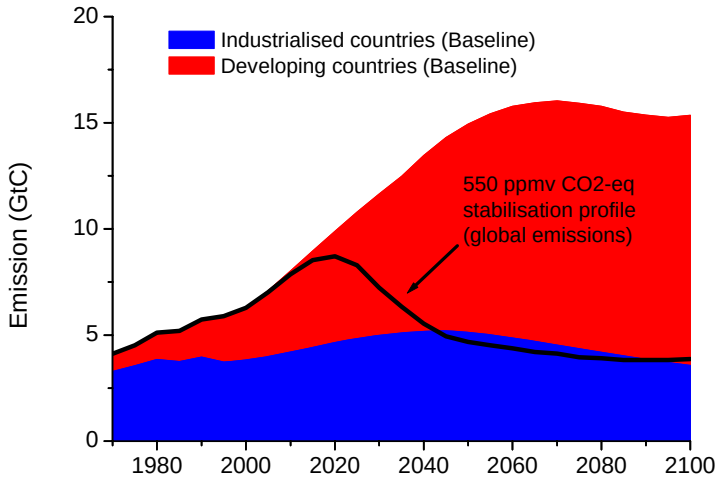

Figure 2: Greenhouse gas emissions from energy according a baseline scenario for industrialised and developing countries, compared to a stabilisation profile for 550 ppmc CO_2-eq. (CPI-scenario, source TIMER-energy model, MNP/RIVM, 2005)

Yet, the controversies over the fairness of various proposals to impose mandatory obligations on advanced developing countries to account for these emissions in the UNFCCC have prevented agreement on these matters. These controversies will not be easily or soon overcome. Nor is it likely that the that the Clean Development Mechanism (CDM) provided in the Kyoto Protocol to integrate developing country actions into the multilateral regime will provide an effective stopgap tool in the extended interim.

Second, the localized impacts of climate change like water shortages, agricultural disruption and coastal flooding pose serious long-term threats to development. These impacts will be felt disproportionately in developing countries. In particular, those nations that are least developed have shown considerable concern about their vulnerability to climate impacts. Since the impacts of climate change are considered a futures problem, climate negotiations have so far concentrated on the mitigation of emissions. The imbalance in emphasis between mitigation and adaptation ought to be restored. Aligning development and climate

[3] The full paper can be found as Annex to this report.

actions in developing and developed countries is a most practical and effective way to restore the balance and facilitate international agreements.
Conventionally, policymakers view climate change as a barrier to development and development as a threat to climate change. The current impasse in negotiations now demands a search for alternate perspectives. The development and climate paradigm views development, i.e. building of capacities, institutions and human capital in developing countries, as the key driving force for enhancing adaptive and mitigation capabilities for addressing climate challenges. It therefore focuses upon economic and social activities that are central to development agendas, as defined by governments and stakeholders in developing countries, to explore how these national development goals can be met in ways that are benign, or relatively less harmful, to climate change.

Looking beyond the experience of the CDM and the Global Environmental Facility (GEF), the development and climate approach suggests international co-operative climate activities between developed and developing countries follow four operational guidelines. The first is that is possible and advisable to mainstream climate concerns into the evolving political and economic conditions in developing nations. Mainstreaming means that climate considerations be made salient to existing policy makers, who at the margin, face many challenges about the set of energy or transport or land use decisions that they seriously entertain as viable development options. Second, development and climate concentrates on the policy and programme options in play in mainstream institutions. It encourages the enactment of those more climate benign, non-climate actions that can transform emissions baselines by enhancing the likelihood that those new and commercially sustainable markets will grow under a reformed political framework. Third, development and climate emphasizes the critical importance of organizational and political barriers to change. To counteract the power of the status quo, development and climate activities should focus on reforms that create opportunities that will appeal to, and be taken up by, existing business or political organizations. These organizations have established financial and human resources upon which they can call in support of their innovative ventures. Finally, the development and climate programme should be entrepreneurial, assisting in the forging of coalitions between mainstream public agencies and private actors, national and multinational, with the organizational and financial capabilities to prosper therein.

There are a variety of national and international financial mechanisms that could be used to help shift development pathways toward solutions that are more sustainable from a climate point of view. The paper elaborates four possible schemes for ensuring resources that, first, respond to providing goods and services for the development priorities of local actors and, second, shift development pathways toward more sustainable solutions. These include: (1) national policies to make private markets work; (2) bilateral ODA and budget based reforms; (3) multilateral financial institutions and energy access funds; and (4) a multilateral climate bank/trust.

In many cases, the adoption of non-climate policies with ancillary climate benefits would create a context in which the commercial development of lower GHG emitting systems could be financed through regular private investment channels. In other cases, there may be a need for one-time incremental resources from public or private sources outside the developing economy to provide start-up costs, reduce initial risks, or install know-how that would lead, once embedded, to a commercially sustainable economic activity or sector. In still further cases, the changing national or local demands for new quality goods and services, along with the enhanced domestic capacity to finance it, may combine with ongoing external transfers to compensate for incremental value of the global public good component.

Analyses of prospective electricity sector reforms in China and India indicate that national development policies can lead to private commercial markets in which natural gas can emerge as both an economically viable substitute for coal in key regions and as a source of reduced carbon emissions. And while it is important to recognize that current trends in national bilateral development assistance agencies (ODA) and in multilateral financial institutions (MFI) are unlikely to make climate specific funding a core mission of these bodies, development and climate funding can be shaped to fit into new ODA processes like budget based reforms or the more recent MFI priorities like poverty reduction. Such opportunities do conform well

to the cultures of these organizations. Finally, a multilateral climate bank or trust could be designed in accord with development and climate principles to fund development policies and programmes, which would compensate the existing limitations of CDM as a climate specific international cooperation mechanism. Several case-studies included in the full paper illustrate and define potential applications of the development and climate approach to mitigation and adaptation in a variety of fields of Indian development.

4. Country perspectives

The presentation of the input paper set the context for the participants, and the workshop switched gear into the 'bottom-up' approach, where the various countries outlined their experiences and perspectives on financing development and climate. Detailed presentations were given on South Africa and Brazil, while additional information was also provided on South Korea. For a detailed elaboration of the Indian case we refer to the paper by Profs. Heller and Shukla (IIM) in the Annex of this report.

A South African Perspective was presented by *Ms. Aditi Maheshwari, National Treasury of South Africa*. South Africa (SA) is a middle income country with per capita GDP of ~ $3000, but with a high degree of inequality, characterized by the formal and informal economy. Its development goals are set in the Reconstruction and Development Programme and the Growth, Employment and Redistribution Strategy. The energy sector continues to be a priority for the country's development, having supported major investments in heavy industry and mining, which shape the economic and energy structure of the country. Eskom, the South African electricity utility, is the 4th largest in the world and accounts for 60% of electricity generation in Africa. SA consumes about 40% of all electricity used in Africa, with only 5% of its population. The overall rate of electrification was 66% in 2001 and has been growing steadily since. Abundance of cheap coal for generation has provided little incentive for efficient use of energy, 93% of electricity is generated from coal fired power stations. This helps place SA as the 15th highest emitter of Carbon Dioxide in 1999 according to the 2003 Human Development Report, whilst having an overall ranking of 111 in the HDI index. As such it is likely to be the only country in Africa that is an important driver and not just a recipient of climate change. Although the environment is not a stated explicitly as a priority for the next decade, it is embedded in the underlying development frameworks. Hence tools such as Environmental Impact Assessments have an important role in South African policy making and are of high standards.

Financing of development and climate activities is growing in tandem with awareness of the importance of climate change for development. However, proportionally more is spent on services/departments achieving core objectives such as health, education, social services. The ODA received is in the form of grants and technical assistance, this is viewed as additional to the budget and not replacement funding for normal revenue. However, it should be noted that ODA in SA is very small relative to government expenditure, representing at maximum 0.15% of GDP as compared to 24% of GDP (see figure 3).

There is a special agency for climate change response in South Africa (called DEAT), but it is recognized that climate change is a cross cutting issue with ramifications for diverse activities in other government departments. The climate change strategy will require government departments to work together in a coordinated manner to ensure that response measures are properly directed, acceptable to all and carried out with a national focus. General awareness within government on the likely impacts of climate change is limited in departments that are not directly involved with the issue - hence capacity will have to be built in order to prepare and adapt adequately. Climate change needs to be addressed in such a way as to assist departments to achieve their service delivery objectives against which the performance of each department is judged. Integrating and mainstreaming climate (in for example the integrated sustainable rural development strategy) will work so long as it is done in a manner consistent with achieving national priorities of poverty alleviation, access to basic amenities including electricity infrastructure development, job creation, rural development, foreign investment, human resource development and improved health leading to sustainable economic growth.

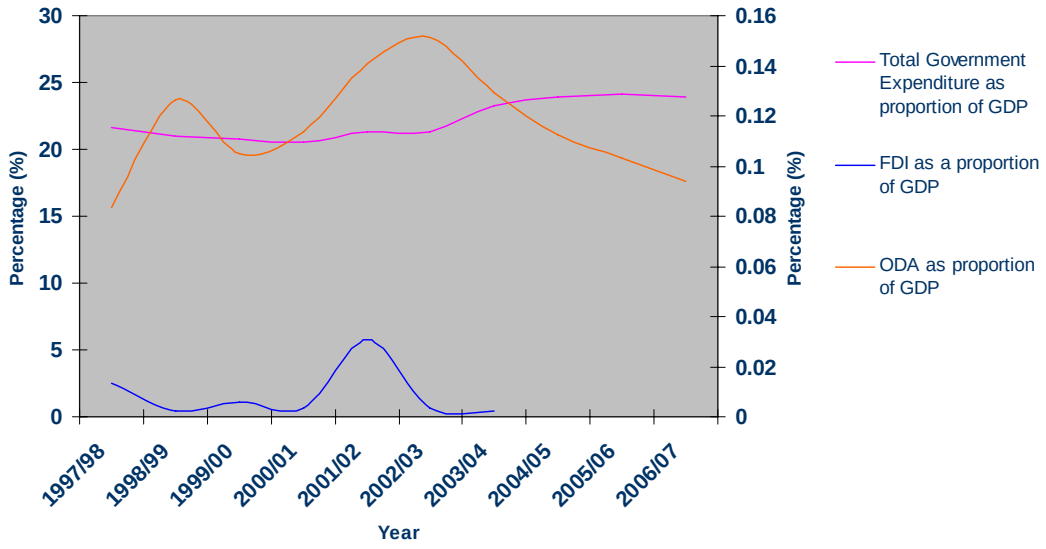

Figure 3: Sources of expenditure as proportion of GDP in South Africa

South Africa has so far attracted limited funding through international finance mechanisms such as the Prototype Carbon Fund, Clean Development Mechanism and the Global Environment Fund, and this is likely to remain the case as regions with greater potential such as Latin America and Asia are targeted first. There is a growing awareness of the need to seek alternative sources of funding for projects in this area, perhaps through the private sector and insurance markets. Public Private Partnerships (PPPs) can help to promote buy-in of the private sector. The other approach being considered is environmental fiscal reform which would improve the allocation of resources whilst simultaneously combating market failure and raising revenue that could be used to fund other environmental projects.

Next, *Mr. Pierre Mukheibir, Project Manager, Energy Research Centre, University of Cape Town, South Africa* explained the key water related issues for financing development in the South African context. The water demand in South Africa is highest for agriculture (60%), followed next is the demand from urban and rural areas (nearly 30%). The government is committed to providing potable water to all people of South Africa by 2008. Access is now improving, though field studies show that the number of properly working drinking water schemes is quite low.

It is predicted that changes in the climate system will impact hydrological systems and water resources in South Africa. Dealing with this therefore directly links to aspects of poverty reduction and promoting sustainable development. Increasing water supply, reducing water demand and better management are ways to adapt to the climate change threat.

In terms of the trends in financing, South Africa cannot rely on overseas development aid to achieve environmental or developmental priorities since they contribute a miniscule proportion. While there is FDI, it has not been specifically directed to environment or developmental policies. In case of financing water supply, the national budget and foreign grants are used for planning; while implementation, operation and maintenance is financed through cross-subsidization, FDI and private sector investments.

Funding for adaptation should be part of development funding in areas of capacity building and training, planning, technology and infrastructure, water efficiency, disaster relief and, pollution control. For the South African case, Mr. Mukheibir identified three specific areas where there is a role for specific climate change funding. These activities include:

- 'seed finance' to get policy development started, e.g. water demand management at local level, Awareness & capacity building;
- precautionary investments as part of the planning process, e.g. vulnerability assessments, disaster planning, and
- incremental costs for implementation, e.g. additional capital investment at project level to meet SD goals and improve CC resilience.

Following the South African presentations, the Brazilian Perspective was communicated by *Prof. Emilio Lebre La Rovere of the Federal University of Rio de Janeiro, Brazil***.** The three issues of importance from a Brazilian perspective are:

1. funding of long-term investment on clean energy sources and energy efficiency,
2. funding for expanding the access to energy in a climate friendly way, and
3. funding for forest conservation and afforestation/reforestation programmes.

An economic analysis was presented, showing the conflicts between macroeconomic goals of developing economies, i.e. curbing inflation rates, servicing debts, realising economic growth and improving income distribution. In Brazil, there are insufficient domestic savings which in turn jeopardize the improvement of general infrastructure; including energy supply (hydropower, renewables), energy efficiency, environmental protection and afforestation.

There have been unfavorable international financing conditions in the last years and FDI has also gone down. The financial agreements with multilateral bodies have focused on macroeconomic structural adjustments and institutional reforms (power sector, telecommunications, sanitation, transports, general infrastructure). The focus on short-term macroeconomic equilibrium has hampered long-term investment of state-owned companies.

Prof. Lebre La Rovere presented the case of the changes in the power sector, which has undergone reform. Privatization has stopped in the power sector and the utilities have been disctributed at the state level. There is a pool of distributors instead of pure market competition. Brazil also in this regard has seen in a shift of general orientation to prioritize security of supply and lowest possible end-user tariffs.

The future challenges for Brazil for financing development include; fostering South-South cooperation in funding new infrastructure (e.g. China/Brazil new partnerships), developing new approaches of relationships with multilateral financial institutions and resolve the possible conflict of interests between public regulation and Public Private Partnerships (PPPs) (e.g. Brazilian power sector).

To conclude the Korean perspective was presented by *Dr. Taeyong Jung, who was representing IGES, Japan* at the meeting but is originally from Korea. Development is a priority in Korea, but climate change issues are less significant as compared to local environmental issues. This is also due to pressure from the local environmental NGOs and the general public awareness. Many advances have been made in developing a domestic emissions trading system, which is also being given a strong government push. Geo-political issues have considerable influence in Korea, for example, they are the reason for preventing the joint development of a gas project with Russia in Siberia. Also the need for huge investments in this project dissuades the private sector from coming into this project.

Ms. Jo-Ellen Parry from the International Institute for Sustainable Development (IISD) in Canada discussed IISDs' work on an integrated approach to addressing climate change. She presented the IISDs' approaches for understanding exposure to multiple risk factors and identifying appropriate policy interventions, and for meeting multiple needs at the community level. She did this by presenting two projects. The first project called 'Mapping Vulnerability to Climate Change and Globalization in India's Agriculture Sector' mapped regions that are exposed to climate change and agricultural trade liberalization

stresses. See figure 4 for a map of 'double exposed' vulnerable regions. The project resulted in the following policy recommendations:

- National Policies
  - importance of state level agricultural policies;
  - policies designed to fortify current coping capacity also have the power to strengthen long-term adaptive capacity;
  - understand how certain factors change the vulnerability of a given community or place over time;
  - private sector and civil society have key roles to play in supplementing government efforts to reduce vulnerability;
- International Policies
  - linking adaptation and international trade policy, e.g. impact of proposed WTO agricultural agreement on the ability of farmers to adapt to climate change.

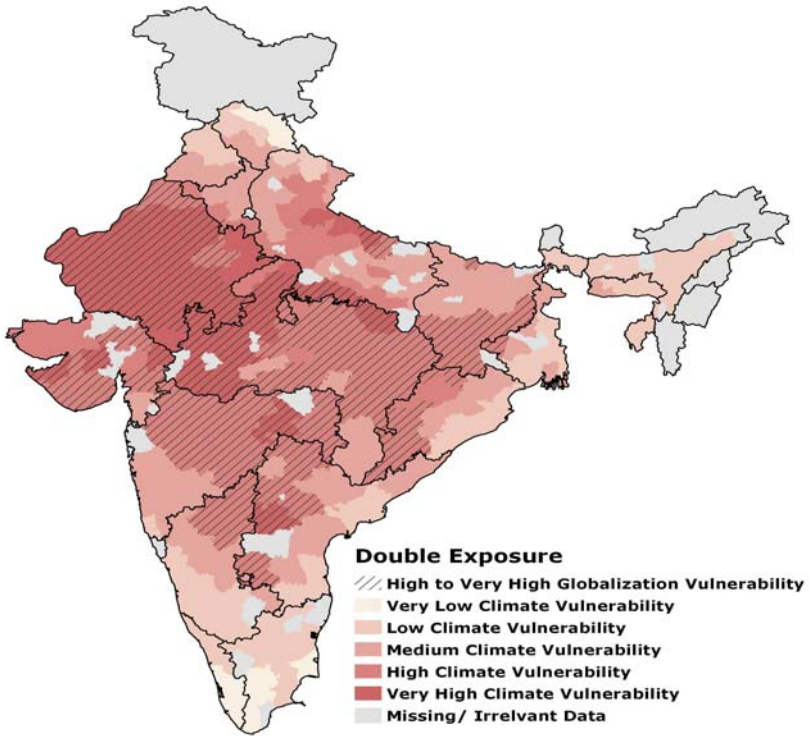

Figure 4: Regions of double exposure climate change and globalization (TERI/CICERO/IISD, 2003)

The second project 'An Ecosystem Approach to Decentralized Renewable Energy' rationale is to reduce risk of climate change impacts at the local level by enhancing economic development and ecosystem security through the provision of decentralized renewable energy, using an ecosystem approach.

Conclusions that can be drawn from both projects are:

- Local and national level policy development and investment decisions require an understanding of and respect for the interconnections between multiple stressors.
- At the local level, resources have to be mobilized towards support for measures that simultaneously reduce climate change vulnerability, build adaptive capacity and have strong mitigation potential.
- Take top-down and bottom up approach to reduce risk and implement robust policies.

5. Integrated development and climate finance

Following the country perspectives, the dialogue turned to actually exploring the key issues of development financing. This discussion was started by a presentation by *Dr. Jan Verhagen, senior researcher at Wageningen University in the Netherlands*. Dr. Verhagen started off by explaining the role of agriculture in development and how global competition in agriculture leads to specialization, intensification, concentration and innovation. The consequence of this trend will be land surplus and environmental degradation. Climate change will impact agriculture and options to deal with these problems need to take into account current problems of food security, jobs and income and risks and revenues. Financing mechanisms that could be applied are subsidies, micro-credits, insurance, lotteries and donations. Worldwide 400 billion US$ subsidies go into agriculture and forestry annually.
Income security is a necessary precondition to bridge the gap between over-exploitation and sustainable resource use. Dr. Verhagen illustrated this further by looking into biodiversity and poverty. Biodiversity conservation and sustainable use of agricultural land could help to change rural areas from poverty traps into land which contributes to sustainable development. However, the main question that needs to be answered is 'who pays for biodiversity and sustainable use of land?' New partnerships between local communities, private sector, development agencies are needed to tackle this problem. One example of a sustainable finance mechanisms is the proposed 'biorights fund' was proposed. This proposal is currently under construction. The main elements are: the global community pays for local cost, it will be based on the development plans, involves local communities based on enhanced job opportunities and needs to include a monitoring and audit procedure. What is new in this idea: the world community can takes its responsibility and get value (services) for money, biorights translate environmental values into cash flows and economic development, it is a business approach based on a contract with local stakeholders and it provides rural poor with a new source of income based on environmental services.

Mr. Takayuki Yamamoto, Chief Representative at the Singapore Office for the Development Bank of Japan explained the objectives of the Development Bank of Japan (DBJ). DBJ aims to revitalize the economy and promote Sustainable Development by promoting long term funding. Mr. Yamamoto discussed the challenge for Sustainable Development within the Bank and gave an introduction to the Japan Carbon Fund. The objective of the Japan Carbon Fund is to purchase Certified Emission Reductions and Emission Reduction Units. The size of the Fund is about US$ 100 million and the equity for this fund is provided by the DBJ, Japan Bank for International Cooperation and the Japanese private enterprises. He stressed the advantages of the Japanese Carbon Fund as a reliable buyer, as it is founded by companies with high credit standing, the linkages it will provide to other forms of funding and to the Japanese industry having an interest in CDM.

Next, the Indian focal point of the *Global Environmental Facility, GEF* was represented at this meeting by its *Director, Mr. S.K. Joshi.* Mr. Joshi gave a detailed account of the operation of GEF with respect to Climate change and the Indian experiences.

Mr. Joshi explained that development and climate change aspects have to be linked, we cannot talk of climate change in isolation. There are very many inter-linkages among the various environmental and development issues. In a situation where there is lack of resources, adequate resources have to be made available by the international community. The GEF is such a mechanism for providing new and additional resources, to meet agreed incremental costs of measures to achieve agreed global environmental benefits

The areas of focus within GEF with respect to climate change include removing barriers to energy efficiency and conversion, promoting the adoption of renewable energy by removing barriers and reducing implementation costs, reducing the long term costs of low GHG emitting energy technologies and promoting sustainable urban transport. Currently, emphasis is on removal of barriers, following which the process could be reproducible elsewhere; barriers can be institutional, financial, management, and other.

Project level financing for climate change in the period 2003-06 is around US$ 754 million. India is both a donor and recipient country. Most projects in India have been in public sector and private sector participation is in infancy. The projects in India include energy conservation in the steel re-rolling sector, carbon emissions reduction through biomass energy, optimizing development of small hydro-electric resources in hilly regions, energy efficiency market development programme, and enabling activities for producing the national communication on climate change for UNFCCC.

GEF provides incremental funding which has multiplier effects. To address the specific issue of development and climate change would require some changes in the GEF mandate. Such changes could include a minimum size of funding so as to reduce transaction costs; and there would be a need for further synchronizing of national priorities with GEF since there are continuous shifts in priorities.

Dr. J. Christensen (UCC) briefly presented the African Rural Energy Enterprise Development (AREED), as an approach to public private partnerships. AREED provides enterprise development services and start-up financing for entrepreneurs who want to set up companies to provide energy services. Figure 5 shows the AREED business model in comparison to the usual approach.

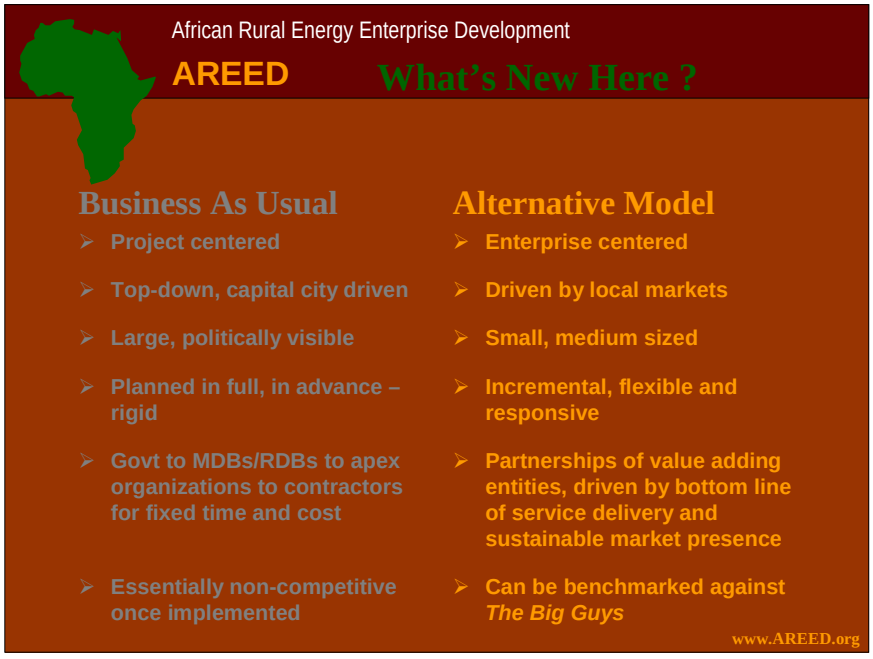

Figure 5: The AREED model for energy enterprise business development

6. Private sector perspectives

Mr Suman Majumdar from the Confederation of Indian Industries, CII presented a view from the private sector in India. The CII has found that the level of awareness on environmental issues is not high in India. Climate change impacts have to be understood and included in decision-making. States in India in particular vary with respect to responding to the issues related to environment.

As an industry body, CII feels energy issues should be looked at as a whole, rather than only focusing on power. In India, there is a Ministry of Non-Conventional Energy and Ministry of Power, but not of energy as a whole. The advantage of an integrated approach would enable to look at the multiple issues related to the energy sector.

Energy cost is a substantial part of manufacturing costs and improving energy efficiency would address the issue of energy sustainability and greenhouse gas emissions, as well as reduce manufacturing costs.
There is a need to understand the small and medium enterprises, since there are good opportunities to incorporate energy efficiency and use of recycled products in these enterprises.

The next presentation was given by the *President of Senegy Global, Mr. Ajay Mathur*. Mr Mathur, in his previous position was heading the climate unit at the environmental division in the World Bank.

According to Mr. Mathur the finance gap is a myth, the real gap is in financable/bankable projects. The private sector does not invest in climate-integrated development, because it sees neither the risks to business sustainability, nor potential for greater than business as usual rewards. By itself the private sector will do nothing if there is no risk or no reward. The private sector is interested to band together to minimize risks and maximize rewards. This 'banding together' enables chunks of finance to work together with other chunks of finance. In order to properly close the gap of bankable project is it essential to bundle financial means. The banding together happens on the basis of past experiences between companies, the fact that gamblers (business with high risk appetite) will play and that governments coax and compel.

Market transformation and enhancing financing will be necessary. Financial institutions must be encouraged to lend for cleaner energy products, micro-credits and energy service companies should be enabled and endogenous capacities enhanced. The question is also if a risk-sharing market in adaptation could happen. The focus is now on climate variability and not climate change. Currently there are too many projects that lead to mal-adaptation, because future climate change is not taken into account. Mandatory climate impact assessments would be a way to deal with that. If insurance evolves, this will provide feedbacks to prevent mal-adaptation. Hence, insurance needs to be based on future climate change.

The final presentations at the workshop were from the banking sector.

ICICI Bank, India's second largest private bank was represented by their *Environmental Director, Mr Anil Malthora*. He outlined their initiative and policies on green business in India. The reason for conducting green business operations are several, namely it strengthens bottom line through operating efficiencies, green businesses give marketing edge over competitors and encourages to innovate and develop products which in turn provide opportunities in new markets. This eventually leads to ICICI Bank being recognized as an environmental leader.
ICICI Banks' initiatives on green businesses include activities such as Municipal Infrastructure, dealing with urban solid waste disposal, sewage treatment and energy efficiency. In the transport sector, ICICI Bank deals with fuel switching / alternate transport technologies and public transportation (high capacity buses). He mentioned the following financial instruments the bank applies: conditional loans with repayment depending on success, multiple interest structures and flexible repayments with lower interest rates during the research phase and higher rates once commercialized, technical assistance grants and

funding for laboratory/pilot/prototype testing and regulatory approval studies. ICICI has a special programme for energy conservation and commercialization with the objective to assist Indian stakeholders in promoting market oriented solutions, leverage of private sector investments, and assist in creating a positive policy and market environment in India and to demonstrate energy efficiency through Energy Service Companies (ESCOs) and utility based demand side management.
Mr. Malhthora elaborated on the ESCOs in great detail because he sees great business opportunities here. Energy audits have established enormous potential to save energy costs. ESCOs implement projects within organizations/businesses and arrange for entire finance. A pre-determined portion of the savings is shared with the end-user/sponsor. Innovative financial solutions are required to improve the bankability of the ESCOs and increase access to credit.

Next, *Ms. Shami Nissan, Managing Director of Innovest* **(**an investment research and advisory specializing in analysing the investment implications of environmental and social issues) elaborated the link between companies' performance on environmental, social, and strategic governance issues, with a particular focus on their impact on competitiveness, profitability, and share price performance.

Ms. Nissan introduced the concept of Socially Responsible Investment (SRI) or Sustainable Investment (SI) which for business means incorporating consideration of sustainability issues into the investment decision-making process. Climate change issues must be addressed to safeguard investments and mange risk. Climate change also represents an opportunity and an investment opportunity is a development opportunity.

The role of investors is important for getting the money for development and climate related projects. Investors have five main tasks that they need to fulfill, these are:

- channel more investment capital into 'clean energy' opportunities (UNEP-Financial Initiative estimates that financing into clean technologies will reach $2 trillion by 2020);
- seek expert advice on climate risk and opportunity;
- incorporate climate change considerations into overall investment strategies;
- request greater disclosure of climate risks by companies;
- engage more actively with the climate policy process and collaborate internationally to achieve this aim.

Several new initiatives are emerging that show that investors are really starting to move on these issues. There is now an investor's network on climate risk that started the carbon disclosure project to ask the world's 500 largest companies to disclose how they are managing climate change related risks and opportunities. In September 2004, the world's first Sustainability Fund was launched that invested exclusively in emerging markets, with a heavy focus on environmental impact and carbon intensity. The Equator Principles are established by the 10 world's largest banks to address social and environmental impacts of the projects they finance. Signatories agreed to a series of guidelines for assessing project finance deals. The group has grown and now accounts for 80% of the project financing globally.

The final presentation of the workshop was prepared by *Mr. Abser Kamal, General Manager at the Grameen Shakti Bank, in Bangladesh*. Due to visa problems, the presentation was given *by Prof. P.R. Shukla-IIM-A, India*. Firstly an introduction was given to the financing model of Grameen Shakti- GS, explaining that the success behind GS promotional work is its innovative financing scheme (including different modes of micro-finance). It is based on the socio-economic situation of Bangladesh and blending with community involvement at grass root level. World Bank & IFC appreciated this model and are now following it. The World Bank is now financing in this sector through Infrastructure Development Company Ltd. (IDCOL).
Grameen Shakti has introduced a new technology package called micro-utility. This mechanism is a sort of selling or sharing solar power with neighbors. This helps to reach the poor who cannot afford one complete solar home system. The mode of payment for this micro-utility is as follows. The entrepreneur pays only 10% of the total price as down payment during installation; the remaining 90% of the cost is made through weekly-collection of the load charge from the users by the entrepreneur. Generally full payment is completed within three and half year. No service charge is applicable for micro-utility system. So far GS has installed about 100 of such micro-utility systems.

The presentation then went into give success case studies in energy loans which have proven to be successful. The Grameen Shakti's current innovative project is 'Grameen Telephone Lady' which is an integrated approach of Solar Home Systems (SHS) and telecommunication. It is empowering the rural women through income generation activities.

The reason behind Grameens' success in financing development activities is due to providing an innovative financing model for the customers, commitment and dedication of the bank. There is a motivational programme for awareness building and an ownership model for better maintenance. Monitoring and evaluation are ever present with a reliable backup service. Due to poverty, many people are deprived of education, health and other basic elements, which are essential for better livelihood. This 'poverty bad cycle' is another cause of environmental pollution in developing countries. Grameen's programmes provide an integrated financial approach for poverty reduction and eco-friendly sustainable development.

7. Discussions

This section summarizes the main discussions held during the entire workshop.

To ensure sustainable development, heavy investments are needed. Financial mechanisms need to be found to realize these. Although the potential of the climate friendly/climate safe development pathway is becoming clear, it does not result in many new projects and plans that could help to make this transition. The challenge is therefore more to develop financially viable projects in the countries.

In the discussions it was explored what kinds of barriers have been encountered in different countries in improving the development pathways. Barriers require more analysis from a finance perspective. For instance, if the barrier is knowledge, there could be demonstration projects. But in many cases, the barrier goes beyond knowledge and depends very much of the situation in which finance have to be provided. Similarly, there could be political barriers. There are issues of immature vis-à-vis mature markets, and risk premiums would vary. Therefore, an assessment of barriers is essential. Moreover, it is necessary to understand the cases where there has been success; understanding barriers and successes could facilitate replicability.

An important issue that came up is that specific financial instruments within the climate regime marginal compared to the investments that are actually needed. Climate concerns therefore would need to be mainstreamed in other forms of finance. It was recognized that there is a need to change national policies to attract private capital to free up public money for other goals. There is however not enough public funding to realize all desired goals. FDI is therefore looked at as an increasingly important resource flow in a number of countries, but not in all. FDI flows are not just based on business opportunity, but also depend on the circumstances within the country (investment climate, governance). However, it also became clear that FDI is not always helping countries to develop in a more sustainable direction. The question is if and how this can be steered. In the case of South Africa, we saw that FDI does not target areas related to environment, and is more business related. Furthermore also FDI flows are not sizeable enough to have significant impact. Private and public capital is thus both needed. Hence a shift towards bundling of financial sources and Public Private Partnerships is needed everywhere.

There is different focus of financing in different countries. In many countries, a shift of focus to liberalizing markets has led to problems, since private capital is not always interested in funding projects that are desired from an integrated development and climate perspective. Therefore, government plans have to be made such that these projects are attractive to the private sector and, as in Brazil case that is where state-owned enterprises come in (public funding, ODA) to take some of the risks.

The role of governments and the private sector in the process of reforms in different countries has to be studied carefully. One has to identify actors who have a self-interest to push policies. The fundamental question is: ‘whose risks are we trying to minimize or whose benefits maximized?’ There could be instances where one’s risk is reduced and another’s benefits increased.

Industrial associations are not environment friendly as such, but can have a positive influence on integrating environment and climate considerations in their work. In India, the Confederation of Indian Industries motivates companies for environment management in terms of adopting practices since they make business sense. Making companies realize this, it becomes easier to adopt some environmental measures. There are many companies that have improved their bottom-line by incorporating environmental aspects. There was some skepticism about whether company decisions are actually influenced by the risks created by policies on climate change related issues. Innovest clarified that it does not only looks at traditional financial indicators when considering environmental prospects. They look at the company history in terms of

emissions, reduction, their targets, their future plans, what percentage of business is in which country and what are the regulations in that country.

8. Outcomes

This section presents the outcomes of the concluding discussions at the workshop, which aimed to bring the presentations and discussions together, to identify and elaborate possibilities for (inter)national policy making that can help financing integrated development and climate strategies.

General conclusions
The Development and climate approach suggests the following operational guidelines for (inter)national co-operative climate activities:

- mainstream climate concerns into the evolving political and economic conditions in developing nations;
- concentrate on the policy and programme options in play in mainstream agencies to change business as usual development;
- emphasize the critical importance of organizational and political barriers to change towards sustainability;
- assist in forging coalitions between mainstream public agencies and private actors that can frame sustainable markets.

With respect to financing integrated development and climate strategies, it was indicated that:

- early integration of development and climate could result in more cost-effective solutions for mitigation and adaptation;
- adoption of non-climate policies with ancillary climate benefits would create a context in which the commercial development of lower GHG emitting systems could be financed through regular private investment channels;
- in some cases there may be a need for one-time incremental resources (public or private) from outside the developing economy to cover start up costs and initial risks;
- ODA, FDI, climate finance and national public budgets alone will often not be sufficient to realize integrated development and climate goals; mobilizing domestic savings is therefore also required;
- to bring together enough funds for financing integrated development and climate initiatives and to cover the different risks related to new projects, a bundling of public and private financial flows will be necessary;
- investors and banks indicate that there is a lack of bankable/financable projects that contribute to making development more sustainable rather than the existence of a ‘finance gap’ that hinders implementation of new projects;
- financing integrated development & climate strategies can not be seen independent of improving key enabling factors for investment in the countries, such as investment climate and governance issues;
- the same ‘enabling environment’ is needed for mobilizing domestic and international financial resources;
- too many projects are leading to mal-adaptation to climate change because no climate impact assessment is made; the insurance industry will have a positive role to play here;
- positive examples from both large scale investors as well as investors focusing on local scale projects are showing the added value of integrated development and climate initiatives.

Approaches for improving financing of integrated development & climate strategies
The workshop identified the following five approaches to improve financing of integrated development and climate strategies:

- national policies to attract new private capital;
- national policies to free public money and/or improve the quality of public investment;
- integration of Development & Climate approach in ODA;
- international Financial Institutions to integrate climate in poverty reduction strategies and finance;
- creation of a multilateral climate trust/climate funds.

With respect to these options some key questions are examined further. It was also recognized that synergies do exist between these options.

How can national policy attract private capital for integrated development and climate strategies?
In general it will be important that national policies:

- help to develop new markets; market transformations will be needed to secure that markets are there for climate friendly initiatives;
- provide an enabling environment for private investments (coherent legal system, investment climate, good governance);
- inform investors about climate change and risks/opportunities (examples are the investor networks/carbon disclosure project and guideline initiatives);
- to help band together various private and public financial flows that each cover part of the risks.

The major barriers to realize these are human and institutional capacity (see also the IPCC Special Report on Technology transfer published in 2000 that has analyzed the barriers to environmentally sound technology). In practice this means for example for the electricity sector that corruption, cross-subsidies, tensions between national and sub-national levels, types of contract (who bears what risks), costs of capital and lack of real prices turn out to be important barriers for investments. The following 'cases' where national policy could play a role in attracting private capital were discussed in more detail: large scale energy supply, rural energy, energy end use and agriculture.

With respect to *large scale energy supply*, the context of energy sector reforms taking place is important. It was noted that current energy sector reforms are different from earlier reforms. The institutional setting for reform has becoming more important as it was recognized that new regulations and policies to protect public interest, such as access and environment, are required. Liberalization of energy markets was taking place to allow FDI to come in, but this didn't work everywhere (for instance not in India and China). It is also important to make a distinction between countries with high and low economic growth, as this is an important determinant for investors. Another important trend that has to be taken into account when looking at integrated development and climate strategies is the diversification of the energy mix for reasons of energy security. To realize changes in a positive direction it will be important to have fiscal reforms, get prices and subsidies right (can cross-subsidies be abolished without endangering access for the poor?) and align interest of public and private partners (for instance through PPPs).

For *rural energy*, decentralized small scale energy supply and demand is important. In terms of finance this implies a focus on micro-finance, which could either be individual or collective. Through the provision of micro-credits the access to improved energy services could be highly improved. This in turn will have positive development effects on for instance education and local employment. There are many positive examples from the private sector (i.e. Grameen Shakti, ICI) and PPPs (i.e. AREED) that assist local initiatives and help to build local institutions and business. If energy reforms are taking place, also rural areas have to be included, which is often not the case now. It also has to be noted that through biomass energy there is an important link to ecosystem services and protection.

For *energy end-use* it was first of all noted that although it is clear that improving efficiency can result in economic gains, this is often not recognized. This is why Energy Service Companies (ESCOs) are considered an interesting option to capture the possible benefits of improving energy efficiency. This could be an entirely market driven operation, in which perhaps public funding is only needed to help starting up ESCOs (through PPP constructions).

In *agriculture* both the global context for agriculture and the local level were included in the discussion. The question from a global perspective is how reduction of subsidies plays out and what the impacts of the WTO agriculture agreements will be for example on the vulnerability of local farmers. On the local level micro-credit systems are important (especially for high risk areas and small farmers), as well as links to insurance systems. Government policies are crucial in building increased resilience of farmers and ensuring

that appropriate small scale finance systems are in place. As an interesting link between the local and the global level, the greening of the commodity chain could be looked at.

How can national policies help to free public capital and/or improve the quality of public investments?
To help bridging the finance gap it was noted that it is important to help free public capital, to be used for other purposes such as development and climate priorities. Options to do this can be found in subsidy reforms, dedicated environmental taxes/levies and improved connections between different investment budgets.

For the *water sector* different forms of finance would be needed. This includes seed finance to push policy development forward (awareness, capacity building), precautionary investments as part of the planning process to build resilience (vulnerability assessments, disaster planning) and incremental costs for implementation of improved plans (additional capital investments at project level). In the latter two cases insurance would also have a role to play. For *infrastructure* in the broader sense, this would also be applicable. Expected climate change impacts are a strong reason for alternative approaches to building new infrastructure.

Options to integrate the development and climate approach in ODA
The option of budget based ODA was discussed, as a new wave of ODA is coming in this form. Budget based ODA has three elements. First, aid funds are delivered from governments to government to supplement budget resources for uses the recipient country sees fit. Second, donor and donee nations agree on certain targets and indicators of overall budget spending and performance that are the conditions for grants and potential renewal of assistance. Third, the budget supplements are accompanied by capacity building grants to ensure budgets are managed efficiently so as to achieve targets. For example, a lack of integration between the water and electricity agenda was noted in India. If budget based ODA could be used to reform relevant national budgetary processes towards an integrated water and power infrastructure investment, both development and dealing with climate change can advance. The question is if this going to make a difference, given the small amount of ODA compared to GDP and overall sector investments.

What can International Financial Institutions s do to integrate climate in Poverty Reduction Stratgies and finance?
The primary focus of the International Financial Institutions such as the World Bank is on development and poverty alleviation. To succeed in mainstreaming climate in the core programmes and policies of for example World Bank or IMF, climate initiatives need to be related to these core targets of the organizations. This could for instance be done through including adaptation activities in the poverty reduction strategy planning process, by ensuring that resilience to climate change increases or that those new projects are less vulnerable to the impact of climate variability and climate change and hence result in greater development benefits. How the integration of low emission approaches in PRSPs can be realized is however less clear.

What can climate funds contribute?
Currently a large number of climate funds are implemented (CDM, UNFCCC Climate Fund and Adaptation Fund, World Bank Prototype carbon Fund, UK Global Opportunities Fund, Japan Carbon Fund, Netherlands CDM fund, etc). It was suggested to develop a Multilateral Climate Trust (modeled after the UK Carbon Trust). Such mechanism could help to influence the choice of the development pathway of countries. It can deliver services and finance to reduce carbon emissions now and/or to help reduce vulnerability to climate change.
The suggestion was raised that it would be helpful to see if and how the various funds do complement or hinder each other. It also isn't very clear what the scale of these funds is in comparison to mainstream development financing.

Follow up

The paper and the outcomes of this workshop were presented at the Global Conference on Energy for Development, organized by the Government of the Netherlands, together with World Bank, UNDP en WBCSD in December 2004[4]. Ideas developed at the workshop will be taken up in the country studies during the second phase of the country studies. Two more international workshops will be organized to further explore how (inter)national policies can contribute to the further development of integrated development and climate strategies.

[4] See www.energyfordevelopment.org for further information on outcomes of this meeting

References

Kok MTJ; Coninck HC de (eds) (2004); Aerts JCJH; Asselt H van; Bakker SJA; Bayangos V; ME den; Gupta J; Heemst J van; Jansen JC; Kok MTJ; Nabuurs GJ; Veraert J; Verhagen A – MNP Report 500036001

Heller TC, Shukla PR (2003) Development and Climate: Engaging Developing Countries for the Pew Center on Global Climate Change

TERI/CICERO/IISD (2003) Vulnerability of Indian agriculture to climate change and economic globalization http://www.teriin.org/coping/pac.pdf

Timer Energy Model on http://www.mnp.nl/en/dossiers/Climatechange/Models/index.html

Annex 1: Financing the Climate-friendly Development Pathway (with Illustrative Case Studies from India)

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Contents

Executive Summary

Climate change interfaces with diverse societal and natural processes and consequently with development processes. Development and climate intersect along two broad dimensions. First, development activities emit greenhouse gases (GHG) that are driving forces of climate change. In spite of the historical record that attributes current GHG concentrations to the emissions of now developed nations, the impact of rising emissions from key development sectors including energy and transport, especially in fast growing developing countries like China and India, will become increasingly important components of planning for global stabilization. Yet, the controversies over the fairness of various proposals to impose mandatory obligations on advanced developing countries to account for these emissions in the UNFCCC have prevented agreement on these matters. These controversies will not be easily or soon overcome. Nor is it likely that the that the Clean Development Mechanism (CDM) provided in the Kyoto Protocol to integrate developing country actions into the multilateral regime will provide an effective stopgap tool in the extended interim.

Conventionally, global policymakers viewed climate change as a barrier to development and development as a threat to climate change. The current impasse in negotiations now demands a search for alternate perspectives. The development and climate paradigm views development, i.e. building of capacities, institutions and human capital in developing countries, as the key driving force for enhancing adaptive and mitigative capabilities for addressing climate challenges. It there-fore focuses upon economic and social activities that are central to development agendas, as defined by capable policy elites in developing countries, to explore how these national development goals can be met in ways that are benign, or relatively less harmful, to climate change.

Looking beyond the experience of the CDM and the Global Environmental Facility (GEF), the development and climate approach suggests international cooperative climate activities between developed and developing countries follow four operational guidelines. The first is that is possible and advisable to main-stream climate concerns into the evolving political and economic conditions in developing nations. Mainstreaming means that climate considerations be made salient to existing policy makers, who at the margin, face many close calls about the set of energy or transport or land use decisions that they seriously entertain as viable development options. Second, development and climate concentrates on the policy and program options in play in mainstream agencies, encouraging the enactment of those more climate benign, non-climate actions that can transform predicted emissions baselines by enhancing the likelihood that new commercially sustainable markets will occupy the new space charted out by a reformed political framework. Third, development and climate emphasizes the critical importance of organizational and political barriers to sustainable change. To counteract the power of the status quo, development and climate activities should focus on market-making reforms that create opportunities that will appeal to, and be taken up by, existing business or political organizations with established financial and human resources upon which they can call in support of their innovative ventures. Finally, the development and climate program should be entrepreneurial, assisting in the forging of coalitions between mainstream public agencies that can frame sustainable markets and private actors, national and multinational, with the requisite organizational and financial capabilities to prosper therein.

There are a variety of national and international financial mechanisms that could be deployed to help shift development pathways toward more sustainable climate solutions. In many cases, the adoption of non-climate policies with ancillary climate benefits would create a context in which the commercial development of lower GHG emitting systems could be financed through regular private investment channels. In other cases, there may be a need for one-time incremental resources from public or private sources outside the developing economy to provide start-up costs, defray initial risks, or install know-how that would lead, once embedded, to a commercially sustainable economic activity or sector. In still further cases, the changing national or local demands for new quality goods and services, along with the enhanced

domestic capacity to finance it, may combine with ongoing external transfers to compensate for incremental value of the global public good component.

Analyses of prospective electricity sector reforms in China and India indicate that national development policies can lead to private commercial markets in which natural gas can emerge as both an economically viable substitute for coal in key regions and as a source of reduced carbon emissions. And while it is important to recognize that current trends in national bilateral development assistance agencies (ODA) and in multilateral financial institutions (MFI) are unlikely to make climate specific funding a core mission of these bodies, development and climate funding can be shaped to fit into new ODA processes like budget based reforms or the more recent MFI priorities like poverty reduction that do conform well to these organizational cultures. Finally, a multilateral climate bank or trust could be designed in accord with development and climate principles to fund development salient policies and programs, which would minimize the existing limitations of CDM as a climate specific international cooperation mechanism. The several annexes to this paper further illustrate and define potential applications of the development and climate approach to mitigation and adaptation in a variety of fields of Indian development.

In the face of ongoing disagreements in the Kyoto Protocol negotiations about the potential obligations of developing countries under the United Nations Framework Convention for Climate Change (UNFCCC), Heller and Shukla, in a recent Pew Center paper, argued that it could more wise and effective, both from economic efficiency as well as political feasibility perspectives, to engage developing nations through the joint design of policies and instruments to align climate and development actions. (Heller and Shukla, 2003) Their *Beyond Kyoto* paper on development and climate proposed strategic directions for so doing, but did not provide specific guidance to make these strategies operational. The paper hopes to help to fill this gap, with a view to making more concrete the arguments of the Heller and Shukla paper. An annex provides case studies and sketches from India's development experience to illustrate issues, programs, policies, projects and actions where the potential for aligning, and financing, climate and development interests may well be further explored.

Annex 1-1: Development and Climate Paradigm

Climate change interfaces with diverse societal and natural processes and consequently with development processes. Development and climate intersect along two broad dimensions. First, development activities emit greenhouse gases (GHG) that are driving forces of climate change. In spite of the historical record that attributes current GHG concentrations to the emissions of now developed nations, the impact of rising emissions from key development sectors including energy and transport, especially in fast growing developing countries like China and India, will become increasingly important components of planning for global stabilization. Yet, the controversies over the fairness of various proposals to impose mandatory obligations on advanced developing countries to account for these emissions in the UNFCCC have prevented agreement on these matters. The Pew paper argues that these controversies will not be easily or soon overcome and that the Clean Development Mechanism (CDM) provided in the Kyoto Protocol to integrate developing country actions into the multilateral regime is unlikely to be an effective stopgap tool in the extended interim. Second, the localized impacts of climate change like water shortages, agricultural disruption and coastal flooding pose serious long-term threats to development. These impacts and will be felt disproportionately in developing countries. In particular, those nations that are least developed have shown considerable concern at their vulnerability to climate impacts. Since the impacts are considered a futures problem, the climate negotiations have concentrated on the emissions mitigation. The imbalance in emphasis between mitigation and adaptation ought be restored. Aligning development and climate actions in developing countries is a most practical and effective way to restore the balance and ensure participation of developing countries.

Conventionally, global policymakers viewed climate change as a barrier to development and development as a threat to climate change. Most conflicts in climate debates and negotiations can be traced to this perspective. The current impasse in negotiations and progressively divergent views among the nations now

demand a search for alternate perspectives. The development and climate paradigm builds from a different initial proposition which views development, i.e. building of capacities, institutions and human capital in developing countries, as the key driving force for enhancing adaptive and mitigative capabilities for addressing climate challenges. The paradigm seeks to expand the frontier that restricts simultaneous improvement of development and climate through innovations and cooperation.

The development and climate program hence proposes to explore myriad economic and social activities that are central to development agenda as defined by policy makers in developing countries and how these might be better oriented towards more climate friendly pathways. Since national development goals in many polities can be met in ways that are benign or relatively less harmful to climate change, the achievement of these goals may also accrue a double dividend in terms of added climate change benefits. The cascading effects of more sustainable development would reduce emissions, moderate the costs of adverse impacts of climate change, and enhance welfare. In recent years, more developing countries have attempted to align national goals with globally agreed more sustainable development priorities (Shukla et. al., 2003). As a result, the conventional paradigm of economic development that was woven around the optimal resource allocation is now extended to include participative processes, local initiatives and global interfaces. Under this emergent perspective, while the efficiency is addressed by market mechanisms, institutions are given primacy in the nation's capacity to use resources optimally.

Many development targets help address climate change concerns effectively. It is clear that increased use of hydro and renewable energy resources would reduce GHG and local pollutant emissions, enhance energy security and provide access to water resources from additional hydro projects. But other actions, even more central to the energy or transport or land use debates at the core of national development programs, such as the mix of natural gas in electricity production or investment in mass transportation in emerging mega-cities, can also alter GHG emissions significantly. And progress toward basic development goals, such as poverty reduction and elimination of hunger would enhance adaptive capacity of poor due to improved food security, health security and enhance their resilience to cope with risks from uncertain and extreme events. The central point is that many actions for climate adaptation and mitigation can be integrated with and incremental to projects that already are occurring for developmental reasons should be designed as incremental or adjunct to projects that are justified for economic development purposes. Climate-friendly development pathways and national sustainable development goals, like conservation of resources and human capacity enhancements, are complementary. In fact, cascading effects of development along a sustainable pathway could reduce emissions and also moderate the costs of adverse impacts of climate change.

Annex 1-2: Finance, Development and Climate

At the core of the development and climate dilemma is the political fact that climate policies, even though the consequences of substantial climate change will fall heavily on poorer nations, are now, and threaten to remain, largely marginal to policy makers in developing countries. This state of affairs reflects both the political commitments held widely in developing countries that the burdens of taking actions to mitigate climate change ought to fall on the industrial nations that have contributed the great bulk of the historical emissions of greenhouse gases (GHG) and the normative proposition that the relief of widespread poverty trumps constraints such as the long-term improvement of the global environment. Consequently, we observe that decision makers in developing countries with policy responsibilities for major GHG inputs such as energy production, transportation services and land use pay scant attention to climate imperatives that they perceive as impediments to economic growth and outside the policy remit they have assumed. Even environ-mental agencies, whether or not they have effective power to counterbalance the more narrow developmental perspective of their line ministry colleagues, rarely focus on problems without more immediate local effects. Given the reality that in most developing (and developed) countries those few actors with the scope and authority to reach across policy fields (e.g. finance ministries) have little knowledge of, or priority for, climate issues, it is little wonder that proposals that they take on and enforce national targets for emissions mitigation have fallen largely on deaf ears.

Yet, at the same time, we should note two important background developments that are relevant to thinking about this dilemma. First, economic growth and political reform are moving forward in a highly uneven pattern in many parts of the developing world. In those countries and regions where growth and reform are more rapid, development analysts describe systematic changes in the organization of private and public institutions. First, the role of markets has increased relative to the power of government agencies in the allocation of economic resources. Yet these market reforms remain partial, such that both more competition and ongoing political influence characterize the economies of advanced developing nations. Second, there are in these economies a wide variety of new actors, often the government-controlled stock companies that have evolved out of former state monopolies, with new global reach and national market power. These entities, armed with close connections to somewhat chastened, but still ambitious government bureaus, have much to say about the shape of the rules and policies that structure the new hybrid markets. Third, there are new and more varied financial channels, including domestic public markets for both equities and bonds, diversified financial intermediaries like insurance companies and mutual and pension funds, and wider access to off-shore capital markets, which provide resources for investment projects. Past financial repression that limited savings opportunities to state banks and, in so doing, assured the state control over economic behavior through selective capital allocations has diminished. Moreover, the share of resources in these high growth areas coming through official development assistance (ODA) plummets, in some cases to complete insignificance.

The result of these institutional changes in advanced, and therefore higher GHG emitting, developing countries is that more development options can be financed and can mount serious contests for their adoption and implementation than was earlier the case. Decisions within this wider portfolio of development options are contested between newly emergent coalitions of (quasi) private firms and retrenching state agencies anxious to enhance their profits and power through the expansion of markets for their assets and the scope of their reformed regulatory domains. Pragmatic political struggles abound in advanced developing countries over the policy and market contexts that will favor alternative business as usual trajectories, and may move national systems down alternative paths. Whether these new contests concern sector specific programs like how the nexus between water and power planning will be managed or more general policies such as the pace of financial reforms or exchange rates, their immediate outcomes may often spillover to delimit the future patterns of development choices a society will find politically, economically, and even culturally salient.

Finally, rapid development encourages the emergence of shifting effective economic and political demands that must be registered by private markets, government regulators and public agencies supplying collective goods, like environmental quality or electricity reliability. The unevenness of economic growth and political transformation across and within developing countries leads to increasing variance in wealth and consumer demand within the developing world that fragments the practicality of uniform strategies of development planning, as well as the longer-run prospects for political unity within states undergoing such diverse rates of transition. These evolving demands are more frequently articulated and pressed by new civil society or private business groups that insert themselves into the partial vacuum created by the dissolution of formerly state chartered social and industrial associations. In sum, as a result of these changes, not only do different GHG emissions paths come to characterize the economies of the advancing and stalled developing nations, but the internal politics and institutional mechanisms that may affect the shape and slope of their baseline carbon trajectories diverge concurrently.

The second background condition for the development and climate perspective is the insight to be drawn from the recent analyses represented in the Special Report on Emissions Scenarios of the Intergovernmental Panel on Climate Change. (IPCC, 2001, 10-11) IPCC scenario development shows that GHG concentrations and alternative strategies for future stabilization thereof can be driven by non-climate choices, as much as by climate specific policies and measures. The paths we expect the business as usual evolution of energy, transport and other major inputs to the rate and quality of GHG emissions to follow may be widely differentiated, depending on decisions made about security, technology, non-climate

environmental policies and lifestyle. The solution to climate problems lies in the combination of alternative development paths that may be taken for reasons not overtly tied to climate goals and any measures that are aimed square at GHG emissions mitigation or adaptation. This insight applies to both the alternative growth paths of developed and developing countries. The policy and market options that are in play in government agencies, among private firms, and within civil associations will frequently have more and less sustainable indirect impacts on climate. China's economic reforms have reduced its energy intensity in the last twenty years without a climate policy; France and Japan have much lower GHG emissions than the United States without reference to their preferences on climate issues at the time their energy infrastructures were designed. As suggested above, to the extent that initial decisions are made about infrastructures, knowledge acquisition or institutions that lower the costs of subsequent choices and produce path-dependent outcomes, a move that steers a nation down one alternative path rather than another can magnify these climate impacts.

If the development and climate argument is that development options that lead down more or less sustainable alternative climate paths are increasingly politically viable in fast growing developing countries, two questions immediately arise. One is what factors impede commitments to the more climate friendly development path. The second is how a development and climate strategy differs from other programs, like CDM or the grants of the Global Environmental Facility (GEF) that have been created to give incentives for developing countries to make more climate favoring choices. The most apparent and most usual answer to the first question is that it is more expensive to carry out projects that have higher environmental quality. This is often true and is the answer that underlies the strategy of CDM. CDM assumes that carbon (GHG) mitigation constitutes an incremental pro-duct or service that will not be realized unless the stream of carbon (GHG) benefits is monetized through sale, preferably on an extended time basis. The reductions in emissions beyond (additional to) the project that would have been built without the commercialization of the carbon stream are converted to marketable assets and transacted in global exchanges. There are several types of difficulty that have appeared in the incipient CDM markets not related to the low demand for these assets due mainly to the withdrawal of the United States from the Kyoto Protocol. Most of these problems are associated with uncertainties about the baseline against which carbon savings are to be measured. Business as usual projections normally assume policies and institutions are exogenous to the forecast. Yet, there are always incentives for sellers of carbon services to lower policy quality to create more assets for sale. Especially in political economies going through fundamental reforms, baselines are in flux, contingent on the direction and intensity of the reform processes. Project investment decisions may hinge on the investors' expectations of how far and fast reform will proceed. In these circumstances, there will be unending disputes about whether projects are actually additional, which will create risks and transaction costs that disrupt the smooth operation of the CDM market. While we return to the CDM debate below, our principal point is that in most developing countries, including the faster growing, many important climate favoring development options are far from commercial margins (across which the value of CDM payments might push them) not because of the engineering costs of building to a higher environmental standard. The more effective barriers lie usually in the institutional and organizational context faced by firms with know-how and interests in these markets.

As opposed to the project-by-project focus of CDM, the GEF has concentrated on transforming market and governmental contexts through financial grants that are intended to remove systematic barriers to passage along more sustainable development paths. There is now a lengthy checklist of such barriers, beginning with an absence of knowledge of viable options, often the object of demonstration projects. Prospective markets for what appear to be technically profitable activities may lie inactive because imperfect capital markets will not provide adequate financing. Studies of the value of micro-credits (see case study 6 in annex) or utility financing for energy efficient lights or appliances turn on such arguments. Organizational barriers that stem from routinized patterns of behavior in public agencies and private markets greatly expand the checklist. Unfamiliar new firms like energy services companies (ESCOs) are unable to attract and hold customers even though they have the expertise and capability to assume the risks of profiting from energy savings. Officials with three-year rotations lack incentives to install equipment with five-year payback periods. Many of the specific discussions of development and climate opportunities in this paper highlight the political barriers caused by fragmented decision making authority and embedded interest

groups averse to new market entrants or institutional change. Some climate friendly options, also discussed within, are impeded by the immaturity of markets they seek to develop and the need to mitigate or share the collective risks of market development.

In its attention to systemic issues than condition development choices rather than to individual projects, development and climate is closer to the GEF than to CDM. However, the development and climate strategy looks beyond the GEF approach to a more comprehensive view of the relationship between political economic decision-making and alternative development options. The record of replication of GEF sponsored projects is sporadic because the GEF tends to treat barriers as more discrete than they are. Removing any discrete impediment(s) to market or institutional transformation runs the substantial risk of failing to disturb some other necessary condition of successful change. Especially because the barriers on which most GEF grants concentrate are those connected with knowledge diffusion and finance, there are less often complementary activities to overcome the more hidden and deeply rooted problems with organization and politics. The development and climate agenda stresses integrated strategies to transform baselines at scale through programs that change the policy and institutional context in which commercially replicable activities with climate favoring effects are more likely to go forward. It aims directly at the political economic and organizational barriers that compose the less transparent segments of the barriers checklist, often unattended by GEF actions. Because of the complex and contested nature of such a program, a development and climate agenda will likely be viable only where major barriers on an inclusive checklist are already disturbed by reforms independently underway in advanced developing countries. It builds on a detailed empirical understanding of development options actually in play among empowered national public and private actors and must assemble an appropriate portfolio of measures that might influence the results of their deliberations.

The development and climate approach might be broken down into four operational guidelines. The first assumes that is possible and advisable to mainstream climate concerns into the evolving political and economic conditions in developing nations. It suggests that we begin with things as they are, rather than searching for optimal solutions that might be imagined. A climate centered strategy that imagines new environmental agencies, effectively enforcing new constraints on a polity already riven by widespread reform of policy jurisdictions and by the restructuring of firms from state controlled to market oriented actors imposes a great burden on societies with scarce organizational capacity. Mainstreaming means that climate considerations be made salient to existing policy makers, who at the margin, face many close calls about the set of energy or transport or land use decisions that they seriously entertain as viable development options. Electricity reform and deregulation is underway for reasons not connected to climate change. Sulfur dioxide emissions are seen as noxious because of regional and local environment effects on morbidity and quality of life without reference to carbon outflows. The inefficiency of water use in agricultural practices that depletes groundwater tables is unsustainable in a pattern that threatens food security regardless of climate induced hydrological disruptions. Yet, in each of these policy fields, central to the develop-ment agenda as understood and organized by national politics, live development options may have greater and lesser impacts on carbon emissions pathways. Development and climate asks only about choices with which empowered agencies are now wrestling, as well as the considerations in the national political culture and institutions that may push toward adopting relatively more or less climate favoring outcomes. Examples to illustrate potential development and climate opportunities that are drawn from the current Indian political context are illustrated in the annexes that follow this section’s general discussion.

Second, the method examines the policy options in play in mainstream agencies for those where more climate benign non-climate policies can transform predicted business as usual baselines by enhancing the likelihood that new commercially sustainable markets will occupy the space charted out by a reformed political framework. It is the multiplier effect of institutional change on replicable innovative markets that justifies the allocation of limited domestic and foreign financial resources and organizational efforts to strategically selected development programs that will reduce GHG emissions at scale over time. Third, development and climate insists on an understanding of barriers to the successful seeding of these new markets that is thicker than that customarily used in GEF projects. In particular, it emphasizes the critical

importance of organizational and political barriers to sustainable change. To counteract the power of the status quo, development and climate activities should focus on possibilities for market-making reforms where there is an installed base of organizations with financial or bureaucratic interests to deal with these less transparent dimensions of a checklist of obstacles to replicable change. This guideline implies that reforms that alter development paths are more likely to take hold where they create opportunities that will appeal to, and be taken up by, existing organizations (or their spin-offs or joint ventures) which have networks of commercial and political relationships, a balance sheet to support new financing, and know-how in the business and technical sector. Such organizations will have a higher likelihood of overcoming barriers to change than will new firms or government agencies that do not have established financial and human resources upon which they can call and because of which they can spare the scarce organizational capital needed for any innovative venture. Finally, the development and climate program focuses strongly on forging coalitions between mainstream public agencies that can frame sustainable markets and private actors, national and multinational, with the requisite organizational and financial capabilities to prosper therein. The added value and specific contribution of programmatic development and climate activities is in the first instance entrepreneurial-- to help identify, promote, staff, and coordinate the emerging constituencies whose influence over choices between realistic development options can shift the development paths that determine what we mean by business as usual.

In addition to the entrepreneurial activities of a development and climate program, it is equally necessary to consider its financial implications. In many cases, the adoption of non-climate policies with ancillary climate benefits would create a context in which the commercial development of lower GHG emitting systems could be financed through regular private investment channels. In other cases, there may be a need for one-time incremental resources from public or private sources outside the developing economy to provide start-up costs, defray initial risks, or install know-how that would lead, once embedded, to a commercially sustainable economic activity or sector. In still further cases, the changing national or local demands for new quality goods and services, along with the enhanced domestic capacity to finance it, may combine with ongoing external transfers to compensate for incremental value of the global public good component. In order to examine these alternative prospects for development and climate financing, we will focus on four possible schemes for ensuring resources that, first, respond to providing goods and services salient to the development priorities of local actors and, second, shift development pathways toward more sustainable climate solutions. These include: (1) national policies to make private markets work; (2) bilateral ODA and budget based reforms; (3) multilateral financial institutions and energy access funds; and (4) a multilateral climate bank/trust. In the following section of the paper, to illustrate that national development policies can make private markets work for climate, we will refer to the issue of electricity reform in India and China, drawing in part on the case studies of Indian electricity reform and the Dabhol gas power plant discussed in the annexes; in the following sections on international assistance, we refer to the examples of sulfur-carbon integration, community small-scale financing, access and regional energy integration to illustrate issues associated with international assistance. We stress there is nothing sacred about this roster. The mix of actors and programs could be rearranged as politically appropriate. We simply want to illustrate that there are multiple financial avenues to be explored in the existing portfolio of development reforms, non-climate development assistance, and climate specific mechanisms that could be fruitfully oriented to the development and climate agenda.

Annex 1-3: National policies: electricity reform and gas power markets

The reorganization of extant electricity systems in the leading developing economies of India and China have been internally motivated by development goals. As India embarked on its broad based economic reforms in the early 1990s, liberalizing policy elites feared that an absence of added power infrastructure would impose a crippling bottleneck on growth. Slightly earlier in China, similar concerns about an inability to expand electricity supplies at a pace that equaled the wider expansion of the economy produced a relaxation of the state monopoly on generation that had been set up after 1949. In each case, the real driver of reforms was less dissatisfaction with the inefficiencies of the established state utilities than the perceived limitations of the established public financing mechanism, state development bank loans, to

mobilize resources sufficient to meet the incremental demand (without excessive inflationary expansions of credit). The pre-reform power system had been built out rapidly in the 1960s and 1970s with below market cost capital on the foundation of the nationally predominant available fuel (coal), usually priced at subsidized rates. Since short run marginal costs were low and long run average costs irrelevant in the face of the economic slowdown of the 1980s, in India electricity end user tariffs had become a political commodity distributed nearly free to the client groups of reigning politicians. In China, by contrast, where economic growth never faltered, retail tariffs were set much higher, with profits over costs in part reinvested in the continuing, if inadequate, expansion of the state system and in part vanishing into the obscure accounting of state enterprises. In both cases, uniform, low quality, unreliable power was supplied to all classes of users across the nation at rates laced with complex cross-subsidies reflecting political priorities.

In the years since the inception of reform, first in China and more recently in India, innovative forms of finance and rising differentiation of user demands have emerged in the development of their electric power systems. Attempts to mobilize investment funds through domestic equity and bond markets; listings on international stock markets of corporative, if still state controlled, power gene-ration firms; loans from presumably newly apolitical national banks capable of real monitoring and imposing hard budgets with commercial lending terms; and foreign direct investors with access to syndications of off-shore borrowing appeared at increasingly wide margins of the orthodox state financing channels. At the same time, pressures that favored an unfamiliar heterogeneity of power production began to gather to mirror the wildly uneven pace of domestic development between regions.

Diversification of fuel supply was encouraged by transport and capacity bottlenecks in the state rail and coal industries, especially for fast growing regions with access to ocean shipping. The prospects, always contested, that reform might decentralize power policy decisions intensified the likelihood that divergent local considerations such as the desire for greater regional energy autonomy free from the political tensions of non-market power dispatch and pricing or the taxes, investment multiplier effects, construction jobs and other less public, but substantial unrecorded benefits associated with infrastructure expansion- pushed away from the earlier system uniformity. Finally, uneven domestic economic development produced growing pockets of end-user demand for alternative, higher quality electric power in terms of its reliability, its environmental impacts, and the relative proportions of peak and base load power as growing consumer incomes reshaped the load curve. Against the backdrop of an existing electricity system based on coal-fired generation and unreliable, politically allocated, fuel supplies, new possibilities for a more differentiated market in electricity services appeared most prominently in the sectors and regions where the pace and prospects for development progressed fastest.

However, nowhere did either the announcement of power reforms or the changing financial and demand conditions that favored them yield a smooth implementation of idealized system designs. Established expectations of continuing inexpensive power among politically empowered groups in India and growing resistance among consumers and politically less protected state enterprises in China to further increases in already high tariffs made the financing of more expensive incremental generation capacity unstable. *Old prices*, which constituted effective constraints on tariffs in the minds of most of electricity end-users, were inconsistent with the costs of *new power* that include the market price of capital, better environmental quality, secure diversification and improved reliability. Newly established regulators charged with managing this dilemma found it far more politically palatable to raise wholesale than retail tariffs, undermining the commercial viability of power supply contracts for incremental capacity. Existing state utilities, though often reorganized as independent power producers, retained both market concentration and political connections that cast a long shadow over new entrants more likely to have access to non-state financing. Rates of theft and other power losses tolerated by inefficient incumbent firms made commercial operation of privatized systems with hard budgets problematic.

These political and structural residues of the pre-reformed system imported conflicts into the heart of the reform process that result in unstable rules and regulations, weak protection for new, especially foreign, investors, and subsidized prices that discourage conservation. Reform is and is likely to remain the ongoing state of the system a continuing struggle with empowered *national energy sector* interests groups on both sides of its various battlefronts. Yet, the uncertain political outcomes of these continuing efforts will have important effects on both development and climate. For example, the rate of substitution of new natural gas-fired power for new coal-fired generation remains an open question in developing energy markets. In important areas of India, China and even in far less advanced niches throughout the South, gas is emerging as an affordable fuel of choice that would have serious climate benefits.

Case studies in India described above, as well as comparable research in China, indicate that during the recent period of even partially and imperfectly implemented electricity reform processes, the impact of system change on carbon intensity has generally been positive. This climate benefit is due mainly to changes in the fuel mix (rather than technical improvements) away from the baseline in the pre-reform state power regimes that tended to reproduce plants with standardized technologies around the nationally dominant fuel, coal, supplemented by large-scale hydro around the edges. In the Indian state of Gujarat, credible estimates show cumulative carbon savings of 40 million tons due to fuel switches to gas (relative to pre-reform baselines) in the first years of the reform period (Shukla et al., 2004). In the state of Andra Pradesh, during the same period, the decline of hydro generation in the state's energy portfolio due to reduction in cross-border water inflows offset the benefits of the introduction of substantial gas-fired new plant. In the fast growing Chinese province of Guangdong, average carbon intensity of electricity production has fallen with the development of more diversified new plant under the relaxed regulated conditions permitted by the central government in the 1990s. In the slow growing industrial province of Liaoning, carbon intensity has been more constant. (Zhang et al., 2005)

The relation between the development project of electricity sector reform and carbon intensity (climate) appears to depend in part on the nature of regulatory reform and in part on the level of government to which the reforms assign the management of the process of managing the electricity portfolio. Where regulatory reforms encourage greater diversity in supply, the shift from a coal or oil baseline can in itself generate environmental benefits measured against established practice. Where reform also includes the decentralization of regulatory authority, the variable character of demand for electricity services among political jurisdictions with variable economic growth can amplify these effects. However, it is important to note that in both India and China, where the progress of comprehensive legal reform has uniformly been halting, the relationship between reform, development and climate is more intricate. In China, the actual weak implementation of reforms was accompanied by effective deregulation and decentralization because of the critical level of demand for new power due to high growth. The central government in the 1990s did not formally enact international electricity reform templates so much as informally relax its pervasive bureaucratic controls. The central state simply averted its reach and its gaze, giving up effective control of electricity development to the fast growing provinces in a (non-) policy close to 'anything goes'. This effective decentralization increased fuel diversity, including nuclear and gas, in those regions where infrastructure growth was most rapid. In India, the slowness of the reforms in the dysfunctional state system pushed the most disserved industrial users to leave the system by building captive plants. Here, stalled reforms and continuing system inadequacy stimulated fast-growing firms with the most to lose from power shortages to opt out by building captive gas plants, with their lower capital costs, under the pressures of hard budgets, uncertain demand and freedom from entanglements with the state controlled coal industry.

In spite of these initial developments, whether the establishment of a growing gas sector will be quick or long deferred will ultimately turn on the outcome of political decisions that remain unresolved at present. The capacity to finance the costs of new gas-fired infrastructure is not the determinative issue. Nor is the matter a simple contest between national economic development and the global environment. There are local development interests motivated by national concerns about political economy and energy security on both sides of the question of whether gas is encouraged or retarded. Moreover, it is important to stress that the more climate friendly gas option may grow or falter with policy choices regardless of whether energy

market reform moves on toward more real economic competition or stalls out in its present hybrid state where the profile of the power system is still strongly influenced by political allocations. We will use the cases of Dabhol Power in India and the controversies over the introduction of liquid natural gas (LNG) facilities in coastal China to illustrate the domestic political dynamics of these choices.

Dabhol Power and investment context

Dabhol's LNG-fired power could always be financed. Its first phase generating station was built with offshore equity and syndicated loans, some from national export-import agencies in the nations of the firms supplying equipment. Its second phase financing, including the LNG facilities, relied more on the emerging, semi-private national Indian banks thought better able to manage the political risks that had become evident in the early years of project development. Private financing and its costs, of course, ultimately depend on estimates of the commercial viability of a project. In Dabhol's situation, there were at least three plausible markets for its power, even though its expected costs far exceeded the average costs of the old and fully depreciated coal plants that supplied most of Maharastra state's existing electricity. The first new market was for baseload power in a fast growing, rapidly liberalizing Indian industrial region, if it was the case that either financial constraints dictated the need for foreign capital additions to weak Indian financial capacity and/or other non-gas options such as the expansion of traditional coal-fired power were limited by inadequate transportation or inadequate supplies (Indian oil). The second market was for incremental, premium peak power for the exploding, higher income residential sector in Bombay. A third potential commercial demand was for quality power for industrial users in need of more secure and reliable power to take advantage of the space opened by economic reform. (A fourth market trading in inter-state traded power over what could become an integrated national grid may have been attractive to energy trader Enron, but was quite speculative in 1991.) These economic expectations lay beneath the Indian government's promulgation of fast-track procedures for large foreign invested electricity projects, of which Dabhol (after a year without applicants) was the first approved.

Both the scale of the Dabhol project, its commitment to off-shore gas sources, and the primitive state of the development of the Indian internal gas market created risks that the private and public sponsors of the project tried to mitigate through a long-term power purchase contract, international arbitration agreements and state and national political guarantees. Still, the project collapsed and the most modern energy facilities in Asia sit idle. The multiple investors are locked in lawsuits and the international market for Indian power development is moribund. Why did this happen? In part, there are organizational reasons to expect over-estimation of commercial demand at the outset of a period of economic reform. Politicians tend to take early credit and plan for the prospective impacts of their proposed changes and to claim the benefits of immediate jobs through construction. Private developers are rewarded through up-front bonuses that bias incentives toward development more than commercial sustainability. Corruption takes hold when a project begins.

In part, there are structural reasons, described above as the dilemma of *old prices, new power*, that are associated with periods of renovation and transformation of power systems. Opposing political interests in Maharastra latched onto the price differentials between Dabhol's gas-fired electricity and existing whole-sale tariffs, however obscure and badly calculated, to launch nationalist attacks on both the foreign developers and their incumbent government allies. The salience of these attacks was enhanced by multiple lawsuits whose ultimate dismissal did little to stem the populist tides that swept over the project. These same political tides made life difficult for the newly established (1998) state independent electricity regulators into whose laps the Dabhol controversy fell, and who faced with little experience or comparative data the questions of whether the contracts were fair, realistic or the products of incompetence and corruption. In final part, infrastructure projects in new markets are always built in the shadow of obsolescing bargains that cause investors to raise risk premia, and power costs derived from them, to politically suspicious levels.

In the absence of an unacceptable sustained political will to bear the political costs of the higher broad-based retail tariffs needed to support substantial increments of new quality power or complementary policy

changes, such as water reforms, that would otherwise satisfy major political constituencies like farmers now dependent on subsidized electricity rates, the prospects for innovative projects represented by the Dabhol case are poor. The original policy environment was not adapted to evolving energy markets and the chances for its comprehensive reform were, at best, too risky. One possible solution to these problems is to rely less on foreign actors who carry inherent political liabilities in a nationalist context and to leave gas market development to Indian firms able better able to manage political risks. This approach may be already visible in the entry of Indian mega-firms like Reliance or Tata Industries into the reforming electricity sector as suppliers of newly discovered Indian gas reserves or as regional distributors.

Alternatively, we might describe a development of policies aimed less at comprehensive energy system reforms than at partial fragmentation of emerging markets. If the policy environment had been piecemeal reshaped to allow Dabhol's output to be channeled mainly to those end-users whose uncharacteristic demand curves made higher priced power affordable, it could have been segregated from its asserted destabilizing effects on general power prices. While tariff rate differentiation is not yet technically or politically apparent in India, as noted above, independent industrial power plants and local networks that fragment off categories of users willing and able to pay for new high quality, usually gas-fired, power are proliferating in economically advanced regions like Gujarat. The passage of the India Electricity Act of 2003 began the process of deciding the scale of such new generators by recognizing, though not resolving, the open access issues connected to the terms (wheeling, transmission and cost-subsidy surcharges) on which their surplus product may be offered to the grid. It is worth noting that similar conditions exist in many countries in much poorer regions like Africa where needed and financable power facilities catering to the demands of more economically promising businesses are blocked by the resistance of the national power utilities to let slip their monopoly on electricity development.

The acceptance of market fragmentation within electricity systems that previously offered only common (low) quality power at common prices (differentiated only by cross-subsidies) through the piecemeal introduction of policy measures that would allow more climate friendly electricity is not without political fallout. If those higher end users, who were previously subjected to both insufficient power and expensive retail tariffs used as the vehicles for income transfers are hived off from the system, the instability of the comprehensive electricity regime will increase. Other means to support existing subsidies will have to be found or the insolvency of the integrated state system will have to be directly confronted. In this sense, Dabhol's failure, whether or not the project was mismanaged and abused by its particular sponsors, may be less the result of inappropriate commercial response to increasingly differentiated energy markets in fast developing regions like West India than a symptom of the continuing need to attack, nationally and internationally, the underlying problems of access to fundamental goods like power and water that plague the poverty ridden segments of these same nations. The existing electricity regime only created bottlenecks to economic growth and incentives for high end users to abandon the national system. The prolongation of the established power order offers no good apparent answer to the political quandaries of access that would justify the inhibition of policy reforms that hold out both development and climate benefits.[7]

[7] The current difficulties of the national (integrated) Indian electricity system in attracting private capital sufficient to meet the demands of a fast growing economy, which is tied to preserving the low prices for poor end user groups like farmers that undercut the credibility as off-takers of distribution companies, may be temporarily alleviated by the infusion of new public capital. Growing Indian government financial reserves and a prospective IMF accounting change to lower reserve requirements can free new capital for infrastructure development even in the absence of system reform. (A similar return to earlier patterns of state financing for infrastructure is likely in oil and gas rich developing countries with an influx of resource rents.) Yet such a strategy fails to resolve the structural and environmental problems of not creating a more qualitatively diversified electricity market, not reducing inefficient power use by charging full costs to all users, and not focusing national and international development assistance directly on the conceptually distinct problem of providing access to power to the poor. See below for discussion of the latter two issues.

Policy context and Chinese gas markets

If the technical and economic prospects for a quickened rate of substitution of gas for coal in China are at least as good as those in India, the political background is quite distinct. Especially in the more developed coastal provinces like Guangdong or Shanghai, retail tariffs have been allowed to rise with income growth and the lack of political pressure to subsidize to levels that well exceed Indian prices. These tariffs are generally sufficient to cover the commercial costs of new power sources, including piped gas and LNG. Moreover, new flexibility in the pricing of international LNG contracts, very recent increases in the price of coal and the transport difficulties of assuring supply from state monopolies and far distant regions have narrowed the relative price margins between coal and gas just as economic growth has stimulated the demand for new capacity. Gas also has local appeal even against presently cheaper expanding hydroelectric supplies because the consuming provinces have little effective control over either the longer run price or the grid reliability of hydropower imported from the West. Left alone with power system design, the coastal provinces will opt economically and politically for higher proportions of gas-fired incremental that would lower the intensity of their carbon baselines. If we add to this analysis the fact that income growth in these fast-developing regions is producing new load curves with sharper peaks, an increased consciousness of the environmental damages of coal combustion, a growing need for more reliable power quality for higher tech industry, and desires to attract more global investment with clean and modern infrastructures, the developmental case for a more pronounced shift to gas in these areas is compelling.

If gas is to increase its near-term penetration of incremental power markets in selected regions, policy reforms will be important. Some of these are related to tariffs and may be amenable to decentralized authority at the provincial levels. For example, although retail tariffs are sufficiently high to pay the costs of new gas power, wholesale cost increases over previous levels will likely squeeze the margins to which established utilities have become accustomed. While the lack of transparent accounting for costs or revenue uses in these state firms prevents any clear understanding of where these margins flowed, it is certain that some defended interests among management and factor suppliers will resist their erosion in ways that will require local political action. Again, if local authorities are able to recognize and give secure enforcement to take or pay contracts for gas off-takers would help shift and spread the risks of immature gas markets away from key infrastructure developers like LNG terminal owners who themselves have fixed contracts for gas purchase. Some public assumption of the start-up costs associated with the development of immature markets has characterized the initial period stabilization of substantial gas markets in most developed countries where gas is now the fuel of choice. (Hayes and Victor, 2004) Finally, innovative efficient practices like peak load pricing or the employ of environmental adders to polluting power for SO_2, NO_X or ash deposits would further favor gas. So far, in periods of very high growth in power demand, Beijing has imposed little central control on provincial final tariffs or on the effective decentralization of portfolio management. What is less clear in the obscurity of the future of regulatory reform is whether these decisions or the institution of innovations in pricing will be left to provincial discretion.

However, many key policy terms that would make gas more competitive in pure economic markets remain well beyond the control of provincial governments well disposed toward gas. Pressing forward with financial reforms that would raise the cost of domestic capital in China to market levels would favor gas plants, which, in most of the world, have lower capital expenditures (CAPEX) and higher operating expenditures (OPEX) than comparable coal plants. Shifts in national macro-economic policies to reduce the current inflated levels of available state bank credit would have similar effects. Appreciation of the Chinese exchange rate against the dollar and other major currencies would enhance the value of imported gas over domestic coal and hydro. So would reductions of tariffs and trade controls on advanced power equipment imports. A policy definition of energy security that afforded some relative privilege to regional assets, including Southeast Asian-Australian and Siberian gas, as against domestic and/or Middle Eastern supplies would also move the gas-coal equilibrium. Whether these reforms that would make gas a fuel of greater choice in competitive markets will occur depends on both the future of federalism in Chinese governance and policy directions in Beijing.

From a development perspective alone, there are good reasons to suggest that the various policy reforms that would help to make the institutional context for gas more favorable are salient to national elites and realistic political options in the near-term. First, in both India and China, there are policy elites who continue to advocate for increased, multisectoral liberalization, including greater deregulation of energy markets and relaxation of state financial and exchange controls. Reforming electricity regulation and getting the cost of capital straight would cause investors, domestic and foreign, to rearrange their energy portfolios. Second, there are ongoing pressures to decentralize more elements of political authority in order to recognize the growing and inevitable diversity of demands for public goods in such large nations, to stimulate some larger degree of regulatory competition between states and provinces, and to manage the complexity of expanding economies where private actors have increasing roles. Gujarat is not Orissa; Guangdong is not Hubei. Both successful experimentation and adaptation to differentiated demand and environmental context require less direction from Beijing and New Delhi.

Third, politically embedded, often quasi-state, companies (Petrochina, China National Offshore Oil Company) and international firms (Shell, Exxon-Mobil, British Petroleum) invested in natural gas understand that the monetization of their assets depends on opening wider the Chinese markets. These same firms have shown willingness to consider active investment in downstream infrastructure, even into power plant development, that is necessary to make these markets emerge (as have Reliance, Tata in India)[8]. The reorganization by energy sectors of once unified energy ministries creates complementary government agencies with strong interest in forming policy coalitions with these firms. In total, gas-favoring interests are viable contestants in all the national policy arenas relevant to market expansion. Chinese national planning documents since 2001 reflect projected expansion of gas fired-power at a faster rate than the electricity sector as a whole (Zhang et al., 2004). Projects like the West-East pipeline or the gasification of Beijing (linked to the 2008 Olympics) demonstrate that even if key decision making authority remains centralized and not driven by pure economic logic as much as by political goals, gas interests have capacity to work their will. As argued above, should the momentum toward competitive market economics and decentralized politics be maintained, the developmental case for gas sector growth beyond business-as-usual expected baselines can be advanced without reliance on climate specific constraints or financing.

From a climate perspective, there are both national and international factors to add to the balance that makes a realistic developmental case for natural gas. The question of what climate actions may be contributed by leading developing countries like India or China has troubled the United Nations Framework Convention for Climate Change (UNFCCC) since its outset. There is no current prospect that hard targets like those of the Kyoto Protocol will be acceptable to them. Even the discussion of processes that link the assumption of hard targets to income growth in fast-developing countries is not seriously on the table. What may be more feasible are voluntary pledges of cooperative climate actions such as carbon intensity targets. Where such objectives overlap with serious developmental interests like those of electricity sector reforms and an increased rate gas for coal substitution, or with some of the other development interests with positive climate implications described in the case studies above, there are better reasons to hope that an international agreement would be practical and productive.

If the combined national interests in development and climate can push the case for policies like gas substitution, then it is also possible to consider whether forms of international assistance, like those described below, can help cement these coalitions. But, before moving on to the prospects for international assistance, it is important to recall two central axioms of the development and climate argument. First, climate initiatives that are not built on a national development foundation are likely to support politically marginal efforts that alienate decision makers with real control over GHG inputs. Second, development

[8] Due to the lack of empirical clarity about the impact of Green investment funds on the cost of capital for firms implementing environmental/climate friendly projects, we do not argue that there are exceptional financial channels that are now available to support such development. Our argument is that in politically realistic configurations of energy markets that are under consideration in fast growing economies, capital subsidies (though welcome) are not necessary.

objectives will continue to have political priority. The question is not more or less development; it is its pathway relative to expected carbon baselines that may be subject to internal political influence and external support.

Annex 1-4: International assistance policies

It is too easy to say that the way to finance climate friendly initiatives, including development and climate, by having national official development assistance (ODA) agencies and international multilateral financial institutions (IFI) set aside special funds for climate. If such dedicated funds from bodies charged with development assistance are forthcoming, that will be of great value. But, heavy reliance on wishes or abstract arguments that special ODA and IFI climate programs will multiply is likely misplaced. First, while there are signs that the secular downward trend in the supply of public international grants and loans is ending, the number of varied calls by particular interest groups for earmarking of these limited resources continues to grow. Among the potential large claimants on new project based ODA, health seems most the flavor of the day. Second, these organizations have their own histories, politics and organizational cultures. Concepts and programs that orient and allocate their funds are in constant circulation in the wider development assistance and economics communities. Unless climate concerns can be fitted within the themes and theories internally recognized themes within these organizations, they are likely to be marginal at best.

The remarks that follow in the next two sub-sections of this paper are limited to a focus on what currently motivates development aid agencies and to the question of whether there are better and worse opportunities to adapt climate favoring initiatives to these organizational fashions. In the final sub-section discussing international mechanisms, we will assume there will be a discrete amount of funds for transfers dedicated under the climate regime for climate specific initiatives. The major issue is how to use those funds for the maximum climate benefit, subject to the reigning criteria of good governance including efficiency, transparency and accountability.

ODA and Budget Based Reforms

Climate initiatives, including development and climate, are more likely to appeal to, and be taken on board by, ODA agencies to the extent that they are perceived as consistent with the organizing visions of their programs. Consequently, to evaluate whether prospects for obtaining more than token ODA financing for climate action are realistic, it makes sense to inquire how different patterns and styles of ODA have been evaluated and where ODA is likely to be going. For some years the secular trends in ODA as a percentage of the gross national products of donor countries has been declining. However, following the 2002 adoption of the multilateral development goals in Johannesburg, there is a broad consensus among leading developed countries that aid must grow in the present decade. Assuming that this consensus will be implemented in substantial part, the principal questions about fit between ODA and climate funding in the near-term future of ODA will concern the qualitative principles that will steer its distribution.

ODA has historically been directed by both strategic and humanitarian goals. Strategic ODA, including aid that is tied to purchases in the donor country, has embodied a wide variety of criteria, including military alliances, colonial affiliations, and, most recently, cooperation against narcotics and terrorism. The allocation of strategic aid has often produced concentrations of funding in nations whose priority on humanitarian grounds would be highly problematic. Humanitarian aid has generally flowed both toward settled populations and refugees in conflict and post-conflict situations and those toward nations with relatively larger needs for poverty relief. However, in recent years there has been increasing controversy of the effectiveness of aid in the humanitarian/need genre.

Econometric studies have yielded surprising results when the effects of aid are regressed on economic development, with significant, though debated, findings that the relationship is bimodal. Where ODA has been moved into nations with institutions that are broadly recognized as constitutive of good governance, its impact on growth has been positive. Where it has been dedica-ted to nations without such institutions, its

effects have been found to be insignificant or even negative. (Burnside and Dollar, 2000, cf. Easterly, 2003) This controversy has led analysts of ODA to compose effectiveness indices, which usually focus on a combination of poverty level, the marginal product of additional aid (absorptive capacity), and the quality of governance. Strange, politically unpalatable, results may follow from the application of effectiveness indices, such as the conclusion that at present most of the world's ODA should flow to India. (Collier and Dollar, 2002) Although such analytical outcomes are without practical impact on ODA distribution, the concept of ranking ODA effectiveness has led to a comprehensive questioning of the received practice of donor communities.

The revaluation of ODA effectiveness has resulted in a less enthusiastic embrace of many of the most familiar types of assistance, often those for which climate aid advocates are prone to appeal. Project based ODA in which funds are earmarked by donors for particular purposes through specified agents (public or non-profit sector grantees) and methods (e.g. support to an NGO for in-stalling solar cells in Andean villages) is relatively less favored in the absence of explicit consideration of the state of the wider systems of institutions in which they would be carried out. The focus of much current ODA has shifted to the performance of these governing institutions, as, at the least, an essential aspect of the assistance program. While some of this newer brand of aid is targeted directly at improving institutional quality (e.g. ODA aimed at upgrading aspects of the rule of law or competition, which might have development and climate impacts by helping independent power producers with better quality technology manage the risks of reforming markets), ODA reform like the Millennium Challenge Account (MCA) proposed by the United States in Monterrey in 2003 would restrict country eligibility for the additional funds to be made available to those able to surpass defined indices of corruption, democracy or rule of law. Qualification criteria would be combined with explicit contracts to measure performance against promised outcomes.

Budget based assistance illustrates another dimension of new wave ODA more nuanced and varied in eligibility design than MCA whole country indices-advocated as a key strategy for distributing incremental ODA by major donors including the EU, Norway, and the United Kingdom[9]. Budget based ODA has three elements. First, aid funds are delivered to governments to supplement their budget resources for uses they see as best fit. Second, the donor and donee nations agree on certain targets and indicators of overall budget spending and performance that are the conditions for the initial grants and potential renewal of assistance. In practice, these output targets can be more or less detailed and specific, with actual aid agreements approaching thick contract proportions that diminish the distance between budget based and project allocated aid. Third, wherever along the spectrum of pure versus more hybrid (targeted) budget based ODA donor requirements do fall, the budget funds are accompanied by capacity building grants that are intended to improve the likelihood that budgets can be managed efficiently so as to hit the designated targets.

Although the theory of budget based, unallocated ODA is rarely transparently stated, it may reflect a gathering perception that weak economic growth is very often associated with poor investment choices in the public sector. Even in nations where government resources, however abundant, are systematically lost through weak revenue collection and further depleted by pervasive corruption, waste (opportunity losses) associated with political patronage, inefficient contracting and bureaucratic mismanagement of the state investment budget remains the principal cause of persistent development failure (Auty, 1995). Budget based ODA is designed to make these state resources, often the larger part of the national investment portfolio, more productive by reforming the budgetary process. At the same time, ODA reform toward budget-based aid is consistent with the leading edge of economic development theory that suggests more focus on particular policies and policy processes than on general institutional reform. In part, this edge picks up new econometric research that finds more significant correlations between growth and specific investment choices than between growth and broad institutional quality (Glaser et al,. 2004) In part, it

[9] See for example, on European Union policies on budget support for poverty reduction in ACP countries, EuropeAid Co-operation Office, DG Development, Note to the members of the EDF Committee, 310st meeting of 30 March 2004 AIDCO C D(2004); on Norwegian aid directions see forthcoming White Paper, government of Norway website.

recognizes that ODA targeting broad institutional reform has been far less productive than once hoped. (Jensen and Heller, 2003)

If we apply the trope of budget based ODA to the case studies described above, several opportunities to fit aid and the development and climate agenda together smoothly. First, the lack of integration between water and electricity decision making that is noted in the Indian electricity reform and South Asian regional programs cases may be seen as an example of less than ideal budget planning that misses optimal public choice, due to segmented budgeting between agencies and across borders. Electricity reforms stumble because the rural poor are politically entitled to low or no cost power used mainly to operate small-scale irrigation pumps. Without collecting even the marginal costs of this power, the state distributors are bankrupt. Generation contracts cannot be credibly committed by insolvent off-takers without access to stable, high and destructive state and cross-subsidies, while farmers drain the water tables with free electricity. The electricity problem is a water problem in disguise. Moreover, as noted above, further errors in the water policy area, including the tendency of states to hoard upstream flows, can exacerbate climate issues by reducing the downstream generation of hydropower and forcing additional fossil fuel combustion. If budget based ODA can be directed through water output and distribution targets that create incentives and capacity to reform relevant national budgetary processes toward an integrated process of water and power infrastructure investment, both development and climate can advance. (Note: Although it is not budget-based assistance, the USAID Indian energy/environment program has just shifted its mission focus to the water/energy nexus.)

Similarly, integrated planning/investment budgeting with positive effects on the carbon baseline can be applied to the analysis of energy conservation. In the absence of real energy prices, there is little reason for end users to employ power efficiently. Distorted prices that forestall the uptake of conservation measures are traceable both to formal subsidies and unintended practices like the theft and corrupt acquisition of power that plagues developing nations. Reforms in electricity distribution systems that are increasingly the developmental object of energy policy makers to reduce these non-technical losses will raise effective power prices and give demand side management programs the leverage they currently lack. Alternatively, if carbon and sulfur markets can be integrated in making infrastructure investment decisions as described in the case study, a more optimal combination of national and global public goods can be produced. In this case, absent hypothetical pledges on intensity targets, policies and measures or other climate action programs voluntarily given by advanced developing nations like India, budget based assistance principles of performance targets and capacity building to meet them may have to be complemented with more classical strategic or tied aid tenets that counsel donor nations to channel aid to compensate recipient nations for external (environmental) services provided[10]. Nevertheless, this case of integrated pollution and resource planning and infrastructure investment may well hold far more appeal for ODA reformers than simple project based climate aid because of its emphasis on improved techniques and practices of public investment.

In closing this section on the value of adapting international climate action to the primary development goals and contemporary practices of ODA, we should recall that much ODA will continue to be distributed according to the strategic concerns of donor states. In those cases, where donors do decide to make climate commitments at home, whether national or multinational, it will invariably make sense for them to enter into some form of international cooperation mechanism to fulfill these commitments more efficiently. Whether assistance is delivered through regional trading markets with crediting of positive climate actions in developing states as is contemplated in the European Trading System or through bilateral cooperation

[10] On October 20, 2004, the European Union announced it would offer trade privileges to developing countries that implement 27 'key international conventions on sustainable development and good governance', including the Kyoto Protocol. The import of this aid through trade program is hard to gauge because developing countries have only reporting obligations under the Kyoto Protocol and because major emitters like China, India and Brazil do not qualify for these benefits directed only to smaller countries with vulnerable and poorly diversified economies. *Financial Times, October 21 2004,@1.*

agreements between one or more developed and developing nations,[11] ODA for climate friendly programs that mitigate emissions will flow overwhelmingly to recipients like new large GHG emitters such as China and India. Climate specific aid will be strategic in the sense that its pattern of distribution will diverge completely from humanitarian aid patterns.

Still, the value of such climate specific assistance will be enhanced if the two heuristics emphasized in this section are applied. First, the qualifying actions that attract climate aid will be better accepted in developing nations if they conform to a development and climate agenda that promises more to the recipient than payment for services rendered. Second, the quality of actions supported must be subjected to the logic and criteria of effective aid. The introduction of poor quality projects that fail to deliver real climate gains for aid delivered will only devalue the other currencies of compliance that circulate in the climate system. (Browne 2004) Such devaluation, like ineffective ODA, serves no good environmental end.

Multilateral Financial Institutions (MFI) and energy access funds

International lending agencies with a developmental mission like the World Bank have responded in recent years to the widely articulated demand they pay greater heed to the environmental consequences of the projects they finance. Through collaboration with special purpose institutions such as the World Council on Dams they have evolved new standards for environmental impacts of loans and grants that amount to a type of negative list on classes of projects. Encouraged by these MFI policy changes, environmental advocates, including climate focused groups, have argued that the environmental characteristics of a project be given positive standing so that the MFIs selectively favor financing climate friendly proposals. Suggestions have been made to create dedicated loan funds in the World Bank or equity funds in its International Finance Corporation to support projects that center on renewable energy or other specific climate favoring technologies. Other requests are put forward that investment risk insurance agencies like the World Bank's Multilateral Investment Guarantee Agency (MIGA), the United States' Overseas Private Investment Corporation (OPIC), and other national export-import financers either offer low cost coverage to climate sustainable projects or, at a minimum, deny coverage to climate damaging projects. Much progress has been made along these lines on negative list side; smaller scale gains only, including the Prototype Carbon Fund, on the side of positive allocation of Bank Group resources.

This result is not surprising if we consider again the importance of organizational cultures and the evolving interpretations that are given to the institutional missions of MFIs. For example, the primary goal of the World Bank Group has from the outset been economic development. In parallel with development theory, the understanding of what this means and how to bring it about has wandered over its nearly five decades of history. Since the late 1990s, however, the reigning view of the Bank Group's objective is clearly poverty relief. Sundry innovative measures, flavored with newspeak acronyms like HIPC (Highly Indebted Poor Countries), LICUS (Low Income Countries Under Stress), have re-centered the Bank's lending and International Development Association (IDA) grant making programs on actions defined by national poverty reduction support plans. In these plans, the wider ODA focus on governance and law reform has a prominent place, but always in relation to its impact on poverty alleviation. Given this mission, which is strongly embraced by both the Bank Group Executive Board and the bank bureaucracy, environmental and climate programs are most likely to be seen as attractive funding opportunities rather than diversions necessary to deflect the impacts of poor public relations when they are directly and plausibly linked to poverty reduction.

The development and climate cases described above would seem to offer a variety of such opportunities to tie climate favoring actions to poverty relief. To illustrate this potential for financing the subset of

[11] A number of such bilateral initiatives have been launched recently whose scale and impacts are still too nascent to evaluate. They include the Netherlands Development Finance Company set up to finance private sector energy projects firm development, the Japan Carbon Fund, scheduled to begin operations in November 2004, and the European Union Energy Initiative for Poverty Eradication and Sustainable Development, which, like most incremental ODA, is targeted to poverty populations.

development and climate projects most related to the Bank's self-identity, let us return first to the question of electricity reform. We have argued above in the discussions of power sector reform, gas fired power, and the water-electricity nexus that well-structured electricity reform can have beneficial climate effects. We suggested that both through viable commercial financing and the fit with newer methods of national ODA financing, it should be possible to bring electricity supplies and prices into line with national development needs in key climate emitting nations including India and China. However, these same electricity reforms could likely be less happy for particular interest groups like poor farmers, who must give up the free or subsidized power they receive that undercuts the financial credibility of reform. Similarly, poor peri-urban populations who have been stealing power or are the objects of new access programs dependent on cross-subsidies from industrial end users may suffer from the needed changes in the electricity system. While current research indicates that to this point electricity reform in leading developing countries has not had damaging effects on the social contract, this may be due to the limited progress of reform to this point more than the longer-run sustainability of existing access programs (Victor and Heller, 2004). And while it may also be possible to demonstrate analytically that higher power costs for the poor are less hurtful than the intermittent and low quality power they currently receive, the political outcry against reform without explicit provision for access is so deafening as to drown out the demand for change.

Access to energy services for the rural and peri-urban poor has for some time been recognized by the World Bank Group as a major plank in the program of poverty relief. Electricity is one element of the portfolio that defines an efficient provision to poor households of energy services. If anything, the existing availability of free, sporadic electricity distorts this efficient household budget by making electricity available, at times, for energy services like cooking that ought probably be done in most cases through propane stoves. The poverty relief mission of the Bank would logically be best pursued by understanding how poor households in different regions of the world would compose an improved energy budget at realistic prices, analyze what is the appropriate place of electricity services within that budget, and act to support financially the distribution of energy infrastructure that is derived from this budget. In other words, in the developing world where financing for institutional/policy reform and poverty relief is always scarce, it is rational to ask specialized national and international institutions to take up those programs that contribute to development and climate that are most attuned to their missions, methods and expertise. For the World Bank Group, placing poverty relief first makes the most sense even for climate related actions.

We would make an analogous argument for the fit between development and climate and World bank financing for the case studies that describe the climate benefits that can flow from improved community finance for the poor and the building of adaptation capacity in those nations, many HIPC and LICUS members, where the anti-developmental costs of climate change will be most evidently felt. For the regional MFIs, like the Manila based Asian Development Bank (ADB), the roster of mission fitted development and climate projects will differ. Regional development banks often place loan and grant priorities on projects that foster regional interdependence and integration. Here the case study emphasizing the development and climate benefits that would arrive through the integration of energy and water markets in South Asia, or the environmental and economic value of ensuring more secure foundations for pipelines from central to South Asia, would seem well suited to ADB initiatives. We have not examined whether there particular development and climate opportunities that might fit smoothly in the emerging agenda of New Economic Partnership for African Development (NEPAD) or the regional integration aspirations of the Inter-American Development Bank, but the Indian and other Asian cases suggest a tailored inquiry would be worthwhile.

Multilateral Climate Bank/Trust

Under multinational and national auspices, specially dedicated funds have been set up to finance projects for climate mitigation and adaptation. We and many others have in various forums written and commented on the programs of the Global Environmental Facility, which is the designated financial mechanism under

the UNFCCC,[12] and on prospects of the several new funds established by the Kyoto Protocol (Pew Report, 2004). We have also spilled much ink, if that phrase is still useful, on the merits and demerits of the Clean Development Mechanism (CDM) the principal emissions trading instrument (Article 12 of the Kyoto Protocol) that covers developing countries. Although the Kyoto Protocol awaits entry in force, the CDM Executive Board has initiated operations to approve methodologies that may be used to generate qualified emissions offsets. These decisions are also to be imported into the European Trading System (ETS) through a recognition directive that allows certified credits to comply with European Union mitigation obligations. Yet, we contend that the early experience of the CDM process reinforces the specific criticisms and limitations of the CDM, and implicitly of other project based emissions trading mechanisms that we have made previously.

Our case against placing much reliance on the CDM has three main tenets. First, the transaction costs of preparing, monitoring and verifying projects is proving very high in comparison to the market value of the offsets to be garnered. Only projects whose commercial prospects are close to the margin of project development can meet these criteria, and for these it may be difficult to prove that the project's realization would not have taken place in the absence of the CDM incentives. The ratio of transaction costs to offset benefits may be even more problematic in projects where regulation of returns, as in the power sector, may be based on rates of return that may be adjusted for CDM value. Second, as noted above, there are serious problems of moral hazard. An initial CDM Board decision approved a methodology to certify projects for GHG recovery from solid waste land-fills. A number of CDM proposals of this have quickly followed this ruling. However, the methodology assumed that in the absence of CDM there would have been no local or national decision to regulate these landfall emissions and all captured gases could be credited as offsets. The process creates incentives for governments in developing countries not to regulate landfill sites in order to create CDM value, in spite of the fact that such regulations have been enacted in other developing jurisdictions for local environmental safety and protection[13]. Similarly, one important developing country has recently shied away from offering a renewable portfolio standard commitment that would lower the carbon baseline and foreclose CDM opportunities. The problem is that any carbon baseline incorporates automatically the political choices that structure energy or transportation or other climate related sectors. CDM certifications demand an inevitable, but unarticulated, external political decision whether to affirm or discredit these domestic political choices.

Third, the evolving baseline recognition procedures seem ill adapted to large projects that could have serious impact on a developing country's emissions trajectories. It is easy to approve, and fast-track CDM mechanisms have been set up for, small-scale projects like renewables or discrete energy efficiency improvements that are off commercial radar screens. The problem is that climate impacts usually come with size. Some large-scale carbon clean technologies like nuclear are explicitly banned from CDM. There is much controversy over large hydro projects, and one can only imagine what furor and carbon market chaos would be occasioned by the development of 30-50 gigawatts of hydro power in the greater Amazon basin. Will clean coal projects be eligible and how will offsets be measured? IGCC gas plants? Gas pipelines and LNG terminals that allow them to operate? What of the GHG gains from mass transit development? The problem, which development and climate highlights throughout its agenda, is what business-as usual means in setting carbon baselines in developing worlds where multiple development trajectories are in play. Even in some of the much smaller projects submitted to the CDM Board for methodology review, the question of whether they may be additional is lost in the political dimensions of what constitutes business-as-usual.

[12] The GEF between 1991 and 1999 financed over 1300 projects with more than US$ 4.5 billion in grants. 227 of these projects were considered as climate change projects with expenditures of over US$ 800 million. For example, in India the GEF invested over US$ 100 million in climate change projects in small and medium enterprise new steel re-rolling technologies, biomass energy, small hydel, and energy efficiency development programs. The grants have been made overwhelmingly to public sector agencies. We have commented above on the relation between GEF and development climate barrier approaches, comments not inapposite to the record of GEF project replicability in India.

[13] Analogous problems are now arising with baselines for industrial process production of f-gas emissions, especially gases 22 and 23. Ongoing comments are available at the website www.unfccc.org under the CDM heading.

Does the decision in the Plantar CDM proposal, which contrasts biomass against coke as a reduction agent in the steel making process, hinge on how correct is the Brazilian/Chinese exchange rate, since the commercial choice between local wood and imported coke shifts with macroeconomic policy. Whether a proposed CDM hydro plant would supplant coal or gas-fired power in Chile may turn on whether peak pricing is reflected in electric tariff decisions.

The objective of international cooperative mechanisms is neither to pretend to an absent objectivity in decision making nor to engage in analytical sophistication that in the end kills projects with transaction costs and uncertainty. It is rather to influence the choice of development path in developing countries whose economic growth and political transformations open up a portfolio of plausible policy contexts and commercial markets adapted thereto with more and less climate friendly effects. One way to approach this task of climate program and policy reform directly is to use a multilateral variant of the Carbon Trust (CT) now operating in the United Kingdom. The CT divides its activities into three categories: (1) services and financing to 'reduce carbon now'; (2) developing low carbon technologies with R&D grants and investments; (3) helping to understand (and publicize) the impact of climate change. (Carbon Trust, 2004) For our present purposes, we can concentrate on the first category of services and loans to mitigate GHG emissions. Developed nations assuming climate change commitments could contribute either financial capital or some percentage of their national stock of emissions permits to a special purpose banking institution or CT that would stand in a fiduciary relationship to its donors. Contributing nations could treat such contributions, or the mitigation they generate, as partial compliance with whatever national, regional or bilateral obligations they have been willing to take on in the global climate effort. The CT would be in a position to open a proto-auction in which it solicited bids for tranches of its capital (money or tradable assets) in which the currency was GHG reductions per capital unit expended.

There should be no illusions that ranking bids and credible performance guarantees would be a simple process amenable to mathematical resolution for CT administration. Since those proposals with the greatest mitigation impacts are likely to be program and policy reforms or infrastructure projects that produce one-time shifts in the national baseline by changing what is meant by business-as-usual, there can be no precise calculation of mid and long term reductions attributable to the actions the CT supports. Nor can politics or political gaming be avoided. What is likely are pre-final bid rounds and negotiations with bidding parties about their political commitments to enact and enforce environment or development policies that define the foundation against which mitigation gains will be measured. The search for formal additionality should not be a CT condition. The purpose of the international support is to induce actors, public and private, to commit to programs and policies to which they are already tempted by self-interest. This self-interest is the best mechanism for self-enforcement. What the CT must sort out is overt strategic gaming that is more likely when national and private interests in the promised results are actually remote.

In the best case, this negotiation and bid evaluation process would be carried on by an independent, professional bank staff that does not depend on the consent of political representatives from either donor or recipient states. Like all international assistance programs, credibility in performance will have to be established. Funding at the outset should be for relatively short term of years to allow evaluation of fund returns. But, if climate specific financial mechanisms are to be an important part of a prospective network of national and multilateral climate regimes, some type of CT would seem to proffer an institution capable of relatively rapid learning, whose experience and know how might later be transferred to more decentralized emissions trading mechanisms like those of the UNFCCC or the ETS or yet unformed national climate programs. Program bids for incremental or shared funds that carried complementary ODA or IFI support under the development and climate umbrella might have particular appeal in a CT investment bud-get.

Annex 1-5: Closing suggestions

This paper has no pretense of closure. We have attempted in describing the development and climate agenda only to stimulate a shift of approaches and attitudes toward these two dimensions of sustainability. Because we believe it will be unproductive to imagine viable international regimes that mandate limits on the GHG emissions of fast-industrializing developing economies, we have concentrated on searching for more flexible modes of engagement with these important nations that respect their need to attend simultaneously to growth and environmental quality. At the same time, it is our judgment that as economies grow, opportunities grow apace through technical and social learning to devise policies and programs that contribute to both these goals. We end therefore with two suggestions. First, we would hope that the climate research community, especially in the developing countries, turns its attention to elaborating a wide portfolio of such opportunities that are specifically attuned to, and in touch with, the development politics of diverse states. Second, we would urge policy makers in the multilateral climate regime, as well as those in national and multilateral aid programs, to reconsider their understandings of the relationships between development and climate. If institutional rules can be realigned to create incentives to explore and expand the territory laid out by development and climate approaches, the thus-far disappointing quest to construct an ideal climate regime can be softened by developmentalist indirection that still reduces the environmental damages to come.

References

Auty M (1995) Patterns of Development: Resources, Politics and Economic Growth, Edward Arnold, London.

Browne (2004), Beyond Kyoto, Foreign Affairs (83): 20-32

Burnside C; Dollar D (2000), "Aid, Policies and Growth", American Economic Review (90) 847-868.

Carbon Trust (2004), Carbon Trust Annual Report 2003/04, (August 2004) London, U.K.

Collier P; Dollar D (2002), Aid Allocation and Poverty Reduction European Economic Review (46) 1475-1500.

Easterly W (2003) Can Foreign Aid Buy Growth? , Journal of Economic Problems (17) 23-48.

Glaser E; LaPorta R; Lopez-de-Silanes F; Schliefer A (2004) Do Institutions Cause Growth? NBER Working Paper 10568 @ http:www.nber.org/papers/w10568

Hayes M; Victor D (2004) The Geopolitics of Gas (forthcoming), material posted at www.pesd.stanford.edu/research/2122.

Heller T; Shukla P (2003) Beyond Kyoto: Advancing the International Effort against Climate Change, Pew Center on Global Climate Change, Washington D.C.

IPCC (2001c.) Climate Change 2001: Synthesis Report. Contributions of Working Group I, II and III to the third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). Cambridge University Press, Cambridge.

Jensen E; Heller T (2003), Beyond Common Knowledge: Empirical Approaches to the Rule of Law, Stanford U. Press, Stanford, CA.

Shukla PR; Heller T; Victor D; Biswas D; Nag T; Yajnik A (2004). Electricity Reforms in India: Firm Choices and Emerging Generation Markets, Tata McGraw-Hill, New Delhi.

Victor D; Heller T (2004), Political Economy of Electric Power Sector Reform: Five Country Study (forth-coming), materials posted at www.pesd.stanford.edu/research/2120

Zhang C; May M; Heller T (forthcoming 2005), Carbon Baselines: Case Studies from Three Chinese Provinces, Energy Policy (33) 451-465.

Zhang C; Shukla P; Victor D; Heller T; Biswas D; Nag T (2004) Baselines for carbon emissions in the Indian and Chinese power sectors: Implications for International Emissions Trading (Working Paper, September 2004, Program in Energy and Sustainable Development, Stanford University

Annex 2: Financing for Development and Climate: *Case Studies from India*

Case Study 1: Conjoint Market for Local and Greenhouse Gas Emissions

Local air pollutants and greenhouse gases are often emitted conjointly, such as during fossil energy use. In India, the electricity sector consumes 40 percent of primary energy, including nearly 70 percent coal (CMIE, 2003). It is the main emitter of carbon dioxide (CO_2) and sulfur dioxide (SO_2). The other large point source (LPS) emitters include power, steel and cement manufacturing units. In the year 2000, two-thirds of India's CO_2 and SO_2 came from 500 LPS, of which seventy percent was contributed by the 82 coal based power plants (Shukla et al., 2004). Transport is another sector with conjoint emissions. The urban pollution loads have risen rapidly, causing significant concern and interventions. In the present case study, we focus on the design and the dynamics of the conjoint market of SO_2 and CO_2 for electric power plants. The future trajectories of CO_2 and SO_2 emissions from India's electricity sector are shown in Table 1 (Menon-Choudhary et al., 2004).

SO_2 and CO_2 Control: Asymmetry of Co-Benefits

Historically, SO_2 and CO_2 emissions from Indian power plants are highly correlated in absence of control on sulfur dioxide emissions from coal use. Prior to 2001, diesel contained nearly 0.75% sulfur; though recent policies have targeted reducing sulfur content in diesel to manage smog in urban areas, most noticeably in Delhi. Sulfur control in power plants is however not pursued with similar vigor; especially the old power plants have remained outside the ambit of regulation. The co-emergence of compound factors of rising pollution, incomes and awareness are however changing the dynamics. Regulations for local pollution control are being instituted, with many measures likely to emerge in the current decade. Coincidentally, the global carbon control regime is also taking shape concurrently. Opportunities therefore exist for creating conjoint emissions control mechanisms. Interestingly however, the relationship between sulfur and carbon control is asymmetric (Shukla et al., 2002; Pandey and Shukla, 2002; Garg et al., 2003). Cost-effective carbon mitigation measures, like better combustion efficiency and fuel-switch from coal to natural gas, reduce sulfur emissions to an even greater extent than carbon emissions. However, cost-effective sulfur control policies, like clean coal technologies or low sulfur diesel, have little or no impact on carbon emissions. Local emissions control measures therefore would fail to net the co-benefits of concurrent SO_2 and CO_2 mitigation. The conjoint market for SO_2 and CO_2 would have to be consciously designed to align both the markets to optimize the co-benefits.

SO_2 Control Policies in India

The SO_2 emissions from power plants are not restricted, though regulations have existed for minimum stack height for dispersion of emissions. Since the year 2000, policies for SO_2 emissions control have been instituted. For instance, the new coal power plants with capacity higher than 500 MW (except IGCC) are required to keep space for future installation of flue-gas desulfurization (FGD) equipment. Another policy mandates the use of washed coal in critically polluted areas or locations 1000 km. away from the mine mouth. Coal washing, though primarily targeted to reduce ash, also reduces sulfur. The present policy directives are technology (or fuel) centered and could be easier to implement, though they are not cost-effective because no flexibility exists to execute cheaper alternatives. Neither do these technology-fix measures permit the co-benefits from conjoint emissions markets to accrue. With the emergence of a global CO_2 regime, the opportunity for conjoint emissions control now exists. We first analyze the benefits of a stylized SO_2 emissions trading system in power plants in India; then turn to the added benefits from the conjoint SO_2 and CO_2 trading market.

Stylized SO_2 Trading in Indian Power Plants

The 82 large coal-based power plants vary in ownership, location, age, quality of coal used, technology type, operational practices and emissions control. Their emissions mitigation costs differ widely; a precondition for setting an emissions trading regime. The business-as-usual (BAU) projection of future SO_2 emission from the power plants (Table 1), driven by technology-centric regulations, at first rising and then following a declining trajectory typical of Kuznets phenomenon (Shukla et al., 2004). As an alternate, we consider achieving the identical emissions trajectory via SO_2 cap and trade. The BAU follows a technology push

path via the advanced FGD technology and coal washing; the cap and trade regime induces wider measures like efficiency improvements in old plants, pre-combustion coal beneficiation and installation of less advanced but more cost-effective FGD equipment. In comparison, a trading regime yields a 44% lower cost to achieve the same emissions trajectory. This would produce a saving of US$ 2.4 billion in 25 years from 2005-30 (Table 1), or an average annual saving of US$ 96 million. The SO_2 control measures under the cap and trade regime, likewise for the technology-centered BAU policies, have little impact on CO_2 emissions.

CO_2 Emissions Mitigation in India's Electricity Sector

Under the BAU, contrary to SO_2 emissions trajectory, the CO_2 emissions would rise secularly (Table 1). CO_2 mitigation in electricity sector, such as via the CDM projects, would reduce emissions from this base trajectory; since reasonable mitigation potential exists even at relatively low cost like US$ 5 per ton of CO_2. Among the low cost options, the coal power plants offer a mix of opportunities like retrofitting to improve energy efficiency of existing plants, upgrading new power plant technologies to super-critical, importing higher quality coal and fuel-switching to natural gas or renewable sources at economic locations. In the 25-year period from 2005-30, cumulative CO_2 emissions from India's electricity sector, under BAU, would be 25 billion ton. From 2005-12, i.e. the remaining Kyoto protocol period, India's electricity sector would emit 5.4 billion ton of CO_2. The average CO_2 price of US$ 5 per ton, the modeling results suggest (Shukla et. al., 2004), would mitigate 330 million tons of CO_2 from the electricity sector, or 6% of sector's cumulative emissions during the remaining Kyoto period. The mitigation over 25 years from 2005-30, at the same price, would be 3.4 billion ton of CO_2, or 12% of sector's BAU emissions during the period. The cost of this mitigation over the 25-year period would be US$ 7.9 billion and revenue from carbon sales would be US$ 17 billion. Besides, many carbon mitigation actions, like efficiency improvements or fuel-switch, would deliver substantial co-benefits from concurrent SO_2 and SPM reduction.

Conjoint Market for CO_2 and SO_2 Emissions Mitigation

The optimum mitigation response actions in separate SO_2 and CO_2 markets are very different. Mitigation of local pollution, since its benefits accrue to local constituents, enters the national agenda prior to CO_2 mitigation. The very low per capita GHG emissions from India provides the moral and practical reasons for delayed national actions in absence of a facilitating global regime. As noted, the early implementation of SO_2 mitigation produces little CO_2 co-benefit, whereas CO_2 mitigation accrues SO_2 co-benefits. Due to this asymmetry, the 'natural' sequencing of SO_2 mitigation prior to CO_2 would be inefficient. The conjoint SO_2 and CO_2 market would rationalize the mitigation actions in both the markets. In developed countries, the SO_2 mitigation regimes were established prior to the emergence of climate change regime, the conjoint markets were not so instituted. Improvement in air quality is now on the immediate national development agenda in many emerging economies, but the climate is still not. The sequencing error is therefore likely to be sustained, unless the regime is design following the integrated perspectives like development and climate.

Our modeling assessment for the conjoint emissions market for the electricity sector in India, presuming the CO_2 price of US$ 5 per ton and identical SO_2 trajectory as in the BAU, shows that mitigation costs for the 25 year period would be lower in the conjoint market by US$ 400 million compared to under the two separately operating markets. Besides, the conjoint market would deliver 520 million tons of additional CO_2 mitigation and thereby add $2.6 billion to the carbon revenues (Table 2).

Conjoint Market Architecture

Climate change response measures have myriad interfaces with national development priorities. The asymmetry and incongruence in the national and global actions, like in the case of CO_2 and SO_2 mitigation, would exist in many spheres. The global and national regimes operate in different realms; with their own goals, aims, pace and structure. The conjoint strategies provide synergy to align and optimize the actions. Aligning the markets is essential for the conjoint architecture. Sustaining the alignment though would require institutional arrangements, operating norms and financial mechanisms.

Table 1: SO_2 and CO_2 Emissions Projections (Electricity sector)

	SO_2 (MT)	**CO_2 (MT)**
2000	2.22	490
2010	2.83	733
2020	2.96	1065
2030	2.41	1418

Table 2: Mitigation costs and benefits (in 2004 US$) for alternate mitigation regimes

Mitigation Regime (from 2005-30)	**Mitigation Cost (2005-30)**	**Direct Benefits (2005-30)**	**Co-benefits (2005-30)**
BAU SO_2 mitigation alone (via technology-centric policies)	$5.5 billion	-	Little carbon mitigation benefit
SO_2 mitigation alone (with SO_2 Cap and Trade regime for BAU trajectory)	$3.1 billion	$1.4 billion saving compared to BAU policies	Marginal carbon mitigation benefit
CO_2 mitigation at $5 per ton price	$7.9 billion	$17 billion carbon revenue	Concurrent reduction in SO_2 saves $1.2 billion for SO_2 mitigation in BAU
Conjoint Mitigation: CO_2 mitigation @ $5 per ton and SO_2 Cap and Trade for BAU trajectory	$10.6 billion	$19.6 billion carbon revenue	Cost of conjoint market operations are lower by $0.4 billion

References

CMIE (Center for Monitoring Indian Economy), (2003). Energy, Center for Monitoring Indian Economy, Mumbai.

Garg A; Shukla PR; Bhattacharya S; Dadhwal VK (2001). Sub-region (district) and Sector Level SO_2 and NO_x Emissions for India: Assessment of Inventories and Mitigation Flexibility, Atmospheric Environment, (35) 703-713.

Garg A; Shukla, PR; Ghosh D; Kapshe M; Nair Rajesh (2003). Future GHG and Local Emissions for India: Policy Links and Disjoints, Mitigation and Adaptation Strategies for Global Change, Vol. 8, No. 1 71-92.

Menon-Choudhary D; Shukla PR; Nag T; Biswas D (2004). Electricity Reforms, Firm level Responses and Environmental Implications, in Studies on Electricity Reforms in India by Ruet J; Kalra P; eds., Manohar Publishers, New Delhi (forthcoming).

Ministry of Power (2001). Blue Print for Power Sector Development, Government of India, August.

Pandey R; Shukla PR (2003). Methodology for Exploring Co-benefits of CO_2 and SO_2 Mitigation Policies in India using AIM/Enduse Model, In Kainuma M; Matsuoka Y; Morita T (eds.) Climate Policy Assessment: Asia-Pacific Integrated Modeling, Springer.

Shukla PR; Rana A; Garg A; Kapshe M; Nair R (2004a). Climate Policy Assessment for India: Applications of Asia-Pacific Integrated Model (AIM), Universities Press, Hyderabad.

Shukla PR; Heller T; Victor D; Biswas D; Nag T; Yajnik A (2004b). Electricity Reforms in India: Firm Choices and Emerging Generation Markets, Tata McGraw-Hill, New Delhi.

Case Study 2: India's Electricity Reforms and GHG Mitigation

India initiated electricity sector reforms in early 1990s. The electricity reforms were embedded within the framework of economic reforms, aiming to make the Indian economy globally competitive. The electricity reforms originally proposed to introduce competition and attract private investments in a sector that was historically unregulated and dominated by government owned utilities. Over a decade, numerous policy initiatives have been taken to enhance private participation, unbundle the monolithic State Electricity Boards (SEB) into separate generation, transmission and distribution companies and institute electricity regulatory commissions. The nexus between reforms and development is explicit. What are examined here are the less obvious implications of reforms on climate, especially GHG emissions.

Private owners have exhibited flexible fuel and technology choices, compared to the politically controlled and cash strapped state utilities whose fuel choice was limited to domestic coal and technology supply from other public sector firms. As a result, technical efficiency has improved (Table 1). The emissions of GHG and local pollutants from fossil combustion are reduced to the extent the heat rates are improved.

*Table 1: Heat Rate**

Fuel	**Average (Kcal / KWh)**		**Marginal (Kcal / KWh)**
	1990	**2001**	**2001**
Coal	3050	2750	2390
Gas	-	2025	1950
* Heat rate = Quantity of energy (Kcal) needed to generate one unit of electricity (KWh)			

Even prior to the reforms, there was secular improvement in heat rates. Finding the contribution of reforms requires addressing the question: what fraction of the improvement could be attributed to the reforms? Our baseline assessment methodology (Shukla et al., 2004c) includes changes in efficiency as well as fuel (Shukla et al., 2004a and Shukla et al., 2004b). Here we consider two pollutants - CO_2 as proxy for global and SO_2 for local externalities. A comparison of actual CO_2 emission baselines with the trend-line that would have materialized in absence of reforms is shown in Figure 1. In the post-reforms decade, the actual carbon baseline for coal power plants shows a 5% improvement, compared to what would have been the case without reforms. The baselines are identical for gas power plants since most capacity is built in the post-reforms period. The overall baseline though shows a rising trend since the share of hydro in electricity generation witnessed a secular decline in the pre-reform period, and a similar trend continues post-reforms (Figure 2).

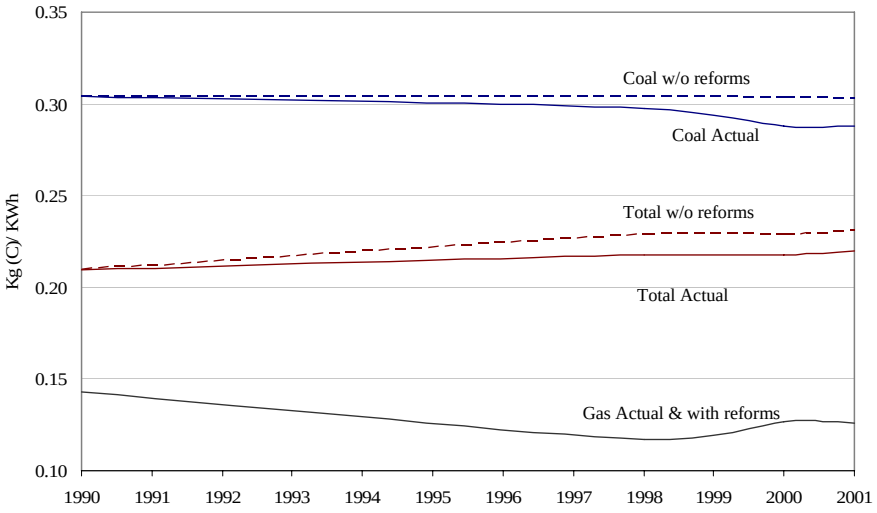
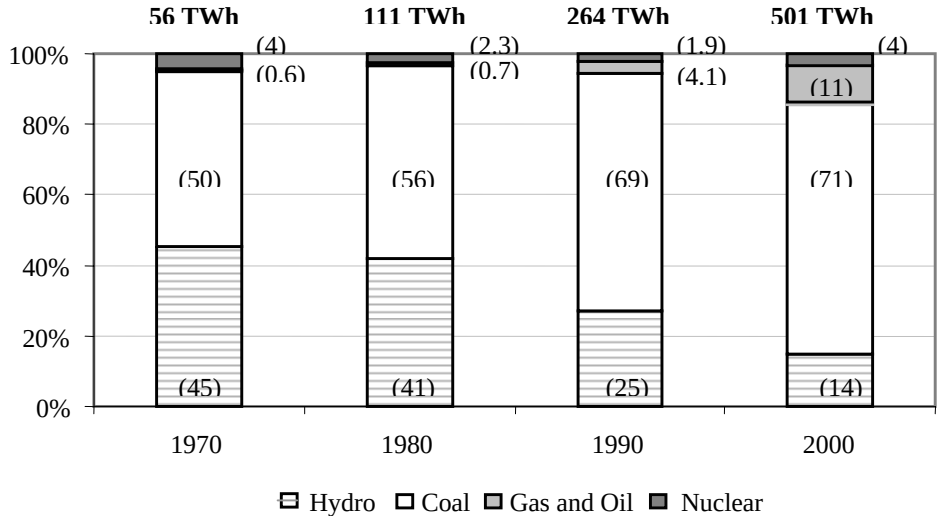


Figure 1: CO_2 Emission Baselines for India

In the decade prior to the reforms, India's electricity sector became more dependent on domestic coal. The share of hydropower, which was 41% in 1980, declined to 25% and 14% in the year 1990 and 2000 respectively. Several factors contributed to the decline in hydro, including civil society's resistance to large dams, interstate water disputes, poor water management, and an inability to price the multiple different benefits of the projects. The hydro sector carried greater investment risks and its co-benefits were public goods. Post-reforms, the sector could not attract private investment and its share continued to decline. Gas technology, on the other hand, carried lower investment risks and found favor in the post-reforms era. The combined share of other non-carbon sources, renewable and nuclear, has stagnated at 4%. The overall carbon baseline of electricity generation has risen, following the declining hydro share, which has overcome the technical efficiency gains from fossil based generation. In absence of reforms, however, the baseline would have risen even more. The contribution of reforms to carbon mitigation (Table 2), during the decade spanning 1992 to 2001, is estimated to be 39.48 million tons of carbon (or 145 million tons of CO_2 equivalent). The carbon mitigation gains would continue to accrue in the future since the reforms have shifted the baseline by 5%. Notably, the reforms also have a benign impact on SO_2 emissions, for which the baseline shift is 9%.



Note: Numbers in bracket ( ) indicate % share. TWh numbers at the top show total electricity generation for the year.

Figure 2: Changing Electricity Generation Mix

Table 2: Carbon Mitigation due to reforms

	Million Ton of Carbon	**%**
1992	0.60	0.9
1993	1.94	2.8
1994	2.45	3.2
1995	3.42	4.1
1996	4.35	5.0
1997	4.64	4.9
1998	4.92	4.8
1999	5.53	5.0
2000	5.76	5.0
2001	5.84	4.9
Total	**39.48**	

Aligning electricity pathways with national development vision

The report 'India Vision 2020' (Planning Commission, 2002) has benchmarked the development vision. According to the document, following the business-as-usual scenario would lead to a three fold increase in electricity demand between 2000 and 2020, requiring 192 GW of additional capacity. The fuel-mix of electricity generation in 2020 for the BAU scenario will have 61% share of coal (Figure 1(a)). Development of electricity sector along this pathway would be very carbon intensive.

The technology and fuel choices for new power projects will provide opportunities to influence the future carbon baseline. The Best Case Scenario (BCS) in the 'India Vision' document foresees the sector to be less carbon intensive. It includes policies for modernization of existing plants, early adaptation of advanced generation technologies, improved T&D efficiency, private and professional management, energy conservation, regional energy co-operation and higher shares of hydro and renewable energy technologies. Implementation of these policies would lower the electricity demand and alter the generation mix. For the BCS scenario, the report estimates the electricity demand to be 12% lower than the BAU. The share of coal in BCS will be 47% and the non-carbon energy sources will contribute a third of the generation. Carbon emissions in 2020, under BCS, would be 81 million tons less than the BAU. The cumulative carbon mitigation from 2005 to 2020, if the electricity path were influenced away from the BAU to the BCS, would be 822 million tons.

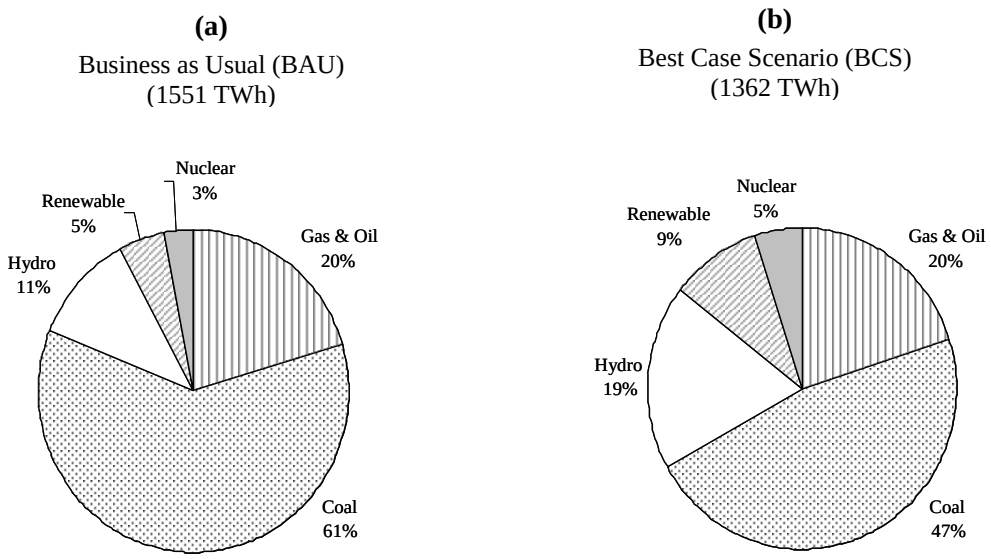


Figure 3: Electricity Generation Mix in 2020

Designing and Financing Climate-friendly Electricity Pathway

India's electricity reforms have conferred emissions mitigation benefits. However, continuation of the current reforms architecture, the BAU pathway, is still expected to keep the sector highly carbon intensive. India's national development vision advocates the measures that could bifurcate the sector's development towards a less carbon intensive and more climate-friendly pathway. The electricity sector's development along the Best Case Scenario, if designed and sustained, would enable transition to low carbon future. How to design and finance the measures that would enable India's electricity sector to develop along this vision? The regime designed to address this question would be concurrently climate-friendly. The key measures are those that would sustain the electricity reforms, enhance energy co-operation and align the electricity markets with energy, water and financial markets. Development transformations pose higher risks to investors, especially the early players. The financial package therefore can and must combine policy reforms with development assistance and climate funds, in addition to conventional finance, to assist the development that is consistent with the national vision and which is inherently climate-friendly.

References

Shukla PR; Biswas D; Nag T; Yajnik A; Heller TC; Victor DG (2004a). Impact of Power Sector Reforms on Technology, Efficiency, and Emissions: Case Study of Andhra Pradesh, India, Working Paper No. 20 PESD(Stanford University).

Shukla PR; Biswas D; Nag T; Yajnik A; Heller TC; Victor DG (2004b). Impact of Power Sector Reforms on Technology, Efficiency, and Emissions: Case Study of Gujarat, India, Working Paper No. 21 PESD(Stanford University).

Shukla PR; Biswas D; Nag T; Yajnik A; Heller TC; Victor DG (2004c). Electricity Reforms in India: Firm Choices and Emerging Generation Markets, Tata McGraw-Hill, New Delhi.

Planning Commission, (2002). Report of the Committee on India Vision 2020, Government of India, New Delhi, December.

Case Study 3: Regional Cooperation: Aligning Markets and Finances

Regional cooperation[14] is among the key principles of sustainable development, exhorted in the Rio declaration on Environment and Development as well as subsequent international declarations on sustainable development. The South Asian region, comprised by Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka, contains a quarter of the global population. The countries have diverse geography, climate, energy endowments and political and economic systems. The diversity, often viewed as a barrier, is the foundation for trade and economic cooperation. The case in point, from a climate mitigation perspective, is energy cooperation. Energy diversity lies in the predominant resource endowments of the countries - coal in India, gas in Bangladesh, hydropower potential in Himalayan nations of Bhutan and Nepal and the strategic location of Pakistan as the transit route linking South Asia with the vast gas and oil resources of Central Asia and the Middle East.

South Asian Energy Status

In the year 2000, South Asia's commercial energy use was composed of 44% coal, 34% petroleum, 13% natural gas, 8% hydroelectricity, and 1% nuclear (EIA, 2002). The region is a net importer of energy, though intra-regional energy trade is minimal. India is the world's third largest producer of coal, but exports little. LPG is imported in the region from afar, while little of Bangladesh's gas is traded in the region. The electricity trade in the region is marginal and inter-country grid infrastructure is lacking.

The compelling argument for energy cooperation lies in the changing energy dynamics in the region, propelled by the rapidly rising energy demand. India needs more and diverse energy than its poor quality domestic coal can supply. Sri Lanka needs fuel and electricity. Bangladesh can export gas profitably to the regional market. Nepal and Bhutan can export hydroelectricity. Pakistan could benefit from energy trade and transit charges. The waters of shared rivers could produce larger benefits if water and hydroelectricity projects were coordinated. The tapping of Himalayan hydroelectric potential could also generate co-benefits from water markets and controlling damages from recurring floods. Energy security, water security and flood control remain among the top priorities of the South Asian countries. The regional energy trade architecture could yield far-reaching economic, development and security benefits to all nations.

Development and Climate Benefits of Energy Cooperation

Cooperation in energy markets needs long-term commitments. Infrastructure investments, like gas pipelines, take time to build and have long payback periods. The ownership and operational arrangements of cross-boundary infrastructures require compatible legal and contract enforcement regimes and shared governance across the countries. The cooperation organization South Asia Association for Regional Cooperation (SAARC) already exists, though the barriers to energy and electricity trade are not addressed, side-lined by the political exigencies, institutional incapacities, weak cross-border regulations regime and lack of regional grid and infrastructure.

Analysis of regional cooperation (Nair et al., 2003; Shukla and Nair, 2003), assuming reasonably integrated energy and electricity markets, shows significant direct, indirect and spillover benefits via economic efficiency, energy security, water security and environment. Energy cooperation would yield direct economic benefits due to energy savings from improved and enlarged fuel and technology choices and reduced investments in energy supply due to lower demand. The economic value of these benefits (Table 1), over the 20 year period 2010-30, would be US$319 billion, nearly 1 percent of the region's GDP for the entire period. These would increase the economic growth for the entire region by 1% each year, sustained over the 20-year period, benefiting the region where largest number of world's poor resides.

[14] Principle 9 of Rio Declaration on Environment and Development 1992 exhorts that the 'States should cooperate to strengthen endogenous capacity-building for sustainable development by improving scientific understanding through exchanges of scientific and technological knowledge, and by enhancing the development, adaptation, diffusion and transfer of technologies, including new and innovative technologies'

Besides the direct development benefits, South Asian regional cooperation would accrue significant climate and local air quality benefits. The cumulative carbon saving for the period 2010-30 (Table 1) would be 1.4 billion tons of carbon (or 5.1 billion tons of CO_2) 70% of the global mitigation target for the Kyoto Protocol, including the United States. The energy changes would also reduce loads of SO_2 in the region by nearly 2.5 million tons of SO_2 emissions each year, a 30% decline. In addition, balanced hydro development would yield spillover benefits, prominent among which would be the enhanced water supply, flood control and rational water management. Energy cooperation in South Asia would bring significant economic, environmental and security benefits to the region, in addition to substantial global climate benefits.

Energy Cooperation: Architecture and Financing

Numerous barriers to South Asian cooperation exist, many rooted in a long history. The political will to forge co-operative alliances is now increasingly evident. The rationale for South Asian energy cooperation derives from diverse energy endowments across the nations, congruence of their energy, water, food and environmental security goals, and common need for economic development to overcome persistent poverty. Climate concerns are secondary to the national development agenda, though intertwined with the development actions.

Regional energy cooperation would require forming new coalitions that would deliver infrastructures for energy supply and electricity T&D, as well as laws and regulations with regional jurisdiction and a coordinating body, which could reside within the existing organizational structure of SAARC. Cross-country regional projects can be financed by international coalitions including regional and international partners. For instance, the pipelines projects like the gas pipeline from Central Asia to North India via Afghanistan and Pakistan, which lingered over a decade in the absence of regional cooperation, can re-emerge under the new cooperation regime. Multi-country hydro projects providing multiple benefits are feasible and can be partnered by coalitions of investors, development financiers, technology providers and national governments. The current climate regime, with CDM as its main instrument, is unlikely to support such projects whose climate benefits are embedded within, and not additional to, the emergent development pathway.

Table 1: Benefits of South Asia Energy Cooperation (Cumulative over 2010-30)

Benefit (Saving)		**$ Billion**	**% of Region's GDP**
Energy (Direct Benefits)			
Energy	59 Exa Joule	178	0.55
Investment in Energy Supply Technologies		72	0.22
Investment in Energy Demand Technologies		69	0.21
Environment (Indirect Benefits)			
Carbon	1.4 Billion Ton	28	0.09
Sulfur Dioxide (SO_2)	50 Million Ton	10	0.03
Total Direct and Indirect Benefits		357	1.10
Spillover Benefits			
Water	16 GW additional hydro capacity		
Flood Control	From additional dams		
Competitiveness	Reduced unit energy/ electricity cost		

References

EIA (2002) (updated periodically). 'Online Country Analysis Briefs', Energy Information Administration, US Department of Energy. Washington DC. www.eia.doe.gov/international**.**

Nair R; Shukla PR; Kapshe M; Garg A; Rana A (2003) 'Analysis of Long-term Energy and Carbon Emission Scenarios for India', Mitigation and Adaptation Strategies for Global Change, Kluwer Academic Publishers, vol. 8, no. 1, pp 53-69.

Shukla PR; Nair R (2003), South Asia Regional Cooperation in Energy and Electricity Markets, Report, Indian Institute of Management, Ahmedabad, India, pages 38.

Case Study 4: Investment Risks in the Indian Energy Sector: The DPC Case

The Dabhol Power Company (DPC) was promoted by the US multinational ENRON Corporation in 1992 to set-up a large 2184 MW base-load plant using Liquefied Natural Gas (LNG) technology at Dabhol in the Maharashtra State of India. Despite numerous controversies and obstacles, the plant commissioned operation of Phase I in May 1999, but had to shut down in May 2001 due to disputes between DPC and its sole buyer Maharashtra State Electricity Board (MSEB) over price and terms of the deal. Here is a brief assessment of investment risks in the context of sectoral reforms.

Commercial risks

As India began its process of economic reform in 1991, the expectations and assessments of key parameters like demand, fuel choice and size were speculative. Early in the reforms, when the DPC project was designed, there was an irrational exuberance about future electricity demand. The two-part tariff formula of the Power Purchase Agreement (PPA) included a fixed capacity charge regardless of the off-take. This permitted a large project size, base load operation and LNG terminal, but created also high and multiplicative risks. Added to these were the currency risks, inherently high in the early reforms period in developing countries when currencies are initially expected to devalue. Two vital requirements for mitigating financial risk are clarity of government policies and existence of credible and independent regulatory authorities. Both were absent when the DPC project was organized. Instead the lenders relied on government guarantees as their main hedge against risks. The financial arrangement acquired a domino structure that collapsed under the weight of an unsustainable tariff, insufficient demand and the poor financial health of the MSEB, converting the players from partners into adversaries. The problems then spilled over from within the project to the wider legal and political domains.

Legal risks

A project must operate 'within the legal framework' governing the sector. Within India's federal structure, setting up a project requires obtaining numerous clearances from the State and the Central Government departments, each clearance adding transaction time and cost. The project also from the outset confronted hostile legal actions. The lack of transparency in approving the project invited Public Interest Litigations (PILs), with the integrity of the PPA being their main target. The foreign arbitration clause raised sovereignty concerns and uncertainty about the validity of the choice of (foreign) law clause created infirmity in the PPA. The regulatory authorities, set up subsequently, were expected to reduce the uncertainties and risks. However, they added to legal complexities and provided a fresh avenue for raising disputes. Ease of judicial review, a much-lauded feature of the Indian legal system, facilitated an excess supply of corrective lawsuits in a participative democracy where stakeholders followed their own path of remedial actions. DPC failed due to unrealistic assumptions about the ability of the legal system to withstand external pressures, not due to particular contractual lacunae.

Political and social risks

Infrastructure projects remain constantly under public scrutiny, criticism and intervention. The DPC project faced all three. Needing foreign investment, the expedient government bypassed procedures that ensure transparent, predictable and accountable outcomes, arousing the suspicions of public and the opposition political parties. Soon in the project life, hotly contested Indian elections produced changes in political party compositions that governed the state and the central governments. Within only a few years of the deal, the newly elected government in Maharashtra showed reluctance to accept a deal consummated by the previous government. This led to new negotiations and changes in PPA. In addition, the DPC project bore exceptional risks since projects led by foreign entities are viewed by nationalists with greater suspicion. Under India's democratic structure, most government actions invite popular protests, media publicity, public interests litigations and political opposition. Justice apart, the political and social actions compounded the already substantial risks from delays fostered by India's dilatory legal processes. The assumptions that India's legal system could protect the complex contract, its political system would standby

the guarantees and the monopoly buyer would remain true to the original contract despite the shifting bargain were all fraught with danger.

Risks from shifting bargain

The DPC case offers vital insights into the complex transactions involved in infrastructure projects. Raymond Vernon's 'obsolescing bargain model' (Vernon, 1971) is pertinent here. Vernon argued that, when an initial agreement is made between a host country and a multinational corporation, the corporation has asymmetrical bargaining power, which stems from the benefits of capital, technology transfer and management expertise it can endow on the host country. Although the high value of its services and high risks enables MNC to extract favorable terms, as the host government gradually captures these gains and the possibilities of extracting embedded infrastructure from the host country disappear, the MNC loses its earlier advantage. Bargaining advantage then shifts from the MNC to the host government. The DPC agreement was struck at a time when India's power sector needed huge investments and the company had capital and technical expertise to offer. As Vernon says, 'the country usually makes few demands at that time for the fear of losing the investments and skills.' Enron came to India knowing well the risks of shifting bargain in emerging markets, but the potential returns were too attractive to disregard. The eventual collapse of the parent company ENRON shifted the bargaining balance further away from the DPC.

Lessons for Development and Climate

The three dollar billion investment in DPC now has stood as a dysfunctional stranded asset for the past two years, in a developing country where capital is scarce and electricity is in short supply. A lesson from the DPC case is that sequencing of reforms is vital. Concurrent reforms in the primary energy market, financial sector and building judicial capacity are essential for reforming the electricity sector. Within the complexities of politico-economic dynamics in developing countries, the macro risks are reduced by the comprehensive reforms and viable financial coalitions including international and domestic partners. A key to managing reforms and investment risks is not to build new structure on the foundations of the old institutional system, but to construct it in lateral alignments with the pillars of modern participative democracy, competitive markets and the rule of law—all goals of a comprehensive development agenda.

The economic damage from DPC's closure is apparent; the climate losses are less obvious. Coal is the usual fuel for the base-load electricity plants in India. A speculative assessment of climate benefits that presumes DPC operating as a replacement for equivalent base-load coal plant arrives at annual saving of nearly 2 million tons of carbon emissions, sustained over for three decades spanning the normal plant life. While it is difficult to be precise about the carbon benefit calculation, the DPC's failure is evidently adverse to both development and climate. The cost is then not only to private investors or India's development. It is global.

The pertinent questions are: How failures like DPC can be avoided? If it happens, how could it be reversed? Answers to these questions belong to the development sphere, though they are vital to climate. Underlying risks that lead to DPC-like failures are endemic in developing economies. The incremental financial instruments like CDM or GEF cannot recoup the climate losses that would result from failures like DPC, the causes of which are inherent in reforming polities and deeply rooted. The climate benefits of DPC, if monetized, could provide an added incentive to DPC's revival, though in the final analysis only more sound development policies would revive the stranded assets of DPC and deliver both development and climate benefits. Ironically, the incremental architecture of the present climate regime would not pay for the climate benefits of sound development policies, notwithstanding the frequent exhortations in the Framework Convention to discover the synergies between climate and sustainable development.

Reference:

Vernon (1971). Sovereignty at Bay: The Multinational Spread of U.S. Enterprises.

Case Study 5: Rural and Decentralized Markets

The debate over development has elicited two extreme regime paradigms - centralized or decentralized. Their alternative perspectives, respectively top-down and bottom-up, differ in policies and implementation strategies. Whereas centralized decision-making has a holistic appeal; the advantages of decentralization are its practicality and flexibility to suit diversity. In developing countries, the existence of the dual economy, characterized by structural dichotomies like the urban-rural divide, a lack of balance between the industrial and agrarian sectors, the co-existence of modern and traditional structures and economic relations ranging from formal to informal, add to the complexity and deter consensus on a unique approach.

Dual economy and hybrid solutions

Whereas the Indian urban, industrial, modern and formal segments are increasingly aligned to global markets; the rural, agrarian, traditional and informal segments operate in isolation. Production in the latter is driven by subsistence; in the former by profit. In the modern economic sphere, market integration permits centralized policy signals like relative price changes to keep sector dynamics aligned to efficient pathways. On the contrary, the traditional economy is fragmented and centralized signals are not effectively transmitted. The decentralized regime is designed to generate time and locale specific signals. However, coordination of varied signals remains critical for realizing synergy benefits.

This persistent duality in developing economies invites hybrid solutions. The influence of centralized policy signals, e.g. electricity reforms, remains primarily confined to the modern sector. These signals are not accurately circulating in the traditional sector, and in some cases, central signals can negatively impact the development priorities of the traditional sector. For instance, the Indian electricity reforms could initially reduce electricity access in rural areas, undermining the national goal to enhance access. A hybrid strategy to enhance access could be to decentralize the electricity supply to rural areas. Substitution of traditional biomass for fossil power sources could involve a host of targeted measures like enhanced education and employment opportunities for women, developing infrastructures to supply cleaner fuels and subsidizing clean fuels (Shukla, 1997). As a case example, we consider the case of decentralized electricity generation in India.

Decentralized electricity

India's electricity policies have followed a centralized perspective. Nearly 45% of total and 56% of rural households have do access to electricity (Ministry of Power, 2004). The access problem has been among the most challenging for the policymakers. Decentralized electricity is an alternative to correct this failure of centralized policies. Studies have shown that the economic benefits, the marginal product, of rural electrification is high (Ranganathan and Ramanayya, 1998) ranging from Rs. 9 to 34 (or 20 to 75 US cents) per KWh. In the absence of a centralized grid reaching such villages, a relatively more expensive decentralized electricity supply would enhance welfare. Decentralized electricity supply is neither claimed as a universal solution for rural electrification nor as a competitive option where grid electricity is accessible. It is an economic proposition where centralized supply is unavailable and the local enterprise, energy resources and technical factors are favorable.

Decentralized electricity, technologies and development

Diverse technology options are available for decentralized and small-scale power supply. Diesel generators, biomass combustion and gasifier technologies, mini and micro hydro, wind and biogas are among the decentralized technologies available in India. Technology selection depends on local resources and capacities. The decentralized energy alternatives could provide the electricity at the rates between Rs. 5 to 9 (or 11 to 20 cents) per KWh. Electricity supply at this price could still be profitable for some revenue generating activities like artisan work, agro-processing and controlled irrigation. The consumption in schools and rural health facilities is also justifiable on public welfare grounds.

Among the primary energy resources, the cost of biomass-based systems is relatively lower since biomass is a stored energy akin to conventional fossil fuels. Hence adaptations of existing commercial technologies

are feasible for biomass electricity generation. Sustainable biomass generation would also deliver significant development benefits like local employment and soil regeneration. Where biomass use is unsustainable, such as through deforestation, decentralized electricity could be detrimental to environment and development. The decentralized energy systems have the additional advantage of flexibility in closely coordinating between generation and consumption.

Decentralized electricity, development and climate

Decentralized electricity could have an ambivalent impact on emissions. Where biomass harvesting is sustainable, its substitution by fossil fuels could add to greenhouse gas emissions. Where fossil fuels replace unsustainable biomass use, the emissions would fall. Conventional decentralization happened in India through the use of diesel water pumps and diesel generators. This route has been polluting and neither economical nor development friendly. Farmers and the rural entrepreneurs followed this route as a sole option. The Decentralized development is therefore not inherently climate-friendly, though climate benefits could be obtained if development and climate interests are aligned. With diverse technology alternatives available now, the decentralized electricity supply could be designed to suit the local conditions.

The case of biomass is interesting as an illustration. In India, the Ministry of Non-conventional Energy Sources (MNES, 2002) has identified significant biomass potential for decentralized rural energy supply. For instance, the potential of co-generation of electricity and steam from bagasse, which is a waste biomass from sugar crushing, is estimated to supply energy for 3,500 MW power. The erratic electricity supply in rural areas frequently disrupts the operations of sugar mills. Decentralized co-generation could supply electricity more reliably, and is more efficient, resource conserving and climate-friendly. Excess electricity could also be sold locally. The carbon saving for 3,500 MW capacity would be 5 million tons of carbon annually.

However, setting-up such decentralized projects in rural areas is neither a technological nor a financial problem as much as a development issue. The power plant operations would require managerial skills for organizing the logistics of bagasse collection and stocking policies. Technical and managerial capacities to operate electricity technologies are of higher order than that for the sugar operation. The most important transition for sugar mill owners could be their business configuration, since in several cases the investment and revenues from electricity could far exceed those from sugar operations, changing the business focus from sugar to electricity supply. In rural areas, factors like the paucity of managerial skills, inability to avert legally the moral hazard of cartelization by sugarcane growers subsequent to the power plant investment and the ability to manage government processes against adverse electricity tariff decisions are often more difficult to mobilize than the technology or finances. The risks from these factors are inherent in development deficiencies and can be alleviated only via development actions. The incremental mechanisms that operate on the technological and financial baselines could miss the larger developmental needs that would make or break the project. Realizing most of the 5 million ton annual carbon saving would require a coordinated developmental program for creating the conditions that would allow the institutionalization of a commercial market, rather than the subsidization of a few isolated projects.

References:

Ministry of Power (2004). Draft National Electricity Policy, at http://www.powermin.nic.in/draft%20national%20electricity%20policy.pdf, visited on September 7, 2004.

MNES (2002). Annual Report, Ministry of Non-conventional Energy Sources, Government of India, New Delhi.

Ranganathan V; Ramanayya (1998). Long-term Impact of Rural Electrification Study of UP and MP, Economic and Political Weekly, December 12.

Shukla PR (1997). Energy for Sustainable Development: A Social Engineering Perspective, The Social Engineer, Vol. 6, No. 2.

Case Study 6: Informal Finance, Development and Climate

Informal transactions exist in all nations, but its extent in developing countries is vast. The informal sector employs large work forces. The informal sector share of the urban labor force in eleven Latin American countries ranged from 30.3 to 57.0 percent (Lubell, 1991). In Kenya, employment in the urban informal and rural non-farm sector in 1985 was estimated at 30 and 13 percent respectively of all employment outside agriculture (Livingstone, 1991). Informal activities are more widespread in rural areas and include artisan work, cattle tending, household labor for collecting fuel-wood, dung and drinking water (Bose, 1993; Cecelski, 1991), irrigation water transactions among farmers (Kolavalli and Chicoine, 1989; Shah, 1993), and subsistence agriculture and tribal economy in the forest areas. The informal sector transactions in developing countries accounted for 30 to 70 percent of GNP (Jagannathan, 1987).

Informal finance

Informal lending mechanisms provide significant credit to small enterprises and households. For instance in Cameroon, 70 percent of the adult population participated in informal financial associations, which in 1988 had deposits equivalent of the 54 percent of country's total savings (Lubell, 1991). Informal credits accounts for about a third to two thirds of total credit in Bangladesh and China; about two-fifths in India and Sri Lanka; and two-thirds to three-quarters in Malaysia, Nepal, Pakistan and Thailand (Montiel et al., 1993). Informal finance dominates the credit submarkets catering to small, poor and risky borrowers and also competes with and complements the formal finance in other submarkets (Ghate, 1992). Informal credit markets are linked to the formal finance sector through the 'middle men' who provide the credit in the informal sector often at interest rates as high as five hundred percent per annum (Hemmer and Mannel, 1989). A study of money lending in the informal credit market in Malawi observed interest rates as high as five thousand percent per annum (Bolnick, 1992). Foreign exchange restrictions in some developing countries lead to exchange rate premiums in the informal market, though the premium is reducing with increased globalization and liberalization.

Informal finance, technology diffusion, development and climate

In the informal markets, interest rates are high and the labor rates are low in absence of firm wage contracts. Consequently, technology diffuses slowly and technology gap is wide. The conservation and environmental benefits associated with advanced technologies are therefore lost. Micro-finance arrangements and development programs have the dual effect of reducing interest rates and enhancing local labor. Technology penetration would follow, as would energy conservation, local environment and climate benefits. The climate centric mechanisms, aiming for incremental climate benefits, would be ineffective since benefits would accrue not from implementing projects that are incremental to the baseline. Decentralized, climate-favoring projects would materialize, if development processes would alter the baseline parameters like interest rates and wages.

References

Bolnick BR (1992), Moneylenders and Informal Financial Markets in Malawi, World Development, Vol. 20, No. 1.

Bose SA (1993), Money, Energy and Welfare: The State and the Household in India's Rural Electrification Policy, Oxford University Press, Delhi.

Cecelski EW (1991), Practical Strategies and Approaches to Addressing Gender Issues at Planning Stages in the Energy and Water Sectors: Lessons from International Experience, Paper presented at the Seminar/Training Workshop on Women in Water and Energy Development in Nepal, Kathmandu, Nepal, November 17-22.

Ghate PB (1992), Interaction Between the Formal and Informal Finance Sectors: The Asian Experience, World Development, Vol. 20, No. 6.

Hemmer H; Mannel C (1989), On the Economic Analysis of the Informal Sector, World Development, Vol. 17, No. 10.

Jagannathan VN (1987), Informal Markets in Developing Countries, Oxford University Press, New York and Oxford.

Kolavalli S; Chicoine D (1989), Groundwater Markets in Gujarat, India, Water resources Development, Vol. 5, No. 1.

Livingstone I (1991), A Reassessment of Kenya's Rural and Urban Informal Sector, World Development, Vol. 19, No. 6.

Lubell H (1991), The Informal Sector: In the 1980's and 1990's, Development Centre Studies, OECD, Paris.

Montiel P; Agenos PR; Haque N (1993), Informal Financial Markets in Developing Countries - A Macroeconomic Analysis, Blackwell, Oxford UK and Cambridge USA.

Shah T (1993), Groundwater markets and Irrigation Development: Political Economy and Practical Policy, Oxford University Press, Bombay.

Case Study 7: Energy & Development Paradoxes and Climate

The energy choices in developing countries are often paradoxical. The three most prominent paradoxes are: i) most expensive energy choices are made by the poor, ii) 'no regret'[15] fuel and technology choices are not made, and iii) modern sector in a developing country has technologies that are close to international best practices, but the technology gap within the country between the modern and traditional sectors is greater. The paradoxes arise from the dual economy structure. Centralised strategies alone are unable to resolve these.

Rural energy, employment and gender justice

The poor in developing countries mainly consume energy for cooking and lighting. Their fuel choices are limited to biomass and kerosene. The latter is used both for cooking and lighting. Electric lighting, even by incandescent bulbs, is ten times more energy efficient that kerosene lamp. Even at subsidized prices, kerosene remains the most expensive lighting fuel. For cooking, the rural poor use biomass, collected by family labor. If collection time is valued at the minimum wage (Mahadevia and Shukla, 1997), the biomass energy is the most expensive cooking fuel. However, the rural labor markets are incomplete and inefficient and there is little or no opportunity value of labor time, especially that of women. The land rent is also not paid since collection is from common property lands. Thus, biomass energy appears as a "free" good to the family and is neither substituted nor used efficiently. The harvesting from open access lands reaches unsustainable levels; causing deforestation (WRI, 1996) and adding to the greenhouse gas flux.

The traditional division of labor that allocates women's time to reproductive activities deprives them of education or formal training for skills. The low value of women's labor translates into the low economic value of life, and beyond emotions and social values, provided little reason for correcting the indoor air pollution a cause of large death toll and ill health in the world (Smith, 1987). The solution lies not in the energy or technology domains, but in development that enhances rural employment and women's education, alters land relations and creates infrastructures. Income augmentation, education and improved market access would promote development goals like employment, gender justice and also simultaneously the climate goals.

'No-regret' paradox: market barriers, development and climate

The failure to make 'no regret' choices seems to defy market logic and the proposition that consumers prefer higher incomes. Overcoming 'no regret' failures is argued to be unequivocally efficient and climate-friendly (IPCC, 2001). In developing countries, the prevalence of 'no regret' failures is widespread. Despite the targeted programs to push 'no regrets' technologies, like improved biomass cook-stoves in rural areas in India, their penetration levels have remained far below their ideal market potential. The explanations like 'irrationality' of consumers or the more conventional approach of attributing the failure to 'market barriers' have not been satisfactory. The 'barriers' approach, that advocates correcting the 'no regret' failure by finding and removing the market barriers, follows a circuitous logic. The failure is defined vis-à-vis the ideal market. In the traditional economy, there are only informal rules, norms and contracts. The market as a formal institution does not exist. The 'no regret' definition presumes the existence of formal market. The benchmark for 'no regret' is flawed, even non-existent.

The 'no regret' paradox arises since the market, an end product of development, is assumed to exist a priori. Development is a process of crating new norms and institutions, including markets. Resolution of 'no regret' failure in developing countries lies in assisting development, and, in turn, climate co-benefits would also accrue.

Technology gap, finance and risks

Technology is central to development. Energy technologies, their efficiency and mix, are the key determinants of the emissions profile of a nation. Most technology stock in developing countries is of old vintage. The immediate measure for bridging the technology gap is to transfer efficient and climate-friendly energy technologies that already exist in the developed world. Curiously, the technology gap is not easy to bridge. The

[15] 'No regret' options are those whose benefits equal or exceed their costs. These are the options worth doing any way (IPCC), and also called 'win-win' options.

gap remains even wider within developing countries like India between the technologies in the modern and traditional sector. The formal market in the modern sector aligns it more closely with the global market than with the traditional sector.

Technology transfers are co-terminus with financial transfers. Reforming the financial sector is generally more difficult than reforming technical or resource based sectors like electricity or energy. However, financial reforms are a precondition reforms in other sectors and must precede others. A key aim of financial reforms is to reduce investment risks. In developing countries, there are varied well-springs from which the risks to investments arise: the evolving legal and regulatory regime, weak contract implementation and intellectual property rights protection, currency fluctuations and inherent uncertainties of demand and supply estimates during the transformation period. Foreign investments, important vehicles for technology transfer, face additional political and social risks as they remain under greater public scrutiny and legal obligations in both the home and the host countries.

Technology transfers that have 'no regret' character fail to happen in practice in the face of these risks. The demanded returns from investments inflate as investors must cover their risks over normal returns. The high interest rate deters the transfer of advanced technologies that have inherently high initial investment per unit capacity and greater operational uncertainties. The power project of the Dabhol Power Company (DPC), promoted by the US multinational ENRON Corporation, is an example (Shukla et al., 2004). The DPC project failed, although it offered international best practice technology, scale economy, cleaner fuel and advanced operational practices. The failure caused loss of development and climate benefits. The DPC case is separately discussed in the context of risks and reforms dynamics in the developing countries.

Technology transfers to traditional sectors in developing countries are even more risk prone in the absence of a credible formal contract regime and market structure. In addition, the weak infrastructure limits technology choices and also adds to operating risks. Advances in global technologies tend to substitute labor by capital. In the traditional sector, labor costs are low and interest rates high, deterring investments in new technologies. As a result, the technology gap between modern and traditional sector within a country widens. The national development processes that create institutions, infrastructures and local financial solutions like micro-finance are the best means for promoting technology transfer, including transfer of energy efficient and climate-friendly technologies, to the traditional sector. Development and climate actions are thus inseparable.

References

IPCC, 2001. Climate Change (2001): Mitigation - Contribution of Working Group III to the IPCC Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). Cambridge University Press, Cambridge.

Mahadevia D; Shukla PR (1997), Women's Development and Energy and Environment Polices, in Energy Strategies and Greenhouse Gas Mitigation (Ed. P.R. Shukla), Allied Publishers, New Delhi.

Shukla PR; Heller T; Victor D; Biswas D; Nag T; Yajnik A; 2004. Electricity Reforms in India: Firm Choices and Emerging Generation Markets, Tata McGraw-Hill, New Delhi.

Smith R (1987). Biofuels, Air Pollution and Health: A Global Review, Plenum Publishing Corporation, New York.

WRI- World Resources Institute, (1996). World Resources- 1994-95: A Guide to the Global Environment, Oxford University Press.

Case Study 8: Climate Impacts on Infrastructure: Adaptation and Insurance

Huge investments are being committed in new infrastructure projects in developing countries. Development of infrastructure enhances the scope of utilizing underemployed resources, in addition to creating new investment opportunities. Infrastructures are long-life assets and are designed to withstand normal variability in climate regime. In recent years, increasing landslides and cloud bursts in the hilly regions have caused significant damage to human settlements and infrastructures. Here we take the case study of the recently constructed Konkan Railway, a major project laid through the high rainfall western Ghat (mountain) region, which is a typical example of high value long-life asset exposed to climate extremes. The analysis of the project shows that the assessment of including adverse climate impacts would have altered the project design and configuration. The case study examines the likely impacts to long-life assets from future climate change and national development strategies. The analysis indicates that the adaptation strategy should integrate the climate change impacts with the overall assessment of investment decisions and design of infrastructure projects. A key adaptation measure would be to develop insurance markets to manage climate change risks for long-life assets.

Infrastructure and Development

Infrastructure is an engine for economic development. Infrastructures facilitate and enable the flow of goods and services. Though pervasive, they are most often ignored as an explicit factor in the economy. Indirectly, the influence of infrastructure is felt in so many different and seemingly unrelated guises that it is difficult to cost or discuss as a single unit. As the backbone of the economy, infrastructure is crucial for industrial growth. The successive five-year plans in India have devoted a large and increasing financial outlay for the development of economic, social and institutional infrastructure (GOI, 1981 and 2001). A major share of plan outlay is committed to a few projects in high priority sectors like power and transport. The India Infrastructure Report (GOI, 1996) estimated the annual investment need for urban water supply, sanitation and roads at about Rs. 280 billion (US$ 6.15 billion) for the next ten years. Investment needs for urban transport infrastructure in cities with population over 100,000 is estimated at Rs. 2,070 billion (US$ 45.4 billion). Significant investments are committed to development of hard infrastructures in India (Table 1) amounting to over 5% of GDP in recent years.

Table 1: Infrastructure sector investment estimate

Sectors	**Projected Financial Requirement** (from 2000 to 2005) Rs. Billion (1995 prices)	US$ Billion (1995 prices)
Power	3100	71.1
Telecom	840	19.3
Roads	440	10.1
Railways	640	14.7
Ports	410	9.4
Urban Infrastructure	1500	34.4
Total (incl. others)	7550	173.1

Some recent initiatives of large-scale infrastructure development in India include the development of national highways network and linking of rivers for development of national water network. The national highways development project covering 13,146 km of road network, with another one thousand km of port and other connectivity, is estimated to cost Rs. 540 billion (US$ 11.8 billion). More than 2,100 km has

already been completed over the last three years and another 5,000 km are under various stages of completion. More than US$ 3.5 billion have been spent and/or committed (http://www.nhai.org/, visited on 25th August, 2003). The river-linking project is estimated to cost Rs. 5,560 billion (US$ 122 billion) over next ten years. Many of these projects would life span beyond this century. These long-life assets would be exposed to the climate change, though they are undertaken without any conscious assessment of future climate change impacts.

Infrastructure and Climate

It is indisputable that long-term climate changes would impact infrastructure. Globally, the extreme weather events are a major cause of damage to infrastructure. In developing countries, public expenditures bear the losses from damage since most infrastructures are government-owned. Even for privatized infrastructure, the *force majeure* provisions largely allocate financial responsibility for catastrophe risk to governments. An inevitable result of the increased damages to infrastructure from climate change will be a dramatic increase in resources needed to restore infrastructure.

From an engineering perspective, infrastructures are designed to tolerate a reasonable level of variability within a climate regime that existed when infrastructure was designed and built. However, climate change can affect both average conditions and the probability of extreme events, temperatures, precipitation patterns, water availability, flooding and water logging, vegetation growth, land slides and land erosion in the medium and long-run (IPCC, 2001c; Rupa Kumar et al., 2003). Different projects display varying level of sensitivity to climate change due to different vulnerability and adaptive capacities (Shukla et al., 2003).

Damages to infrastructure are exacerbated by high vulnerability and low adaptive capacity to natural disasters. For instance the tropical cyclone that struck Gujarat state on the western coast of India on 9th June 1998 left thousands dead and caused property damage of Rs. 26 billion (US$ 570 million) (Raju and Sinha, 1998) to thriving industrial complexes of Kandla, Porbandar and Jamnagar. Another recent incident is the Konkan Railway accident on the western Indian coastal Ghats on 21st June 2003 night that left more than 50 dead (Deccan Herald, 2003). The accident was caused by landslide due to incessant heavy rains, presumably higher than the system's adaptive capacity. Possibly, climate change might have taken its first toll on the Indian railway system since the accident site was not an identified vulnerable spot by the railway administration based on past rainfall history, because the slope and the cutting was geologically stable.

More severe climatic changes in future may add to the repair and maintenance costs of such assets. Infrastructures display a bathtub shaped cost curve for repair and maintenance. In the initial stabilization period they may require frequent maintenance. The maintenance requirement decreases once the system has stabilized (Figure 1). It increases again due to wear and tear as the asset reaches the end of its useful life. Attention to climate change impacts becomes important since these may be more pronounced in the later part of the 21st century (IPCC, 2001b). These two effects coupled together, would increase the economic impact on infrastructures.

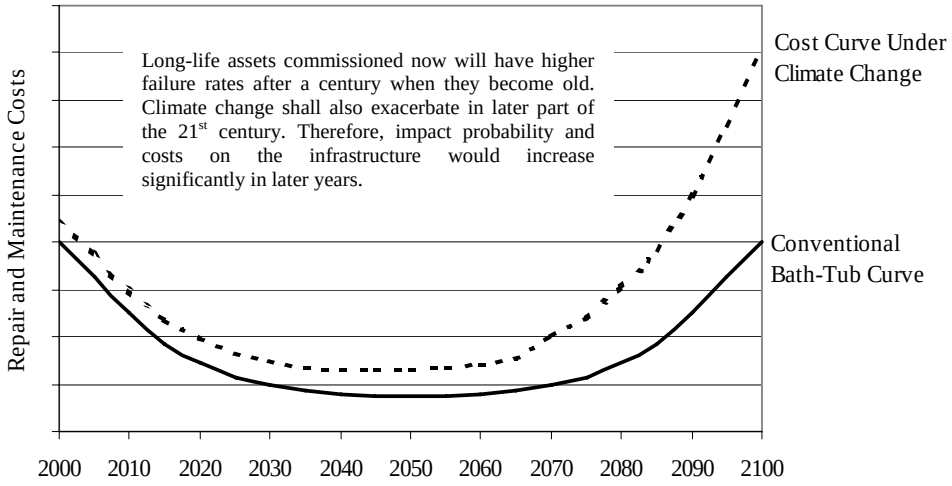


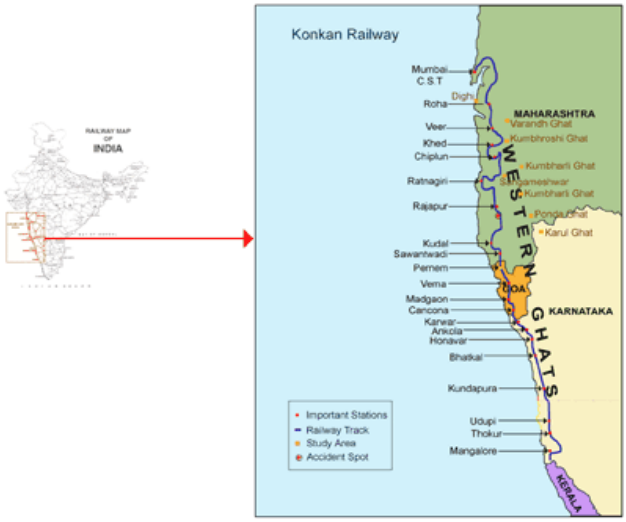
Figure 1: Infrastructure maintenance and impact costs

The Case of Konkan Railway

Konkan is a coastal strip of land bounded by the Sahyadri hills on the east and Arabian Sea on the west on the western coast of India. The Konkan Railway project (Figure 2), covering a distance of 760 km and costed at Rs. 34 billion (US$ 745 million), was conceived with the objective of bridging the Konkan gap and reducing the distance and travel time between Mumbai, and coastal Karnataka and Kerala. It is the first major infrastructure project in India to be taken on the Build, Operate, and Transfer (BOT) basis. Indian Railway set up Konkan Railway Corporation Limited (KRCL) as a BOT operator in July 1990. The railway line passing through the mountainous region has 179 major bridges and 1819 minor bridges. There are nine tunnels exceeding 2.2 km, a tunnel length that was never built in India earlier (KRCL, 1999). KRCL track passes through more than one thousand cuttings[16], with 224 being deeper than 12 meters. All these deep cuttings have been declared as vulnerable spots by KRCL after the June 2003 accident.

The Konkan Railway commenced commercial operations on January 26, 1998, Impact of the KRCL on its surrounding environment, including the route alignment through Goa, were major concerns raised by various interest groups and researchers from the project inception itself (Raghuram, 1999). The Western Ghats, through which the Konkan Railway passes, experience moderate to heavy rainfall and the marine ecosystems are sensitive to climate changes. Many studies were carried out to analyze the impacts of Konkan Railway project on the surrounding ecosystems and environment (Rajaram et al., 2001). However, no assessment was made of the impacts on Konkan Railway from future environmental changes like the climate change.

[16] Small hillocks are cut through to construct passage for the railway track duly maintaining reasonable slope for the track. These passages are called cuttings. Cuttings are like top open tunnels, with spread out slopes on either side. Some cuttings are deeper than 12 to 15 meters. Such deep cuttings pose higher safety hazards due to higher possibilities of water logging and landslides. Cuttings cave in mostly due to excessive rains. Unstable cutting-slope and geological characteristics of the soil determine its sensitivity to rains. Adaptation measures include regular monitoring during rainy season, temporary speed restrictions on the trains passing through these cuttings, nylon-net erection and retaining wall construction to trap sliding boulders, removing precariously placed boulders in anticipation, appropriate drainage construction and maintenance, further easing out and consolidation of the cutting-slopes, paving and sowing of grass on the cutting-slopes.



The 760 Km long Konkan Railway on the Western coastal ghats of India is an engineering marvel with 179 main and 1819 minor bridges, 92 tunnels (covering 12% of the total route) and over 1,000 cuttings (224 deeper than 12 meters). The longest tunnel is 6.5 Km long and the longest bridge is over 2 Km. The pillars of the tallest viaduct bridge are more than 64 meters high, taller than Qutab Minar.

- Presently 20% of repair and maintenance expenses on tracks, tunnels and bridges are due to climatic reasons.
- A recent accident on 21st June 2003 night (see ⊕ on the map), resulting in over 50 deaths, was caused by landslide at a deep cutting due to incessant heavy rains, presumably higher than the system's adaptive capacity. Consequent to the accident, maximum permissible speed of trains has been reduced from 120 Km/h to 75 Km/h.
- 200 mm rainfall within 24 hours increases system vulnerability (Nagrajan et al., 2000) (see present vulnerable regions as ■ on the map). Future rainfall pattern shows that such events are likely to occur more frequently and with higher intensity (chapter 3 of this book).
- Adaptation measures should also consider vulnerable spot identification based on future climate change projections.

Figure 2: Konkan Railway

Climate Change Impacts on Konkan Railway

The causal matrix of climate impacts on Konkan Railway (Table 2) show that the most relevant factors for measurement of potential impacts are rainfall, having a strong negative influence; and preventive maintenance, being a strong positive influence (for detailed discussion see Kapshe et al., 2003). Rainfall changes would be influenced by external factors including future climate change, whereas preventive maintenance is internal to system and would help mitigate the impacts. In the case of Konkan Railway, the studies showed that the main forcing variable causing impacts would be the rainfall threshold for landslides parameterized as 'more than 200 mm precipitation in 24 hours' (Nagrajan et al., 2000). Climate change would influence the probability distribution of the parameter 'number of days exceeding 200 mm rainfall' via a shift in the mean of rainfall pattern or its variability (see Figure 3 for stylized representation of shifting distribution). Increasing mean and variability of the number of days with heavy rainfall would cause added impacts.

Future rainfall projections for India have indicated an increasing rainfall trend (Rupa Kumar et al., 2002). Given the increasing trend of rainfall and spatial variability, the Konkan region is expected to receive more than 1000 mm rainfall in a month during the monsoon season. With such a heavy concentration of rainfall, days with more than 200 mm precipitation, in a season, would increase. Further, the studies show that the statistical characteristics of the daily rainfall over India also have significant spatial variations. Observations show that during the summer monsoon season, heavy rainfall in just 10 to 20% of total rain days contributes 50% of the seasonal rainfall at most stations. A rainfall increase pattern in the Western Ghats adds to the problem. The

assessment from Regional Circulation Model (Rupa Kumar et al., 2003) along the Konkan Railway route show increased rainfall for the years 2040 and 2080 under three scenarios.

Development Pattern and Impacts on Infrastructure

Rainfall is but one factor causing the landslides, the others being geology, soil structure, vegetation cover, slope, etc. Future development patterns would influence factors like vegetation cover and therefore the probability distribution of landslides. For instance, development along a sustainable pathway would protect the forests in the western Ghat region and reduce the probability of landslide. Associated with each development pathway there will be a unique probability distribution for such parameters. This aside, the development pathway could also influence the impacts through modifying the actions of the project owners. The transport safety policy, for instance, under different development patterns would not be identical. The pathways having strong rail safety norms or high compensations would make the project owners pay greater attention to maintenance, warning systems and organizing response measures in case of landslides or accident. The climate impacts on infrastructure are therefore not governed solely by the underlying distribution of climate parameter like "the amount of rain fall in a day" but also by the underlying development parameters that mediate the influence of changing climate parameter on the driving parameters of impacts.

Table 2: Causal matrix for impact analysis for Konkan Railway

		Dependent variables	Environmental Variables						Project Components		
	Forcing Variables	Temperature	Rainfall	Sea level rise	Extreme events	Water logging	Vegetation growth	Land slide	Safety/Efficiency	Maintenance	Traffic volume
Environmental Variables	Temperature		L	M	L	--	L	--	--	--	L
	Rainfall	L		--	M	M	M	H	L	L	M
	Sea level rise	--	--		--	M	L	M	L	--	L
	Extreme events	--	L	--		M	--	M	L	--	M
	Water logging	--	--	--	--		--	L	L	--	M
	Vegetation growth	L	L	--	--	--		L	--	L	--
Project Components	Land slide	--	--	--	--	M	L		M	L	H
	Safety/Efficiency	--	--	--	--	L	--	L		M	M
	Maintenance	--	--	--	--	M	L	H	H		M
	Traffic volume	--	--	--	--	--	--	--	L	M	

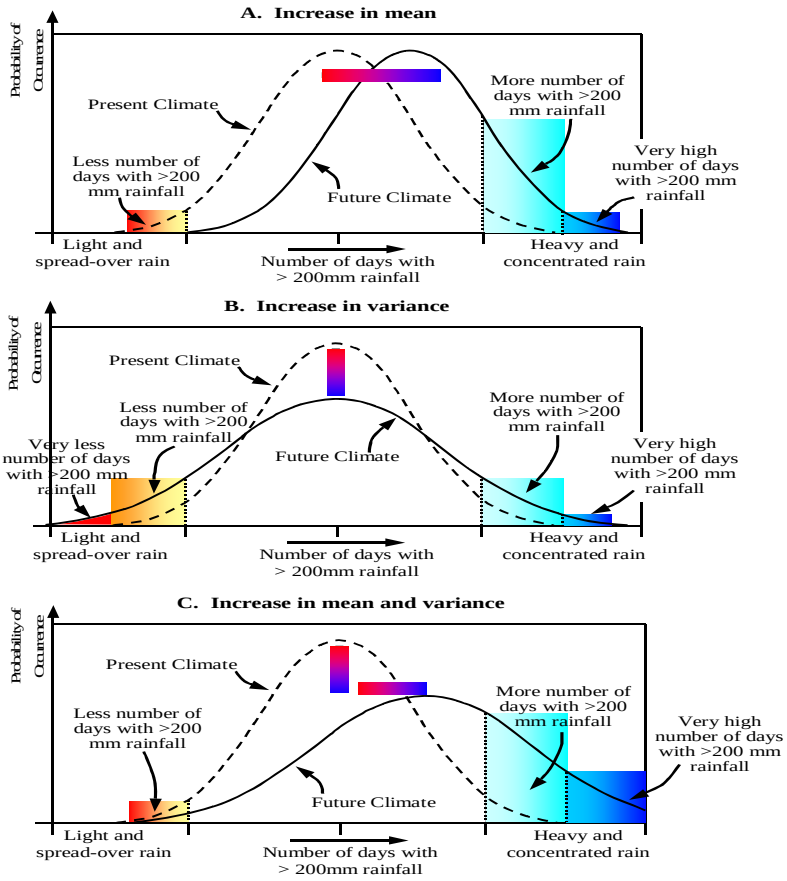


Figure 3: Stylized Probability distribution for 'number of days exceeding 200 mm precipitation'

Adaptation

The operating experience of Konkan Railway shows that each year during the monsoon, the train schedules are disrupted due to water logging and landslides. For instance, a major traffic suspensions was for fourteen continuous days during 11th to 25th July 2000 due to landslides at 36 locations caused by more than 300 mm rainfall on a single day. The expected losses were estimated to be about Rs 100 million (US$ 2.2 million). There were a total of 140 reported incidences of landslides during the entire monsoon season in 2000. For adaptation, vulnerable locations are annually identified and preventive maintenance is carried out before the onset of monsoon. In early years, the vulnerable locations numbered between 60 and 120. In the year 2002, more than 200 vulnerable spots were identified. Konkan Railway spends over Rs 50 million (US$ 1.1 million) annually to reduce such locations and stabilize the track for trouble-free train operations. Though, after the 21st June 2003 accident, all the cuttings deeper than 12 meters are declared vulnerable locations, besides other existing vulnerable locations. Adaptation measures are being implemented, such as easing out and paving slopes at deep cuttings, increased patrolling, installing electronic systems for early landslide warning, and anti-collision devices. Seismographs are planned at some sensitive locations. Such measures, while increasing safety, have been adding significantly to the costs.

The present design code of Konkan Railway took into account the normal climate change variability and not extreme climatic events, which can cross the threshold. Konkan Railway now spends 6% of revenue on repair and maintenance, 70% of which is for repair and maintenance of permanent way, bridges and tunnels. As estimated by Konkan Railway officials, about 20% of this expenditure takes place for minimizing climate related impacts. The increased rainfall or its variability would increase the expenditure on repair and maintenance. In later decades of the century, the impacts could be larger due to compounded effects of climate change and the aging of the railway infrastructure.

Climate Risk and Insurance

Globally, the insurance sector has been participating in covering the risks of large-scale infrastructure projects against future uncertainties. Climate change increases risks for the insurance sector. Unless, the impacts are understood well and covered, the risks are enhanced for the investors or insurers. The insurance companies can allocate risks, provided that they are 'properly and timely informed' on the consequences of climate change (Tol, 1998). For example, in the event of a catastrophic event, the insurance sector reacts to increased risk and large losses by restricting coverage and raising premiums. Conventionally, risks are managed through four means, i.e. by avoiding, mitigating, retaining or transferring the risk. The first two (avoidance and mitigation) are risk control measures and the latter two (retention and transfer) as risk financing measures. Risk financing funds those losses that remain after the application of risk control measures, including those risks accepted as not being able to be controlled and those where controls proved inadequate to contain the risk (AACI, 2003).

The IPCC Third Assessment Report (IPCC, 2001a; IPCC, 2001b) has concluded that, during the 20th century, the frequency of extreme precipitation events has increased mid- and high northern latitudes (with 66-90% confidence), and that the occurrence of extreme weather events has increased in temperate and tropical Asia, including floods, droughts, forest fires and tropical cyclones (with 67-95% confidence). The IPCC has noted some indication of increases in extra-tropical cyclone activity during the latter half of the 20th century in the northern hemisphere. At the same time, more pronounced severe dry events have occurred in the past decades over Sahel, eastern Asia and southern Africa (IPCC, 2001a). Globally, over the past decade the premium for catastrophe insurance has been high and cyclical, ranging from double to 18-times the actuarial fair premium, although there have been periods where the price actually fell below pure premium. Thus the insurance instruments appear to be costly, however, this may change as investors gain more experience (Andersen, 2001).

Infrastructure Insurance in Developing Countries

Despite the costs, there is a great deal of excitement about the potential of insurance and other forms of risk transfer for hedging the risks of extreme weather-related and other disasters facing developing countries. Governments carry a large and highly dependent portfolio of infrastructure assets, some of which are critical for restoring economic growth, and for the same reason as firms they may wish to reduce the variance of their disaster losses by diversifying with insurance and other risk-transfer instruments. A government of a country is, however, different from a firm since most governments can pass their infra-structure losses on to taxpayers. Thus it appears that the governments are less risk averse than firms, and risk aversion is the main justification for paying the additional costs for insurance (Arrow and Lind, 1970).

A developing country may not be able to pass its losses fully on to taxpayers, and risk transfer may be the only available option for covering extreme-event losses. Many governments of developing countries do carry some limited insurance, some limited insurance on its quasi-private capital stock like airports, telecom energy facilities and state-owned enterprises, whereas roads, bridges, hospitals, government buildings remain without protection (Pollner, 2000). Lacking more attractive financing alternatives, the government benefits from risk transfer since it reduces the variability of its disaster losses, but risk transfer requires resources that could otherwise be invested in the economy. In terms of economic growth there is thus an inherent trade-off: a reduction in funds spent on current growth permits a government to protect itself against extreme future losses.

Conclusion

The Konkan Railway project illustrates that long-life infrastructures would be vulnerable to the climatic changes. The project financing should account for these added risks and project engineering should build these factors into the design. The assessment of probabilities of the key drivers causing impact is vital for risk and insurance assessments. The infrastructure sector is a vital sector where huge investments are being committed in developing countries. The sector creates long-life and open-to-weather assets that shall face increasing impacts from the changing climate. It would be prudent for developing country policymakers to

pay attention to protect these assets, which may otherwise cause significant welfare losses to future generations. Myriad adaptation strategies are needed. These would include the incorporation of future climate extremes in the project design parameters in the immediate-term; improved operational and maintenance practices in the near-term; and improved climate predictions and creation of insurance markets in the long-term.

References

AACI (Australasian Advisory Committee on Insurance) (2003). Risk, The Environment and The Role of The Insurance Industry. Report of UNEP Finance Initiative.

Andersen T J (2001). Managing Economic Exposures of Natural Disasters. Exploring Alternative Financial Risk Management Opportunities and Instruments. IDB, Washington DC.

Arrow KJ; Lind RC (1970). Uncertainty and the Evaluation of Public Investment Decisions. The American Economic Review 60, 364-378.

Deccan Herald (2003). Konkan rail mishap toll rises to 51. Deccan Herald, Online Edition, June 25, 2003. (http://www.deccanherald.com/deccanherald/jun25/n2.asp). September 2003.

GOI (1981). Economic Survey 1980-1981. Economic Division, Ministry of Finance, Government of India.

GOI (1996). The India Infrastructure Report. Volumes I, II and III. The Rakesh Mohan Committee, National Council for Applied Economic Research, Government of India, New Delhi.

GOI (2001). Economic Survey 2000-2001. Economic Division, Ministry of Finance, Government of India.

Indiacore, 2003. (http://www.indiacore.com/urban-infra.html). August 25, 2003.

IPCC (2001a). Climate change 2001: The Scientific Basis- Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). Cambridge University Press, Cambridge.

IPCC (2001b). Climate Change 2001: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). Cambridge University Press, Cambridge.

IPCC (2001c). Climate Change 2001: Synthesis Report. Contributions of Working Group I, II and III to the third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). Cambridge University Press, Cambridge.

Kapshe M; Shukla PR; Garg A (2003). Climate Change Impacts on Infrastrucutre and Energy Systems, In: Shukla PR; Subodh Sharma NH; Ravindranath A; Garg A; Bhattacharya S (Eds.), Climate Change and India: Vulnerability Assessment and Adaptation. Universities Press (India) Pvt Ltd, Hyderabad.

KRCL (1999). Treatise on Konkan Railway. Konkan Railway Corporation Limited, Mumbai.

Nagrajan R; Roy A; Vinod Kumar R; Mukherjee A; Khire MV (2000). Landslide hazard mapping based on terrain and climatic factors for tropical monsoon regions. Bulletin of Engineering Geology and the Environment 58, 275-287, Springer-Verlag.

Pollner J (2000). Managing catastrophic risks using alternative risk financing & insurance pooling mechanisms. World Bank, Washington D.C.

Raghuram G (1999). Environmental concerns and its impact on infrastructure development: Konkan Railway Corporation (Choice of alignment in Goa) - A case study. In: Raghuram G; Jain R; Sinha S; Pangotra P; and Morris S (Eds.), Infrastructure Development and Financing: Towards a Public-Private Partnership. Macmillan India Limited, Delhi.

Rajaram B; Nagarajan R; Khire MV (2001). Synergistic use of orbital satellite image and ground-based information in environmental monitoring of railway alignment construction- a case study. International Journal of Remote Sensing 22(16), 3187-3201.

Raju DVS; Sinha J (1998). Vulnerability and failure study of built environment in Gujarat cyclone. Paper presented at National Conference on Disaster & Technology, Manipal, September 1998.

Rupa Kumar K; Krishna Kumar K; Ashrit RG; Patwardhan S K; Pant GB (2002). Climate change in India: Observations and model projections. In: Shukla PR; Sharma Subodh K; Ramana PV (Eds.), Climate Change and India: Issues, Concerns and Opportunities. Tata McGraw-Hill Publishing Company Limited, New Delhi.

Rupa Kumar K; Krishna Kumar K; Prasanna V; Kamala K; Deshpande NR; Patwardhan SK; Pant GB (2003). Future Climate Scenarios. In: Shukla PR; Sharma Subodh K; Ravindranath NH; Garg A; Bhattacharya S (Eds.), Climate Change and India: Vulnerability Assessment and Adaptation. Universities Press (India) Pvt Ltd, Hyderabad.

Shukla, PR; Sharma Subodh K; Garg A; Bhattacharya S; Ravindranath NH (2003). Climate Change Vulnerability and Adaptation: The Context, In: Shukla PR; Subodh Sharma NH; Ravindranath A; Garg A; Bhattacharya S (Eds.), Climate Change and India: Vulnerability Assessment and Adaptation. Universities Press (India) Pvt Ltd, Hyderabad.

Tol RSJ (1998). Climate change and insurance: a critical appraisal. Energy Policy 26, 257-262.

Annex 3:

Netherlands Environmental Assessment Agency

विद्याविनियोगाद्विकासः
IIM AHMEDABAD

Workshop Development and Climate
27-28 September 2004
Venue: Hotel Le Meridien, New Delhi, India

Programme

[IMPORTANT NOTICE: This programme is subject to changes]

Workshop Chairs: Dr. Prodipto Ghosh, Secretary, Indian Ministry of Environment and Forests
Dr. John Christensen, Head, United Nations Environment Programme-Risoe
Dr. Bert Metz, Co-Chair IPCC and Global Sustainability & Climate Unit

Monday, 27th September 2004

09:00 - 09:30	**Inaugural Address** Dr. Prodipto Ghosh, Secretary, Indian Ministry of Environment and Forests
09:30 - 10:30	**Introduction to Development & Climate Project** Findings from Phase I and Introduction to Phase II : Dr. John Christensen, Head, United Nations Environment Programme-Risoe, Roskilde, Denmark; From National Studies to International Policy Making: Dr. Bert Metz, Intergovernmental Panel for Climate Change (IPCC), Co-Chair Working Group III and Global Sustainability & Climate Unit, Netherlands Environmental Assessment Agency (RIVM), Bilthoven, Netherlands **Questions and Discussion**
10:30 - 11:00	**Coffee Break**
11:00 - 12:30	**Introduction to the workshop Financing Development & Presentation of Paper "Financing the Climate-friendly Development Pathway"** Prof. Thomas Heller, Professor, Stanford University, Stanford, United States of America Prof. P.R. Shukla, Professor, Indian Institute of Management-Ahmedabad, India **Questions and Discussion**
12:30 - 14:00	**Buffet Lunch**
14:00 - 16:00	**Country Perspectives on Financing Development & Climate** - How has development finance worked and what are its implications for climate? - What actions country could take to integrate development and climate in finance?

	South Africa: Ms. Aditi Maheshwari, Economic Services, National Treasury Department Korea: Dr. Taeyong Jung, IGES **Questions and Discussion**
16:00 - 16:30	**Tea Break**
16:30 - 18:00	**Key Issues for Financing Development** Speakers: (15 minutes each) Theme 1: Water and Food & Agriculture Mr. Pierre Mukheibir, Projects Manager, Energy Research Centre, University of Cape Town, South Africa; Theme 2: Energy & Integration Prof. Emilio Lebre La Rovere, Federal University of Rio de Janeiro, Brazil **Questions and Discussion**
18:00	**End of Day 1**
19:30	**Dinner**

Tuesday, 28th September 2004

09:00- 10:45	**Integrated Development Finance** How development finance could be integrated with other priorities? Speakers: (15 Minutes each) Dr. Jan Verhagen, Plant Research International, Wageningen University, Netherlands Ms. Jo-Ellen Perry, Manager Climate & Energy, International Institute for Sustainable Development Mr. Takayuki Yamamoto, Chief Representative, Development Bank of Japan Mr. S.K. Joshi, GEF Operational Focal Point at the Government of India **Questions and Discussion**
10:45 - 11:00	**Coffee Break**
11:00 - 12:00	**Financing Mechanisms for development and climate**. What are the regular and alternative financing mechanisms that can enhance integrated development and climate finance? Speakers: (15 minutes each) Dr. John Christensen, Head, United Nations Environment Programme-Risoe, Roskilde, Denmark; Mr. Suman Majumdar, Head, Environmental Management Division, Confederation of Indian Industries, India Mr. Ajay Mathur, President, Global Senergy, India **Questions and Discussion**
12:00 - 13:30	**Buffet Lunch**
13:30 - 14:45	**Private Actor Perspectives** What does the private sector need in terms of finance to respond to the climate challenge? How can the private sector facilitate financing for Development and Climate? Speakers: (15 minutes each) Mr. Anil Malthora, Vice-President, ICICI Bank, India Ms. Shami Nissan, Managing Director, Innovest Group, International Mr. Abser Kamal, General Manger, Grameen Shakti Bank, Bangladesh **Discussion**
14:45-17:00	**Implications for national and international policy on financing integrated development and climate strategies** **Plenary Discussion to develop recommendations**
17:00-17:15 17:15-18:00	**Tea Break** **Closing Session**

Annex 4:

Netherlands Environmental Assessment Agency

Workshop Development and Climate
27-28 September 2004
Venue: Hotel Le Meridien, New Delhi, India

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