Reducing Greenhouse Gas Emissions in India

Financial mechanisms and opportunities for EU-India collaboration

Report for the Swedish Ministry of Environment

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Preamble

This report was produced on request from the Swedish Ministry of Environment to inform the Swedish Presidency of the EU in preparation for the upcoming EU-India Summit in New Delhi on 6 November 2009.

It is an independent report from a group of research institutes with the Stockholm Environment Institute (SEI) as lead partner in cooperation with The Energy and Resources Institute (TERI) in New Delhi, Svenska Miljöinstitutet (IVL) in Stockholm, Centre for International Climate and Environmental Research - Oslo (CICERO) in Norway and Linköping University. Funding has been provided from the MISTRA-funded CLIPORE project and from core funds provided to SEI from the Ministry.

The presentation and analysis of this work build to a large extent on secondary sources, complemented with results from discussions and interviews in New Delhi during August 2009 with a number of actors concerned with climate change policies and financial mechanisms, including:

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- Dr Ajay Mathur, Director General, Bureau of Energy Efficiency, Government of India
- Shri. Deepak Gupta, Secretary, Ministry of New and Renewable Energy, Government of India
- J. M. Mauskar, Additional Secretary, Ministry of Environment and Forests (MoEF), Government of India
- Anders Sjöberg, Minister and Deputy Head of Mission, Embassy of Sweden, New Delhi
- Arati Davis, National Programme Officer, Environment and Energy, Embassy of Sweden
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The recommendations presented in section 7 of the report are those of SEI.

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Executive Summary

This report illuminates potential areas for collaboration between the EU and India on actions that reduce greenhouse gas emissions in India.

If human-induced climate change is to have any hope of being limited to 2 degrees, it is essential that ways are found to address rapidly rising greenhouse gas emissions in India, as elsewhere. This is a challenging proposition: even though India's per capita emissions are very low, her 1.15 billion people are collectively a major source of greenhouse gas emissions. This fact, coupled with the immediate task of tackling widespread poverty, means that the international community must play a major role in providing financial and technological resources to support India's domestic efforts.

As India's 2008 *National Action Plan on Climate Change* recognises, tackling the country's greenhouse gas emissions means not least finding ways to transform a rapidly growing energy sector. International financial mechanisms such as the Clean Development Mechanism and the Global Environment Facility have been unable to deliver the scale of transformative change needed to shift India's emissions trajectory. While the Indian government has already initiated some ambitious policy measures – particularly pertaining to solar energy and energy efficiency – the effectiveness of international finance mechanisms and other forms of international partnership will be crucial in determining the success of greenhouse gas mitigation efforts.

The EU India Summit is held a month before COP15 negotiations in Copenhagen. While this provides challenges in terms of seeking concrete agreements on questions of finance, it is also an important opportunity to devise complementary efforts outside the UNFCCC process. Genuine, productive collaboration could not only be used to foster the sorts of transformative changes that are needed in India's growing economy but could also create a spirit of cooperation that spills over into UNFCCC negotiations.

Successful EU and India collaboration will necessarily be focused in areas of common interest. While a primary aim of the EU is to catalyse large GHG emission reductions, India's key interests are in supporting economic development and enhancing technology transfer. Areas of collaboration must therefore lie at the intersection of these objectives. This report recommends several specific areas that could prove productive sites for collaboration between the parties, namely:

- Implementing a clean-cooking stoves program to reduce both the health and climate impacts of black carbon ("soot") emissions from India's very large non-commercial energy sector, and to provide an understanding of the technological, economic and policy conditions needed to dramatically scale up the deployment of cleaner stoves;
- Developing a concrete package for supporting solar energy development and deployment, consisting of financial resources raised and delivered through European Development Banks as well as a joint research program to drive down technology costs and foster local manufacture; and
- Supporting implementation of the National Mission on Enhanced Energy Efficiency, in particular by using credit lines to Indian financial institutions for targeting lending to Energy Service Companies, and by establishing EU-India research teams to work on identifying and tailoring high efficiency technologies for deployment in the small and medium-sized industry sector.

1. Introduction

This report identifies areas of potential collaboration between the EU and India that could reduce greenhouse gas (GHG) emissions. The EU-India Summit in November 2009 will be a challenging forum to tackle climate change issues, coming just weeks ahead of COP15 negotiations in Copenhagen. As a result, specific new initiatives on climate financing may be difficult to agree upon at the Summit. At the same time, there are opportunities for partnership on activities that assist India in meeting its domestic objectives that can simultaneously reduce GHG emissions. Well-designed collaborative activities can strengthen the EU-India partnership, and set the tone for more productive agreements in international climate negotiations.

By virtue of her very large population, India is a major emitter of greenhouse gases, ranking fourth globally in overall terms (behind the US, China, and the EU) and contributing around 5.5% of global emissions (FIIA, 2009). Emissions are also growing rapidly. However India's cumulative historical emissions remain low relative to most industrialised countries, and its per capita emissions of 1.7 tCO_2 (WRI/CAIT) are very low, even relative to other major developing economies (the world average is around 5.8 tCO_2 per capita). This dichotomy partly explains the difficulties faced in designing an effective and fair global climate agreement.

A global climate agreement must find ways to catalyse deep emission reductions in India, both in the near- and longer-term. This does not necessarily require, however, that India bear the financial burden for climate change mitigation. International financing mechanisms and other forms of partnership can play a key role in fostering the widespread transfer and deployment of suitable low-emissions technology. Close partnership with industrialised countries, and the EU in particular, will be essential to accomplish this.

India and the EU have voiced different perspectives on some key issues relating to a future climate change framework. Generally, the EU looks into the future and sees India as a major source of GHG emissions which must be brought into a future global climate agreement via emissions commitments and fuller participation in global carbon markets. By contrast, India looks at the past and argues that developed countries bear full responsibility to pay for mitigation and adaptation in developing countries, on the basis not only of historical responsibility for GHG pollution but also their greater capacity to pay and significantly higher per capita emissions. If efforts to seriously tackle climate change are to be effective, the EU and India must find ways to bridge this gap and bring these perspectives into closer alignment.

India ranks 128th in the Human Development Index, with an estimated 34% of its population living on less than US$1 per day and 80% on less than US$2 per day (FIIA, 2009). Millions of people lack access to clean drinking water and adequate nutrition. Up to 400 million people (and well over 50% of the rural population) lack access to electricity (FIIA, 2009). While climate change is likely to exacerbate India's development challenges, especially for rural and small-scale livelihoods, economic development remains the Government's overwhelming priority. India is pursuing a rapid expansion in energy supply and power generation, and consequently greenhouse gas emissions are poised to rise dramatically.

India is generally supportive of efforts by industrialised countries, including the EU, to stimulate emission reductions in India, provided that these resources are not simply diverted from development aid and that the efforts themselves also assist India in making progress towards its domestic development objectives. At the same time, however, India asserts that any financial support which flows outside of the UNFCCC will not be considered as contributions towards industrialised countries' climate financing obligations. This position makes bilateral financial engagement somewhat challenging.

1.1 EU India Summit collaboration

Since 2005, the *EU-India Joint Action Plan* has formalised cooperation on climate change. Under the plan, an EU-India Energy Panel was established and has subsequently set up joint working groups on nuclear fusion/ITER, coal and clean coal technologies, and renewable energies and energy efficiency. An EU-India Science and Technology Steering Committee was also established. At the 2008 summit, recognising that more concrete activities were required, the parties agreed to a joint work programme, *EU-India Co-operation on Energy, Clean Development and Climate Change.* The initial communication of this initiative (EU-India, 2008a) lists a range of focus areas for future cooperation, though falls short of specifying concrete actions. The 2008 Summit report points to agreement between the parties to "*explore the upscaling of financing for activities to address climate change and further explore the potential for research and technology cooperation and the options for technology transfer*" (p3). In more specific terms, it also highlights agreement to "*foster cooperation on solar energy with a view to jointly developing a flagship programme in solar energy*" (p4)[1].

It is not clear what concrete actions have been implemented through the various working groups or the Joint Work Program and there is a sense that, despite progress in agreeing broad visions and principles, action on the ground is small (Luff and Runacres, 2009).

The 2009 Summit is poised delicately before UNFCCC negotiations in Copenhagen. While this presents challenges, it could also provide an occasion for both parties not only to discuss issues of future climate finance, which will be a central theme in Copenhagen, but also to identify areas of tangible collaboration. This report illuminates opportunities for such collaboration.

1.2 About this report

This report begins, in **Section 2**, by describing the sources and trends driving India's greenhouse gas emissions, outlining key sectors and technologies that offer the potential for significant emission reductions, and reviewing estimates of the investment and financing needed to put India on a sustained low-carbon path. **Section 3** describes the various Government of India policies aimed at simultaneously improving energy security, promoting development and reducing emissions. **Section 4** presents the principal international mechanisms for supporting, transferring and financing emission reduction actions and technologies – the Global Environment Facility, the Clean Development Mechanism and bilateral and multilateral funding – and the limitations of these mechanisms in recent Indian experience. Constraints identified through past experience have helped to inform proposals to reform existing, and launch new, climate finance mechanisms. These proposals, driven by the urgent need to generate finance commensurate with achieving the reductions that could avert dangerous climate change, are described in **Section 5**, along with the specific perspectives articulated by the EU and India in the context of international negotiations. **Section 6** summarises the types of barriers facing efforts to reduce emissions and possible ways in which these can be overcome. Finally, **Section 7** discusses how the different perspectives could be bridged, and offers some specific initiatives for Summit participants to consider. These initiatives, which focus on subsistence fuel use, solar energy and energy efficiency, can deliver major development benefits to India while strengthening the EU-India partnership and fostering a spirit of greater cooperation in the context of international climate negotiations.

[1] This activity does not appear specifically in the list of priorities for the *EU-India initiative on Clean Development and Climate Change* agreed at the same summit, so it is unclear how, if at all, this is being progressed.

2. Technology and investment needs for reducing emissions

Key messages

- Making substantial inroads into India's fast growing greenhouse gas emissions will require major transformations in the energy sector.
- Policy and financial support must find ways of catalysing massive deployment in renewable energy, a broad and rapid uptake of energy efficiency opportunities, and a shift to higher efficiency coal plant to lessen the impacts of the country's planned expansion in fossil-fuel based capacity. These measures also have strong local and regional environmental co-benefits, and so align well with India's development priorities.
- The non-commercial energy sector is very large in India, and is characterised by the burning of biomass. This not only has major local health impacts but the release of 'black carbon' (or soot) also has important regional climate-forcing effects. A shift to cleaner cooking fuels could bring major development and climate benefits for India.
- Estimates of the incremental investment costs associated with shifting India onto a low carbon pathway vary significantly. It is clear, however, that delivering major transformation in the energy sector could very feasibly require tens of billions of Euros annually out to 2030.

2.1 India's emissions profile and predicted growth

Between 1994 and 2005, India's greenhouse gas emissions are estimated to have risen by approximately 50%[2], placing it in the top five emitters globally in terms of annual emissions. However, per capita emissions are very much lower than those of either industrialised countries or other major developing economies. For example, in 2006 India's per capita CO_2 emissions from fuel combustion (not total emissions) were estimated at 1.13 tonnes, compared to 4.28 for China, 8.07 for EU-27, 19.0 for USA and 4.28 for the world average (IEA, 2008).

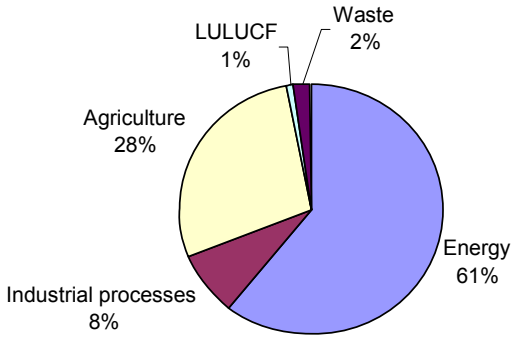
The largest bulk of India's emissions come from the energy sector. In 1994 energy accounted for about 61% of total CO_2e emissions – of which almost half came from electricity supply, 20% from industrial fuel combustion and around 11% from transport. Road transport accounted for nearly 90% transport emissions (the remaining 10% coming from rail, aviation and shipping). WRI estimates suggest that the overall contribution of the energy sector is rising (around 66% by 2005). Of the other sectors, *agriculture* accounted for 28% of total emissions in 1994 (around 22% in 2005), *industrial process* emissions contributed around 6-8%[3], *waste disposal* accounted for 2% (rising to nearly 7% in 2005), and *land use and land use change* accounted for 1% (net carbon storage in 2000). Figure 2.1 shows a sectoral breakdown of emissions for 1994.

The *emission intensity* of India's economy in 2006, estimated at 0.34 kgCO_2 per US$ GDP (at 'Purchasing Power Parity', 2000 prices), was roughly equal to the emission intensity for EU-27 (0.33 kgCO_2) and below the world average (0.49 kgCO_2)(IEA, 2008).

[2] Official data of India's GHG emissions is available only for 1994 (MoEF, 2004), when aggregate emissions amounted to around 1229 MtCO_2e. More recently, the World Resources Institute (http://cait.wri.org/) has published unofficial estimates for the years 2000 (1560 MtCO_2e) and 2005 (1860 MtCO_2e). The general spread of emissions across different sectors is reasonably consistent. Discrepancies, for example in relation to industrial process emissions, could be the product of either real changes in emissions or different data collection methodologies.

[3] Official data indicates that industrial processes contributed around 103 MtCO_2e in 1994, while WRI estimates this sector contributed just over half that amount in 2000 and around 88 MtCO_2e in 2005. Despite this discrepancy, this sector's share of total emissions is relatively consistent between both sources in the range 6-8%.

Figure 2.1 Emissions by sector, 1994 (*based on data from MOE, 2004*)



A recently published collation of five modelling exercises (MOEF, 2009) provides a range of estimates for India's future emissions trajectory. Projections of per capita emissions in 2031 range from 2.77 to 5 tCO_2, while total emissions range from 4 billion to 7 billion tCO_2. (Only one of the five exercises included methane emissions from agriculture, which is a notable omission since this sector comprised 28% of India's total emissions in 1994).

Growth in the energy sector is unquestionably the most significant driving force behind India's emissions trajectory. Projected energy demand growth in the period out to 2030 is staggering. TERI (2008) estimates per capita energy-related emissions in 2031 will be around 5 tCO_2e without major mitigation initiatives. Total commercial energy[4] consumption could increase by around 660% between 2001 and 2031, from 283 to 2150 million tonnes of oil equivalent.

2.2 Sectoral transformations and technology implications

Various studies (TERI 2008, UNFCCC 2007, McKinsey 2009) have attempted to forecast the technological changes that will be necessary if India's growing emissions are to be reigned in. Although underpinned by different assumptions, looking across these studies at a coarse level some key patterns emerge. Unsurprisingly, in the energy sector the adoption of more energy efficient technologies as well as a shift to cleaner fuels is needed. Given the massive predicted growth rates for both coal and petroleum[5], it is necessary to focus on ways of providing the same needs (power, light, heat, mobility) with a reduced level of climate impact.

Mitigation opportunities will also exist in other sectors, though to date it appears much less has been done to understand and quantify potential options in areas such as agriculture, industrial processes and waste.

2.2.1 Stationary energy

The key technologies of course vary according to the degree of mitigation ambition. In a political acceptability sense, they also depend on the level of co-benefits each generates for India in pursuing its development objectives. In the context of this report, "key technologies" are

[4] "Commercial energy" refers to energy produced and sold commercially. India is somewhat unusual for a large economy in that a significant share of energy is derived from non-commercial sources, mostly biomass and dung.

[5] TERI (2008) estimates that coal consumption could rise from 147 MtOE in 2001/02 to 1167 MtOE in 2031/32, while petroleum consumption also increases by over eight times in this period.

therefore those where mitigation objectives and domestic policy objectives are mutually served. From this starting point a few key technologies emerge:

- *Higher thermal efficiency coal plant*. Although still carbon intensive, a shift from subcritical to supercritical or more advanced plant results in highly significant efficiency gains;
- *Renewable energy*. Expanding the installed capacity of wind, solar (both PV and concentrated thermal) and biomass technologies is crucial. The scale at which renewables could be deployed relies to a great extent on their commercial competitiveness, which in turn depends heavily on the success of technology development and diffusion.
- *Energy efficiency*. Reducing baseload energy demand via improvements in energy efficiency is often cited among the least cost options for servicing future energy needs and for tackling emissions. Indian sources[6] suggest that many large energy-intensive industries in India (eg cement, steel) are already using world's best practice technology. However, significant energy efficiency gains have been identified in relation to small and medium-sized industries (SMEs), buildings and appliances, and through reducing energy losses in transmission and distribution.

From a co-benefits perspective, shifts in energy production which reduce coal consumption without reducing overall energy security can deliver significant gains in terms of reduced regional air pollution, water consumption (where plants are inland and rely on fresh water for cooling) and waste ash[7]. Per unit of energy served, the scale of environmental co-benefits is much greater where energy needs are serviced by renewables and energy efficiency. However, higher efficiency coal plant is also significant given the very large, rapid expansion of coal capacity planned by the Indian government and the long operating lives of these assets.

In each of the above cases, existing technologies are capable of making a significant difference to emissions provided they become more accessible in India, with the possible exception of the SME sector where significant local tailoring of technologies may be required.

Figure 2.2 underscores the importance of renewables. Even in the least ambitious of three mitigation scenarios modeled by TERI (2008), the installed capacity of wind, solar and biomass plant by 2031 is around 200 GW (installed capacity in December 2007 was just over 11 GW). In particular, the importance of solar energy rises dramatically as mitigation ambitions increase.

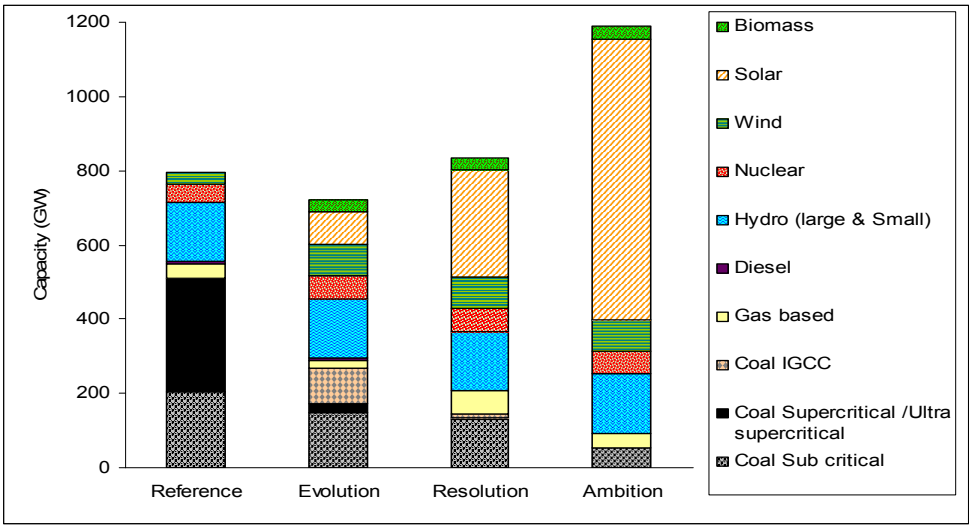
Large scale *hydro power* also has the potential to make a contribution to mitigation, though it faces challenges including defining water rights, displacement of communities, and the location of resources in geographically difficult, politically turbulent and impoverished regions, which also lack transmission infrastructure. Nonetheless, the government has already prioritised full exploitation of India's major hydro potential.

The Indian government has made *nuclear* energy expansion a priority. However, given the long lead times to finance and commission a nuclear plant, its high costs as well as the complex regulatory framework needed, it is unlikely to deliver significant emission reduction benefits in the period out to 2030. It could, however, result in GHG benefits beyond that time if it displaces the building of coal-fired plant. Given that the EU and India already collaborate on nuclear issues through the International Thermonuclear Experimental Reactor (ITER) Working Group and that boosting support for nuclear energy in India could be politically sensitive within the EU, opportunities for further near to medium-term collaboration are not considered in this report.

[6] Both the Chamber of Indian Industry (CII) and Bureau Energy Efficiency, in discussions with SEI, August 2009

[7] Coal combustion results in very large emissions of toxic air pollutants (such as NOx, Sox, toxic metals such as mercury, and fine particles), which have significant human health consequences on a local and regional scale.

Figure 2.2: Electricity generation in 2031/32 under various energy growth scenarios



Note: The per capita CO_2 emissions implied in each of these scenarios are 3.3 tonnes per capita in the "Evolution" scenario, 1.9 tonnes per capita in the "Resolution" scenario and 1.2 tonnes per capita in the "Ambition" scenario. These compare with 5 tonnes per capita in the Reference scenario. (Source: TERI, 2008)

Carbon capture and storage is unlikely to be a key technology in India in the near future. R&D, both globally and in India, may help overcome the fact that the technology itself is still in development (for power plant applications) and that there has been limited geophysical assessment of potential storage capacity in India. However, the most important obstacle in the context of this report is that CCS does not accrue any development co-benefits for India.

2.2.2 Transport

Although India's vehicle ownership levels and mobility demands are still relatively low, both are rising. It is imperative that the transport sector experiences a 'course correction' early in this growth phase, before technologies and transport choices become locked into emissions intensive patterns. Various options exist for enabling growth in mobility while tackling emissions, though it seems relatively little detailed evaluation of their probable costs and GHG emission consequences in an Indian context are available. Some key actions include *improving vehicle efficiencies* through fuel economy standards for manufacturers, *improving fuel quality* (including encouraging growth in cleaner fuels), and *mode shifting*. The latter includes not only expansion and improvement to public transport systems, but also shifting of freight transport to rail and sea modes.

2.2.3 Non-commercial energy

India's non-commercial energy sector is unusually large for a major economy[8]. As a consequence, emissions of "black carbon" have been identified as significant regional drivers of global warming. Black carbon (sometimes referred to as "soot") are small particles produced by the incomplete combustion of fossil fuels, biofuels and biomass. Evidence has emerged in recent years that black carbon from fossil fuels and biomass is second only to carbon dioxide in

[8] Sources (eg the IEA-India Joint Workshop on Energy Efficiency and Standards Labelling) suggest biomass is still the dominant source of primary energy in India, with some suggesting it provides 30-40% of total primary energy. MOE (2004) indicates that around 60% of Indian households still rely on traditional sources of energy like fuelwood, dung and crop residues for their energy needs.

contributing to climate forcing, and its effects on sensitive areas such as glaciers is even more pronounced. Black carbon resides in the atmosphere for only 1-2 weeks, whereas carbon dioxide remains for hundreds of years. Consequently, major reductions in black carbon emissions can have immediate climate benefits, both regionally and globally.

The burning of biomass is a major source of black carbon emissions, especially in India, which has the world's greatest concentration of traditional biomass users due to high population density. Traditional biomass burning also causes serious safety and health problems, including respiratory illness from indoor air pollution; it impacts women and children disproportionately, and the time spent gathering fuelwood reduces their time for education and productive activities. Worldwide, more than three billion people depend on solid fuels, including biomass (wood, dung and agricultural residues) to meet their most basic energy needs (WHO, 2006). As a consequence, exposure to indoor air pollution is responsible for 1.6 million deaths and 2.7% of the global burden of disease[9]. In India it is estimated the inhalation of indoor smoke is responsible for over 400,000 deaths annually, mostly among women and children (Smith, 2000).

Although black carbon plays a major role in driving regional warming, it is not a "greenhouse gas" and is not covered by the UNFCCC and Kyoto Protocol. Black carbon emissions are therefore not included in India's GHG inventory detailed in Section 2.1 and Appendix 1. Despite this, several studies have indicated that reducing black carbon emissions may be among the most accessible, quick and cost effective actions to mitigate climate warming over the coming decades (e.g. Hansen et al.; Jacobson, 2002; Bond and Sun, 2005). Recently, the UNEP has urged greater focus on black carbon when considering options for mitigating climate change[10]. With respect to biofuel cooking, black carbon can be drastically reduced by encouraging alternate cooking methods, particularly in rural areas.

2.3 Investment cost implications of pursuing GHG emission reductions

Cost estimates of India's incremental investment needs under different mitigation scenarios are few and varied, and heavily sensitive to assumptions about technology availability and cost. Global level studies provide coarse estimates of the magnitude of finance needed between now and 2030. UNFCCC (2007) estimates annual incremental investment needs in India in 2030 to be around US$6.2 billion. McKinsey (2009) estimate the overall incremental investment needed in India to meet its "abatement case" is roughly €13 billion annually between 2010 and 2020, and then €23 billion annually over the decade to 2030. The range of assumptions and methodological approaches used to generate these figures vary, so they are at best indicative guides to the magnitude of investment needs.

In the *power generation* sector, TERI (2008) estimated total incremental undiscounted investment costs under various mitigation scenarios out to 2031/32. These range from Rs 26 billion (€367 billion) up to Rs 392 trillion (€5.6 trillion) up until 2031[11]. The extremely high estimate for the most ambitious scenario is driven by its very high share of solar. Potential investments in the *transport* sector are also very significant. According to McKinsey, investment in "oil efficient transportation infrastructure" will require around €130 billion from 2010 to 2030.

[9] In poor developing countries, only malnutrition, unsafe sex and lack of clean water and adequate sanitation were greater health threats than indoor air pollution (WHO, 2006).

[10] http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=596&ArticleID=6299&l=en&t=long

[11] Calculated assuming €1 = Rs 70. Averaged out over a 30-year period Rs 392 trillion is roughly €190 billion annually. Annual investment needs over the period are likely to start out at a level below this and increase in later years to over €190 billion.

3. Key Indian government policies

Key messages

- Several of the National Missions under India's National Action Plan on Climate Change provide a basis for policy measures targeting renewables – especially solar energy – and energy efficiency.
- India's target of 20 GW of installed solar capacity by 2020 is highly ambitious. Success in meeting this target will require international collaboration in technology development, support for development of a local manufacturing base and innovative financial mechanisms to enhance its commerciality.
- A number of key policy interventions are planned to boost energy efficiency activity, targeting large industrial users, small and medium-sized enterprises and households.
- India has signaled a policy intent to encourage a shift to cleaner transport modes and fuels, while in the forestry sector it is pursuing an aggressive program of reforestation under the National Mission for a Green India.

In July 2007, Prime Minister Manmohan Singh publicly committed to ensuring that "*India's per capita emissions never exceed the per capita emissions of the industrialized countries*" (GOI 2008). While an important statement of intent, without a legal basis either domestically or internationally to motivate compliance it is at this stage largely symbolic.

India's strategy for tackling climate change while pursuing development is set out in its *National Action Plan on Climate Change* (NAPCC), released in 2008. It includes a target to reduce the *emissions intensity* of India's economy (per unit of GDP) by 20% between 2007/08 and 2016/17, also articulated in the Eleventh Five Year Plan (2007-2012). The NAPCC has eight National Missions at its core:

- National Solar Mission
- National Mission on Enhanced Energy Efficiency
- National Mission on Sustainable Habitat
- National Water Mission
- National Mission for Sustaining the Himalayan Eco-system
- National Mission for a Green India
- National Mission for Sustainable Agriculture
- National Mission on Strategic Knowledge for Climate Change

Detailed work plans for each are in development and are expected to emerge publicly in the coming months. Through the NAPCC and various other policies (such as the Integrated Energy Policy, Urban Transportation Policy, Five Year Plans), the Indian government has articulated policy priorities, and in some cases introduced specific measures and programs, that if successfully implemented will provide support for some of the key sectors and technologies identified in Section 2 to reduce emissions below a 'business as usual' trajectory.

3.1 Stationary energy

In addition to the NAPCC, the *Integrated Energy Policy* (2005) contains a number of broad priorities and goals with respect to the key sectors and technologies identified in Section 2.

3.1.1 Energy supply

On the supply side, there are a range of important policy measures tackling the efficiency of coal-fired plant as well as renewable energy technologies.

Higher efficiency coal plant

Efforts are being made to increase the uptake of higher efficiency coal plant during the development of new capacity. Discussions between SEI and representatives of the Indian government suggest that India is taking steps to increase the availability of supercritical technology within the country by pooling demand to lower costs, however domestic manufacturing capacity is still constrained by intellectual property rights issues.

A program is underway to renovate existing power plants to improve their efficiency, under the Five Year Plans. Since 1983/84, there has been over 10% reduction in the heat rate (kilocalories of fuel used per unit of electricity produced) of thermal power plants in the country. The Global Environment Facility has contributed $45m to this program.

Renewables

By December 2007, the gross installed capacity of grid interactive renewables power in India was 11,273 MW. A large chunk of this is wind power (7,844 MW), making India 5th in the world in terms of installed wind capacity (MNRE, 2008). Much of this development has been stimulated by domestic tax incentives, and to a lesser extent revenue from the Clean Development Mechanism.

India overachieved by more than 100% the target in its 10th Five Year Plan (2002-07) for the installation of grid-interactive renewable power capacity, installing 6,711 MW of new capacity against a target of 3,075 MW. This was driven largely by the wind power[12]. The target for the Eleventh Five Year Plan (2007-2012) is to install 15,000 MW of renewable power (more than two-thirds being wind power) and the government budget allocation for it is Rs 105 billion (roughly €1.5 billion) (GOI 2008). Aside from direct budgetary support, India's main renewable energy financing agency (IREDA) is also likely to issue bonds to raise capital to the tune of Rs 3-4 billion (roughly €40-60 million) annually to finance renewable energy programmes (GOI 2008). These will be used to introduce feed-in laws or differential tariffs for grid-interactive power, thus leading to the phasing out of capital subsidies (which reward installed capacity) in favour of energy output. (Note however that the National Solar target is framed in installed capacity terms, not energy output)(GOI 2008).

Solar power has emerged as a strong focus for the Indian government. The *National Solar Mission* aims to promote the development and use of solar energy for power generation and other uses, with the ultimate objective of making solar competitive with fossil-based energy options. Its objectives include the establishment of a solar research centre, increased international collaboration on technology development, strengthening of domestic manufacturing capacity, and increased government funding and international support. Importantly, it also contains a target to install 20,000 MW of solar generation capacity by 2020, 100,000 MW by 2030 and 200,000 MW by 2050.

In addition, the Ministry of New and Renewable Energy's *Integrated Rural Energy Programme* (IREP) aims to provide for minimum domestic energy needs for cooking, heating and lighting purposes to rural people in selected village cluster, with a focus on renewable energy.

[12] See table 10.30 in GOI 2008b for a break-up of the targets vs achieved capacity in the Tenth Plan by renewable source.

On hydro power, the Integrated Energy Policy contains an explicit prioritisation of India exploiting its full large scale hydro potential. Nuclear energy is also a particular focus for India, with the 11th Five Year Plan and the NAPCC both mentioning nuclear as an important element. The Integrated Energy Policy prioritises providing containing support to the three stage development of India's nuclear potential, echoed in the NAPCC.

3.1.2 Energy demand

The *National Mission on Enhanced Energy Efficiency* is the key focus for future government action on energy efficiency. The government recently approved the detailed implementation plan for this mission, which is due for release imminently. The Bureau of Energy Efficiency (BEE) have indicated that the plan is largely consistent with the previously released Approach Paper (BEE, 2009)[13]. Four key initiatives emerge for future prioritisation:

- Introducing an energy saving certificate trading scheme to maximise the economic efficiency by which large energy intensive energy users will meet future mandatory efficiency requirements.
- Providing partial risk guarantees to financial institutions for commercial lending to energy service companies (ESCOs).
- Fostering market transformation in appliances, using the carbon market (programmatic CDM) as a financing vehicle. An initial target area is compact fluorescent light bulbs. If programmatic CDM proves successful, several other examples may be pursued (eg buildings, agricultural pumps).
- Introducing fiscal signals, namely a peak electricity price for industrial and commercial users, as a way of stimulating demand management initiatives.

The National Mission is not the first effort by the government to tackle energy efficiency. The *Energy Conservation Act (2001)* empowers the government to, inter alia, prescribe and ensure compliance with standards and norms for energy consumers, prescribe energy conservation building codes, and energy audits. There are a range of existing programmes under the BEE in key sectors of energy demand.

Large energy users

Energy efficiency manuals are in development for 15 energy-intensive industrial sectors: aluminium, fertilizers, iron & steel, cement, pulp & paper, chlor alkali, sugar, textiles, chemicals, railways, port services, transport sector (industries and services), petrochemicals & petroleum refineries, thermal power stations & hydro power stations, and power transmission and distribution.

Buildings and appliances

A standards and labelling programme for manufacturers of electrical appliances was launched in May 2006. Though the programme is voluntary in its current initial stage, the intention is for it to eventually become mandatory.

The Energy Conservation Building Code (ECBC), launched in May 2007, sets energy efficiency standards for commercial buildings, prescribing minimum standards for the external wall, roof, glass structures, lighting, heating, ventilation and air-conditioning in each of the five climatic zones in the country. An R&D programme will support ECBC by developing energy efficient windows, low cost insulation material, etc, and through simulation models to predict energy consumption. The goal is to reduce energy consumption in commercial buildings by 25-40%.

[13] During discussions with SEI, 2009

BEE has an R&D programme to develop (a) energy efficient ceiling fans, very low energy consuming circuits for stand-by power in offices and households, and to promote LED based lighting devices. The programme is intended to enhance demand side energy management by upgrading technology.

The *Energy Conservation Act (2001)* requires major commercial consumers to conduct and report on energy audits (verification, monitoring and analysis of energy use; technical reports and cost-benefit analysis; and action plans to reduce consumption), to be undertaken by accredited Energy Auditors. Accreditation of Energy Auditors and consultants is conducted by BEE.

The Bachat Lamp Yojana provides energy saving Compact Fluorescent Lamps (CFL) to domestic households at the price of standard bulbs. The aim is to replace 400 million light points, and there is an ambition that the price difference will be recovered through revenue from the Clean Development Mechanism.

Reducing losses in transmission and distribution

The Integrated Energy Policy has a focus on controlling the aggregate technical and commercial losses of the state transmission and distribution utilities.

The 11th Five Year Plan Approach Paper proposed restructuring the Accelerated Power Development and Reform Programme (APDRP) to bring down transmission and distribution losses, using technological tools such as smart metering and GIS mapping for real time monitoring and accountability at each distribution transformer. The 11th Five Year Plan aims to reduce losses to 15% or less by 2012.

3.2 Transport

India's *Auto Fuel Policy* (2003) includes a road map for reducing the emission norms for new vehicles. It encourages the use of CNG/LNG in cities affected by high motor vehicle pollution, and envisages the accelerated development of alternate technologies like battery and fuel cell-powered vehicles as well as a programme for research and development support.

The government's *Integrated Transport Policy* (2001) promotes the use of ethanol-blended petrol and bio-diesel. Further, clean fuels like CNG (compressed natural gas) and LPG (liquefied petroleum gas) have also been introduced in some cities, with efforts to expand their network to other cities. In 2004 the government mandated 5% blending of petrol with ethanol, subject to certain conditions.

The Planning Commission's *National Mission on Bio-Diesel* is to be undertaken in two phases. The first (demonstration phase), under which a large area of land in 26 states will be brought under Jatropha plantations, was to be implemented by 2006/07. The second phase will consist of a self-sustaining expansion of the programme leading to the production of bio-diesel necessary for 20% blend in the year 2011/12. The total fund requirement for the mission is Rs 1,500 crore.

The *National Mission on Sustainable Habitat* suggests a future focus on strengthening the enforcement of vehicle fuel economy standards, and using pricing measures to encourage the purchase of efficient vehicles and incentives for the use of public transportation.

The *National Urban Transport Policy* emphasizes the development and usage of extensive public transport facilities (including non-motorized modes) over personal vehicles. A Working Group on Urban Transport including Mass Rapid Transport Systems for Eleventh Five Year Plan (2007-2012) is set up to estimate future urban transport needs.

3.3 Forest carbon stocks

The *National Forestry Action Programme*, adopted in 1999, laid down a 20-year programme to arrest deforestation and extend forest/ tree cover to 108 million hectares, i.e. 33% of India's total area. Since 2002 all government afforestation schemes were brought under a single *National Afforestation Programme*, being implemented through decentralized Forest Development Agencies (FDA) set up at the forest division level. The Working Group on Forests under the 11th Five Year Plan (2007-2012) proposes expansion of forest and tree cover by 1% annually during the plan period. Side by side with afforestation of new areas, increasing the tree density of open forests (10-40 % crown density) and moderately dense forests (40-70 % crown cover) is being undertaken on a priority basis.

The *National Mission for a Green* India targets afforestation of 6 million hectares of degraded forest lands and the expansion of overall forest cover from 23 to 33% of India's territory by 2012 (GOI, 2008).

4. Experience with international mechanisms for mitigation financing and technology transfer in India

Key messages

- The UNFCCC's financial mechanisms for supporting GHG reductions (CDM and GEF) have had mixed success in achieving both EU and Indian objectives. The level of finance made available to India through these mechanisms is entirely inadequate to catalyse major transformations in the energy sector.
- Experience points to the need for changes to existing mechanisms and/or the creation of new ones, in order to increase the scale of financing, the range of activities reached and to foster greater technology transfer.
- Traditional bilateral and multilateral development funding (including ODA) has played a complementary role in supporting GHG reductions, where it invests in activities such as renewable energy and energy efficiency projects. There is scope for ODA to continue to play such a role.

4.1 UNFCCC mechanisms

The principal mechanisms available to India for financing climate change mitigation activities and technology transfer under the UNFCCC are the CDM and the GEF[14]. Relative to other developing countries, India has benefited significantly from both the mechanisms. Although it is not always clear whether these mechanisms have been the prime driver of the various projects supported, the two mechanisms have nonetheless played a complementary role: CDM finance has generally flowed to renewable energy and industrial energy efficiency projects, while GEF finance has also supported early stage technology development as well as efficiency improvements in small-scale industries that are not easily captured by the carbon market.

4.1.1 Clean Development Mechanism (CDM)

CDM finance provides an additional revenue stream for eligible projects, and in doing so can catalyse emission reduction activities in India. It does not offset Indian emissions, however, since the credits generated by these activities are used by Annex I parties to meet their own emission reduction obligations.

From the EU's perspective, the CDM is intended to be [among other things] a mechanism for lowering compliance costs with its emission obligations. By comparison, India's objectives for CDM are as a vehicle for fostering technology transfer and as a supplementary finance stream for projects and policies that are of domestic importance for non-climate reasons, particularly energy security and sustainable development. The effectiveness of CDM therefore needs to be seen within the context of both sets of objectives.

India was one of the early movers into the CDM market with its first registered project coming within a month of the Kyoto Protocol being ratified. In the last four years approximately one quarter of the almost 1700 projects registered worldwide have occurred in India, accounting for 21% of Certified Emission Reductions (CERs) issued worldwide.

[14] Other mechanisms under the Convention include the Special Climate Change Fund (SCCF) and the Adaptation Fund. The SCCF also funds technology transfer activities under its Programme for Transfer of Technology but has seen very limited activity to date. Of the $74 million received by March 2008, $14 million was allocated to technology transfer globally.

The majority of Indian CDM projects are renewable energy and energy efficiency activities, which is a good alignment with some key sectors and technologies identified in Section 2. Biomass, wind and hydro have all been supported, while energy efficiency projects have been primarily within industrial facilities. CDM has also played a role in promoting industrial co-generation, especially in sugar industries. Out of 1179 Indian projects at various stages in the CDM pipeline, 299 are from biomass, 312 from wind, 292 from energy efficiency and 127 from hydro (CD4CDM, Sep, 2009).

The Indian government has not intervened in the CDM market to either set a floor price for CERs or to make bilateral arrangement compulsory (as China has). CDM in India exhibits a number of characteristics:

- Most projects tend to be unilateral in nature. Only 4 of the 54 projects registered in India during the first six months of 2009 were bilateral, compared to 19 of 82 in 2008. This trend suggests that although the Indian CDM market is witnessing a revival from the slump witnessed in 2008, the participation of developed countries at the project development stage is diminishing.
- There is a lack of large-scale projects. Smaller project sizes are a concern for maintaining market attractiveness as the transaction costs tend to be higher in comparison to project revenue. Also, within the CDM generally larger projects have tended to involve a higher degree of technology transfer (Seres & Haites, 2008), whereas the technology transfer rate for India has been low (16% of projects vs 36% across the CDM).
- On the market side, European buyers, particularly private sector parties, are the dominant CER purchasers in India. However, many Indian sellers are still holding onto their CERs, which they are able to do as they have not entered into an upfront financing model and do not need to deliver CERs to any partner. This has made the market a tough place for buyers, who have to shell out a number of offers before sealing the final deal.

Programmatic CDM has so far not lived up to expectations. At present, two projects from India feature at the validation stage in the programmatic CDM pipeline (CD4CDM, Sep, 2009). One of these projects has been initiated by a government body, to support a transition from incandescent to CFL bulbs in households. It is possible that a successful example of programmatic CDM will pave the way for more such interventions. It could, for example, provide a boost to the National Solar Mission as well as other off-grid options, especially in rural India. The Bureau of Energy Efficiency suggest, for instance, that programmatic CDM could be used to systematically upgrade agricultural pumps[15].

India's critique of CDM

India is generally positive of the CDM concept, though is somewhat critical of its application so far. CDM has generated an additional revenue stream for some private companies, and has also generated interest and awareness about climate change in different strata of Indian society. Industry, in general, is upbeat about CDM and has taken measures to ensure that projects that earn them carbon credits are made known to the public.

However, several common criticisms prevail:

- It is not proving effective as a vehicle for significant technology transfer;
- It has not been very successful in reaching projects that are innovative and not commonplace (a phenomenon not unique to India but globally);

[15] Ajay Mathur, Bureau of Energy Efficiency, in discussion with SEI, August 2009.

- The huge inflow of projects has created extensive delays in the registration process (a growing pipeline). This particularly has implications for projects that are dependent on carbon revenue, especially those requiring an up-front cash flow, which is typical of community-driven projects;
- It is not structured to value non-GHG benefits associated with individual projects. As a result, India is not seeing significant co-benefits in the projects developed to date;
- SMEs have not been able to get the benefit of CDM because the transaction costs are too high to justify the typically small projects that SMEs may undertake; and
- Implementation of programmatic CDM is still difficult and parties involved are not yet assured about its delivery. CER buyers avoid providing upfront financing for such initiatives because of high delivery risk, and large consultants are not interested in programmatic initiatives as they see an opportunity to earn more money in other CDM projects.

4.1.2 Global Environment Facility (GEF)

GEF funds for climate mitigation are delivered in the form of grants. Since 1991, the EU has committed an amount of almost US $86 million annually towards climate change activities through GEF, totalling approximately $2.5 billion in total. Of this, India has accessed $244 million (for 38 separate projects) and leveraged a little over $1.4 billion in co-financing[16].

GEF funds have been used to finance technology demonstration and commercialisation in a wide range of sectors in India. More than half of GEF climate change financing to India has been allocated to four projects, that – like CDM – aligns relatively well with the key sectors identified in Section 2:

- Promoting and commercializing wind and solar PV technologies ($41 million, through two projects). These projects have been partially credited with creating a domestic manufacturing base for these technologies, although its contribution to domestic transformation has been limited (40% of solar PV output is exported) (GEF 2004). The provision of concessional financing through Indian Renewable Energy Development Agency (IREDA) using GEF grants, coupled with domestic drivers such as depreciation benefits and feed-in tariffs, as well as international carbon financing, have catalysed significant private investment in wind energy.
- Improving the efficiency of old coal-fired power plants through renovation and modernization (R&M) ($45 million). GEF has also funded efficiency improvements in industries such as brick manufacturing and tea processing; and
- Removal of institutional, policy, and financial barriers to enable shifts to more energy efficient modes of urban transport ($23 million).

Before the carbon market developed, GEF's early activities in India focused mainly on renewable energy. With more recent projects covering energy efficiency and the transportation sector, GEF has addressed some sectoral gaps not reached by the international carbon market or domestic measures, though the level of GEF funding has been inadequate to catalyse major transformation.

Although past delays between GEF's third and fourth replenishment have led to the loss of co-financing, recent changes in 2006 to a system of country-based resource allocations, where the

[16] The figures and descriptions of projects presented in this section are drawn from Pande 2009 and GEF's projects database available at www.gefonline.org

indicative level of funding available is known at the outset, has enabled greater leveraging of upfront co-financing (Pande 2009). This is evident from the fact that $70 million of the $76 million allocated for climate change in India under GEF's fourth replenishment which runs until 2010 has already been accessed and has leveraged over $570 million in co-financing.

India's criticisms of the GEF funding include that the amount dedicated to climate change is inadequate, that projects supported by GEF are small in both number and size, that the approval process is cumbersome and time consuming, and that projects are not demand driven but instead defined heavily by GEF's own mandate.

4.2 Finance from bilateral and multilateral institutions

Bilateral and multilateral finance institutions (BFIs and MFIs) have traditionally been a vehicle for delivering overseas development assistance (ODA). Recently these institutions are developing an increasing focus on climate change, either in addition to or as a co-benefit of existing finance. In some areas traditional development aid has been able to deliver GHG co-benefits, for instance where it has been used to support projects in the clean energy, energy efficiency, urban infrastructure and forestry sectors. ODA is typically delivered in the form of loans (often 'soft' loans), with some grant finance also available. It is important to be aware that discussing development aid as a vehicle for delivering climate change outcomes is a point of sensitivity for India (and other developing countries), who are anxious to ensure that ODA commitments are not shifted to fund climate initiatives.

Nonetheless, it is still useful to understand that development finance can, and in some cases does, generate co-benefits for the climate. BFIs and MFIs have, for instance, funded the development of knowledge products for both policy and new technologies, built domestic capacity for monitoring and reporting GHG emissions, as well as provided finance to enable participation in the CDM (for example, support for project preparation work, pre-feasibility and feasibility studies) and pilot demonstration projects[17]. Most of these are activities which are not reached by carbon market mechanisms. However, not all ODA finance complements climate change objectives. In the energy sector, much greater support is provided for fossil fuel projects than for clean energy[18].

India does foresee a role for the bilateral and multilateral development agencies in financing the base costs (non-incremental component) of economic and social development, through a range of financial instruments including traditional equity and loan investments, concessional loans, loan guarantees, and a range of funds for acquisition, development, deployment and diffusion of technologies. However, where these flows are accounted for as ODA they are not considered as "new and additional" climate finance.

4.3 A comparative assessment of the mechanisms

The different sources of finance flowing to India that result in reduced GHG emissions are often intertwined, not only with multiple sources of international public and carbon financing but also domestic public finance. Roughly $1.4 billion is estimated to have flowed to climate change mitigation activities in India through international climate financing mechanisms and

[17] Conclusion based on an inventory of projects funded by EU and its member countries prepared by diplomatic staff in Delhi, and on the note in Annex 5, Table A5:3 of the World Bank's draft consultation paper on *Development and Climate Change A Strategic Framework for the World Bank* available at: http://go.worldbank.org/WWT4W1LH60

[18] Of total international public finance (including GEF) between 1997 to 2005, only 20% ($1.8 billion per year) was directed towards energy efficiency ($0.4 billion/year) and renewable energy ($1.4 billion per year). The remaining 80% went largely towards conventional energy projects and infrastructure. GEF is the exception with 100% of the funds going to renewable energy or energy efficiency projects (Lazarus and Polycarp 2009, using data from Tirpak and Adams 2008).

development aid over the period 1997-2005[19]. While roughly $540 million has flowed directly through the UNFCCC mechanisms (CDM and GEF), the remaining $900 million has come from bilateral and multilateral aid agencies through their funding of renewable energy and energy efficiency activities as part of their ODA obligations (see Appendix 2).

The funds flowing through these mechanisms have been able to leverage co-financing much higher than the funds provided through the mechanisms themselves. In the case of GEF, it is roughly 7 times GEF financing (Pande, 2009). A main source of co-financing is the government (both national and state) either directly through budgetary support or indirectly through publicly-owned utilities and financing agencies. ODA has also been a major source of co-financing for some GEF-sponsored projects and is also likely to have supported some CDM projects. The private sector has also been a major source of co-finance especially for CDM projects.

CDM in India has not captured many projects with high capital costs and long gestation periods that could result in significant long-term emission reductions, partly because there is uncertainty about the long-term carbon market and the fungibility of Indian CERs post-2012. While ODA has played a role in financing large-scale, long-term infrastructure projects – for instance in the energy and transportation sectors – it has not consistently considered the potential for GHG reductions as an explicit part of project design and so may have missed out on opportunities to enhance the GHG co-benefits of this finance stream[20]. Where the net costs of more carbon-friendly alternatives of such development-oriented projects are higher, GEF could have provided gap financing but it has not done so in India as yet with the notable exception of the renovation and modernisation of old coal-fired plants[21]. A possible reason for this could be that the scale of incremental investment needed for such projects are much higher than the GEF budget permits.

GEF has been able to support technologies that are in the early stages of their development through demonstration and commercialisation projects. CDM and ODA has typically been directed towards technologies that are already commercially viable. In the case of ODA it has been used to support projects that face difficulties accessing private finance because they are perceived to be somewhat risky to the private sector. Some technologies, such as wind, have benefited significantly from CDM revenues, although domestic fiscal incentives appear to be the prime drivers of its high uptake in India.

The governance systems of the international financing mechanisms are still far from perfect. Both CDM and GEF are ridden with administrative and procedural hurdles that make the clearance process lengthy and cumbersome, while the project-by-project approach certainly cannot deliver the scope of activities envisaged to tackle climate change. Supporting mechanisms that go beyond this approach therefore need to be developed. Some such approaches are discussed in Section 5.

[19] While GEF funding has been available longer (since 1991), and the CDM estimates relate to credits sold past 2005, these estimates serve as useful approximations of the funds that have flowed to India over the 1997-2005 period.

[20] Based on SEI discussions with various BFIs regarding climate financing, 2009.

[21] See http://www.gefonline.org/projectDetailsSQL.cfm?projID=2946 for details on this project.

5. Proposals for new and amended finance mechanisms

Key messages

- India expresses a strong desire that finance mechanisms – both fund-based and carbon market mechanisms – should shift from a project-based approach to a programmatic approach, where possible, and that targeting of mitigation actions be demand-driven from developing countries.
- The EU's exploration of various sectoral approaches would seem to represent both a shift away from project-based financing and also enable a more demand-driven approach to funding, however India has so far not been supportive of sectoral mechanisms. This could derive from a fear that once sectoral mechanisms and baselines are introduced internationally they will be used to impose mandatory emission reduction obligations on India and other developing countries.
- Multilateral and bilateral finance institutions have established several different streams of finance that can support emission reductions in India. Whereas carbon finance funds are able to stimulate the CDM market, other forms of finance can support projects that are not well reached by the carbon market, and can complement traditional ODA activities.

Given the scale of finance that will be needed in India and globally to significantly reduce greenhouse gas emissions, current financial mechanisms are clearly inadequate to provide the necessary resources. This points to the need for new finance that can augment existing flows, and will require both enhanced mechanisms as well as very deep emission reduction targets among industrialised countries to increase carbon markets.

Several initiatives are currently underway that could substantially change the international climate investment landscape, globally and with respect to India. Most prominent are the international negotiations for post-2012 agreement under the UNFCCC and the associated proposals for new and expanded climate funds and market mechanisms. In addition, several bilateral and multilateral initiatives have been recently launched that could complement or serve as laboratories for mechanisms created under the UNFCCC.

This section describes these proposals, touching on EU and India perspectives, and then discusses their potential implications in India's economic context.

5.1 Broad perspectives of EU and India on future financial mechanisms

The European Commission has developed a working document supporting a comprehensive climate agreement in Copenhagen (EC, 2009). In regards to developing countries, structural provisions for financing "low carbon development" through both public funds and carbon crediting mechanisms are outlined.

A key EU focus for future climate financing is to build a liquid carbon market with broad sectoral coverage in order to maximise the cost-effectiveness of GHG emission reductions. Tying this to deep emission cuts will then create a robust carbon price signal, necessary to drive major investments in clean technology. To achieve this:

- The current Kyoto mechanisms need to be improved to enhance their cost-effectiveness while maintaining and strengthening environmental integrity;
- Participation in existing mechanisms should be enhanced; and
- New carbon market mechanisms should be introduced.

The proposals from EU focus strongly on introducing a sectoral approach, focusing on economic sectors that have high emissions from large point sources, high mitigation potential and sufficient data available to support crediting.

India's focus with respect to future financial mechanisms for climate is primarily on establishing a framework of "new, additional, adequate and predictable" grant-based finance channelled through the UNFCCC, in support of existing commitments under Article 4.3 of the Convention. A secondary objective, though also important, is to strengthen the ability of various carbon market mechanisms such as CDM (which are linked to the mitigation obligations of industrialised countries) to provide financial flows to India and to enhance the ability of these flows to foster both development co-benefits and technology transfer.

Besides carbon market mechanisms, numerous fund-based mechanisms have been suggested. The fault lines in these proposals lie in their governance. While many developing countries have proposed multilateral funds guided and governed by the UNFCCC (e.g. the Green Fund, Technology Fund, expanding the UNFCCC funds), others have proposed building on existing bilateral and multilateral funding structures (such as the multilateral, regional and bilateral development banks and aid agencies). A third option is a hybrid, where the fund is guided by the UNFCCC, but governed by trustees outside the convention.

An important feature in India's position on climate finance is a clear distinction between funds provided through the UNFCCC and those outside the Convention, including flows through carbon market mechanisms. India argues that whereas the former will contribute to the fulfilment of financing commitments by developed countries, the latter should not.

In India, as in other developing countries (for example, the G77 + China proposal), there is a strong desire that finance mechanisms – both fund-based and carbon market mechanisms – should shift from a project-based approach to a programmatic approach, where possible. They also argue that mitigation actions should be demand-driven from developing countries.

Within this context, the remainder of this section focuses on specific proposals that have been brought forward that can generate finance for mitigation.

5.2 Reforming CDM

Both the EU and India agree that reform is needed of the CDM, though the parties are not in complete agreeance of how this should be done. Generally, proposals for a reformed CDM are motivated by the need for a greater convergence of purpose as far as the mechanism is concerned between Annex I and non-Annex I countries:

- To *improve environmental integrity*, the use of standardised, multi-project baselines, performance-based additionality tests, positive or negative lists for project eligibility, and/or multiplication factors to increase or decrease CERs issued for specific project activities have all been proposed. The process of coming up with project eligibility lists and multipliers will, however, be highly politicised and prone to stakeholder interests, and there are concerns about complicating the existing system which is already quite complicated.
- To *lower transaction costs*, defining standardised baselines and using performance-based additionality tests could eliminate the need for project-by-project additionality assessment, and could also increase investor certainty (Maosheng 2008).
- To address *concerns about the concentration of CDM activity in relatively few developing countries* (including India), proposals include giving preferential treatment in project eligibility to groups of developing countries (such as LDC and SIDS) that so far have developed few CDM projects. For obvious reasons this proposal is not supported in India.

- To *prioritise CDM projects that have greater co-benefits* (for example, poverty alleviation, technology transfer, local and regional environmental improvements), a "fast track" CDM approach for projects with high co-benefits could be explored. This would not be straightforward, however, not least because defining and quantifying co-benefits may not be easy.
- To *expand the scope of mitigation actions* which CDM can support, there are proposals to include more project types currently not eligible under CDM. Some LULUCF and REDD activities, carbon capture and storage (CCS) and nuclear projects have been proposed for inclusion under CDM. The emission reduction potential of these activities may be high, but concerns over leakage and wrong incentives in the case of CCS, safety in the case of nuclear activities, and permanence in the case of LULUCF and REDD activities have prevented their inclusion. Furthermore, for some of these activities sustainability criteria would be hard to meet.
- Also to *expand the scale of mitigation* by extending the reach of CDM to different sectors and even into incentivising government policy action that could bring about transformative changes in key sectors, proposals abound for moving from project-based to programmatic, sectoral and policy-based crediting approaches (discussed below).
- To *reach mitigation opportunities in SMEs*, proposals have focused on establishing some form of preferential access to the CDM market, for example by a simplified procedure for small-scale projects.

Recognising that the current project- or activity-based approach of CDM may not be amenable to capturing emission reductions in sectors that comprise of numerous small units or incentivising government policy action on GHG mitigation, new programmatic, sectoral and policy-based crediting approaches have been put forth.

Programmatic approaches are already being experimented with under CDM. Such an approach can reduce transaction costs, and some argue that it could provide a testing ground for policy-based approaches (Leguet and Elabed, 2008). Assessing the additionality of government policies may be even more difficult than in the case of projects or programs as governments are motivated by numerous political and strategic reasons. Such approaches may also diminish the role of the private sector if governments retain the economic benefits of emission reductions. However, till now Programmatic CDM has not met its potential and has been a non-starter (Capoor and Ambrosi, 2009).

Other possibilities are to base financing on sectoral approaches, on mechanisms built around Nationally Appropriate Mitigation Actions (NAMAs), and/or on Retirement-CER Obligations (Müller and Ghosh, 2008). Sectoral possibilities are discussed below, since these may not necessarily be linked to the CDM framework.

5.3 Sectoral approaches

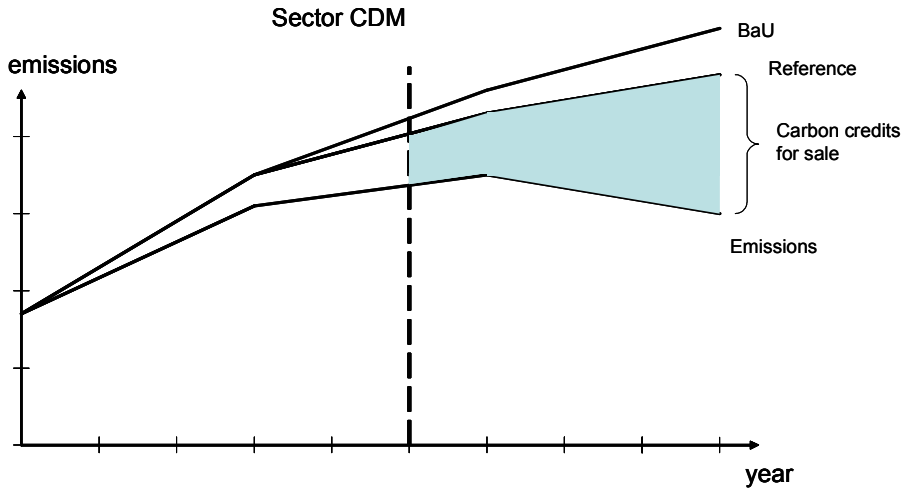
Sectoral approaches are being explored not least as a way of overcoming problems proving project additionality (within the existing CDM), of catalysing larger scale emission reductions and of incentivising domestic *policy* measures in key emission source sectors. A number of variations of a new sectoral crediting approach have been floated.

- Sector CDM – Shifting the existing CDM baseline approach from the project to the sectoral level, aggregate emission reductions in a specific sector within a country are credited against a sectoral reference level for emissions which is negotiated with the host country. If emissions are reduced below the reference level, the avoided emissions render off-sets that can be sold on the international market.

- Sector no-lose targets (SNLTs) – Very similar to Sector CDM, except that SNLTs need not be structurally attached to the CDM, so could be a mechanism for directing finance outside the carbon market. SNLTs are implemented voluntarily by developing countries, and there is no sanction if the target is not achieved, hence the term "no-lose".
- Sectoral Emission Trading – The sectoral reference level becomes a negotiated "compliance level" which defines the available volumes of emission allowances. An advantage of participating in emission trading over voluntary sectoral crediting mechanisms is that tradable units can be allocated ex-ante on the basis of a target applied to a sector. A sectoral emission trading system can be linked to other international emission trading systems, such as the EU ETS.

With each of these approaches, the EU suggests that the sectoral reference level should be set sufficiently below business-as usual emission projections, should reflect national circumstances and should become more ambitious over time (see Figure 5.1). Sectoral baselines could be based on absolute emissions, or alternatively be intensity-based.

Figure 5.1. Baseline setting under a Sector CDM or Sector No Lose mechanism



Compared to project-based CDM, sectoral crediting mechanisms with ambitious baselines or no-lose targets could:

- significantly scale up the finance for mitigation action;
- significantly strengthen developing countries engagement in systematic mitigation action;
- address concerns about additionality where an ambitious sectoral reference level is agreed upon; and
- reduce potential leakage of emissions between countries, by capturing all sectoral emissions regardless of their location.

The issue of sectoral approaches is not an area where the EU and India have been in agreement to date. The EU sees sectoral approaches as holding potential for large GHG mitigation that far outpaces the current project-based mechanism, thereby increasing both the scale of mitigation activity achieved by CDM finance and financial flows to developing countries through the CDM. It also sees such an approach as reducing competitive distortion between

countries, since sectoral agreements would be directed towards sectors that are exposed to international competition[22] (as well as where carbon-related costs are a significant part of the total costs, such as power production).

India is less positive. It suggests that sectoral approaches may not overcome some of the problems identified with the existing CDM, namely the lack of participation of developed country parties in projects (hence low technology transfer), and an inability to motivate action by small entities. India also claims such an approach would be impractical in an Indian context. Sectoral crediting demands a small number of large coordinated emitters with homogenous products, such as power production, aluminium, or international aviation and shipping. The number of industrial units in India is huge and plants vary widely in both size and age. Lack of data from such installations is also a significantly constraining factor. With both sectoral and NAMA crediting, the issue of baseline determination is problematic. At a more fundamental level, it is possible that India fears the introduction of sectoral mechanisms might be used in the future to force developing countries into mandatory emission reduction obligations.

India is essentially intending to apply a form of sectoral mechanism domestically to stimulate energy efficiency activities, through the introduction of an energy efficiency certificate scheme for large energy users (see Section 3). However, India sees this domestic policy approach as being a different issue to one which may imply international commitments.

5.4 Dedicated climate funds

Developing countries including India have a strong interest in the establishment of dedicated climate funds that will be funded by industrialised countries and be used to pay for mitigation and adaptation in developing countries. The focus here is not on 'carbon finance' funds which are used to purchase emission reduction credits (CERs) through the CDDM, but on finance streams that can support emission reduction projects that are not part of the carbon market (in other words, emission reductions that are above and beyond the obligations of Annex I countries).

In reality, climate-related finance could come in various forms – either as dedicated funds under the UNFCCC, as multilateral or bilateral funds outside the UNFCCC (for instance, through the various development banks) and via private sector climate funds. Depending on the structure and source of finance underpinning such funds, these could leverage larger private finance flows and can be employed in a variety of instruments, including pure grants, interest reduction, publicly supported loan facilities and venture capital funds.

5.4.1 Funds under the UNFCCC

A central issue within the UNFCCC is to increase the scale of existing mechanisms to tackle required mitigation efforts. This could include increasing the funding of the GEF, the SCCF and the LDCF.

The establishment of a *World Climate Change Fund (Green Fund)* has been proposed by Mexico, with a revenue of at least US$10 billion raised by contributions from all countries determined according to emissions, population and GDP indices. The revenue, to be used for mitigation, adaptation and clean technology development, would be open to all countries, with the expectation that industrialised countries would be net contributors and developing countries

[22] In SEI discussions with Indian parties, the latter raised the argument that if sectoral approaches end up preventing a relocation of industry to developing countries this is in fact *increasing* competitive distortion. Therefore, regardless of whether this argument is merited, framing a discussion of sectoral approaches in terms of reducing competitive distortion may not be the most productive way to progress discussions on this topic.

net beneficiaries. Alternative proposals based on defined financial contributions from industrialised countries, with a disbursement of funds aimed at specific targets or regions, include the *Convention Adaptation Fund, Technology Fund and Insurance Mechanism* (focused on small island developing states, SIDS) and the *Multilateral Technology Acquisition Fund* proposed by China.

A short-term solution for aiding the poorest countries facing challenges of climate change could be the proposed *Global Climate Financing Mechanism* (GCFM). Although conceived as a mechanism for financing adaptation, consideration could be given to expanding its scale and including mitigation. The GCFM would raise funds on the capital market through the issuance of "climate" bonds, and the finance raised could be spent on near-term priority climate-related investments in developing countries[23]. Repayment of the bonds to investors over a long-term period (20 years) would be met using legally binding commitments from supporting industrialised countries. The GCFM is therefore essentially a mechanism for front-end loading of future public finance – it does not increase the quantum of finance available per se, but rather makes it available earlier for spending. Its value then is in being able to bring forward action on climate change. It has been seen so far as a interim financing option while other mechanisms are developed for the post-2012, and could speed up the introduction of new measures.

5.4.2 Scaling up funds outside the UNFCCC

Article 11 of the Convention refers to a potential role for climate finance to be made available outside of the UNFCCC. Such funds are important in scaling up the availability of finance for GHG mitigation in developing countries. Again, it is useful to distinguish between carbon funds and other finance streams supporting emission reductions.

There are already several climate finance streams outside the UNFCCC framework, where perhaps the most prominent agents are the multilateral and bilateral development banks, bilateral development cooperation agencies and the private sector.

Multilateral and bilateral funds

There are several new bilateral and multilateral funds established to address climate change that are supported by voluntary contributions. In mid 2008, the multilateral development banks including the World Bank and regional development banks, established two Climate Investment Funds – the Clean Technology Fund (CTF) and the Strategic Climate Fund (SCF) to promote scaled up demonstration, deployment and transfer of low-carbon technologies.[24] The funds are intended to serve as an interim financing mechanism until the climate negotiations establish a new mechanism, but they also provide a model for financing that finds support among developed countries. In addition to these two funds several other schemes are proposed, including the following: The *Prototype Carbon Fund (PCF)*, where governments and industries have contributed some $180 million to pioneer projects on renewable energy, energy efficiency and sustainable development. The *Community Development Carbon Fund* has a specific aim towards financing small-scale projects in particularly poor areas of the developing world. High emphasis is placed on poverty reduction. *The European Investment Bank (EIB)* has, together with the European Bank for Reconstruction and Development (EBRD), established the Multilateral Carbon Credit Fund (MCCF), with the primary aim of supporting carbon markets in economies in transition.[25]

[23] Finance raised could be directed through existing climate funds, if appropriately focused.
[24] http://go.worldbank.org/58OVAGT860
[25] The EBRD and the Exim Bank of India have agreed on a framework loan for financing renewable energy and energy efficiency projects. http://www.eib.org/projects/loans/2008/20080119.htm?lang=-en

There are various examples of bilateral finance for climate change. Japan's *Cool Earth Initiative* aims at raising US$10 billion to support climate change alleviation policies, adaptation policies and access to clean energy. The German *International Climate Protection Initiative* follows a decision to use some of the revenues from domestic emissions trading to fund sustainable energy supply projects, and to support adaptation and biodiversity conservation through bilateral projects.

Private carbon funds

In addition to funds managed by governments or large institutions there are several private carbon funds operating in the market, such as the *European Carbon Fund (ECF)*. The ECF aims at financing the carbon component of environmentally-friendly projects, and also providing more liquidity to the European carbon market. The scope of the fund is global and credits are purchased on a forward-basis, thus contributing to project development. Other private funds include *Japan Carbon Finance Ltd* and the *Asian Carbon Fund.* The Asian Carbon Fund has a particular focus on India and China, with 50% of purchases coming from these countries.

5.5 Enhanced REDD

Reducing Emission from Deforestation and forest Degradation (REDD) is probably one of the most important land use and forest-related issues in the present negotiations, and its likely outcome is not yet clear. India is pushing for an expanded mechanism to incentivise forest conservation and management. India argues that co-benefits that can come from fostering sustainable forest management, for instance it could complement the aims and objectives of other relevant international conventions and agreements. The issue of conservation and enhancement of carbon in forest has also been stressed as an important parameter in terms of avoiding international leakage, where countries with historical low deforestation rates would become new deforestation countries if not compensated. India maintains that financial incentives are needed to help overcome high opportunity costs involved in stabilising and conserving forest cover.

The suggested REDD mechanism does not do much in an Indian context[26] because it is primarily a compensation mechanism for reducing deforestation, whereas India has already more or less halted its net emission from forests (Chabra and Dadhwal, 2004). Indeed, India has reforested in the recent past, increasing its forest cover from 64 million ha in 1982 to almost 68 in 2000 (FAO, 2005). India therefore proposes that a REDD mechanism should compensate not only for reducing deforestation but also for i) stabilizing forest cover and ii) conserving and increasing forest cover (UNFCCC, 2007b). India, as a Party in the negotiations, has therefore played a role in development of the forest mechanism from focusing purely on deforestation (RED) to deforestation and degradation (REDD) to the issues of conservation and enhancement of carbon stock (REDD+) (Parker et al. 2009).

To fund this, India's submission proposes two different approaches; a) a market based approach for the actual reduction of emission from degradation and for the enhancement of carbon through increments in carbon stocks in existing forests, and b) a non-market based approach for existing carbon stocks (baseline carbon stock) or hence stabilisation and conservation. India invites industrialised countries to mobilise resources to operationalise the non-market mechanism.

[26] Since COP13 in 2007, several REDD pilot activities have been launched, including bilateral, regional and international initiatives. India is not among the REDD pilot countries.

6. Overcoming barriers to reducing GHG emissions

Key messages

- Measures to catalyse investment in clean energy options in India need to be capable of overcoming both financial and technical barriers.
- Where a low-carbon project is less commercially attractive than more emission intensive alternatives – as is often the case for renewable energy – additional revenue flows are needed in the form of carbon market payments, subsidies (or taxes on carbon intensive options) and/or grants. For technologies such as solar energy, several mechanisms working in tandem are likely to be needed, which gives scope for international action to work in cooperation with domestic measures.
- Where a project is commercially attractive in the long term but constrained by high up-front costs – such as energy efficiency – there is a need for front-end loading of finance in the form of loans. Finance through market mechanisms can contribute by increasing the commercial returns of a wider array of actions.
- Technological barriers, for instance in the small and medium-sized industry sector, can be overcome through joint research and development efforts, involving both local and international partners and finance. Finding ways to enable local production of key technologies is important given that costs are a major barrier to India implementing low carbon options. Reducing manufacturing costs could also future costs for the EU in meeting its emission reduction obligations.

An array of financial, technological and institutional barriers constrain the effective, large scale deployment of low-emission technology in key sectors. These are not necessarily unique to India. With finance, for instance, the barrier is sometimes a difficulty accessing up-front finance, as could be the case for higher efficiency coal plant and energy efficiency, for example. In other cases a low emission option generates lower economic returns, or net present value, over the project life, for example in the case of solar energy compared to traditional fossil fuel-based sources. Both of these translate as opportunity costs for proponents and financiers.

This section considers briefly the types of barriers facing emission reduction actions in India's energy sector[27], and then the potential for different kinds of financial instruments and other interventions to help overcome these. These are summarised further in Appendix 1.

6.1 Barriers in key sectors

6.1.1 Stationary energy sector

Finance- and technology-related issues figure prominently among the barriers that limit the improvements in *power plant efficiency*. The utilities lack the technical know-how and human capacity to adopt more advanced technologies. Moreover, the financing needed to meet the high capital costs of these technologies is inadequate.

The high investment cost of *renewable energy technologies*, coupled with limited fiscal and regulatory incentives, and an uncertain carbon market are the some of the major barriers to the expansion of renewables in India. In addition, wind energy is facing challenges with lower than expected efficiencies, while solar technologies are faced with increasing silicon costs.

[27] The barriers outlined on this section draws on work currently being done by the Stockholm Environment Institute in Erickson et. al. 2009.

There has been limited penetration of energy efficiency technologies in India, which is due largely to high up-front investment requirements and lack of awareness about these technologies in different sectors and applications. Access to private capital for efficiency improvements can be constrained by financial institutions being unfamiliar with these kinds of activities and hence unsure of their ability to deliver adequate financial returns. India also suggests it has difficulties accessing newer technologies from industrialised countries, either because they are too expensive or because Indian operators are unaware of the technologies.

In the case of *buildings*, the lack of suitably qualified professionals (architects and builders) and materials limits the construction of *energy efficient buildings*. Moreover, energy efficiency is faced with the problem of split incentives – the economic savings accruing from energy efficient buildings are enjoyed by tenants, but the costs are borne by builders with no easy way to recover the higher costs.

Some of the large *industrial* units in India are using state-of-the art technology, in sectors such as cement and iron and steel. Although opportunities remain to upgrade other older plants, in the cement sector it has been suggested that the poor quality of fly ash and steel slag used as a clinker substitute and the high costs of its transportation and handling limits its use.

Improving energy efficiency from *small- and medium-sized enterprises* (SMEs) presents a high potential for emission reductions, but again SMEs are constrained by an inability to access more efficient technologies. Moreover, the heterogeneity of industrial units– differing vintages, inputs, and product mixes – makes using standardised benchmarks for carbon finance mechanisms very challenging[28]. A further important constraint is the absence of energy service companies (ESCOs) in India, who would fill the role of helping SMEs find and finance efficiency improvements. The establishment of ESCOs is constrained by a lack of start up capital from financial institutions, who are unaccustomed to the business model of these organisations[29].

6.1.2 Transport sector

Reducing transport emissions will ultimately require profound changes in transportation planning and infrastructure, as well as a transition to low carbon fuels. One of the supply-side barriers to improving *vehicle efficiency* is the perceived commercial risk for manufacturers to investing in efficient technology development, stemming in part from a lack of clear regulatory signals in the form of vehicle efficiency standards. On the demand-side, the up-front costs of electric and hybrid vehicles are high. The lack of charging infrastructure for electric vehicles is also a barrier (Ojha 2009).

Alternative fuels such as natural gas and biofuels (ethanol, biodiesel) have been promoted as less carbon-intensive alternatives to conventional petroleum-based fuels. Domestic resources of natural gas are limited and face similar issues with the security of supply as oil does. The use of biofuels, with its demand on arable land and irrigated water, competes with more pressing domestic policy food security goals.

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[28] See Garg, Rajiv, 2008. IEA Workshop on Sectoral Approaches for International Climate Policy, Paris, http://www.iea.org/Textbase/work/2008/Sectoral/RajivGarg.pdf

[29] ESCOs develop and implement projects that result in energy savings for their clients. They are distinguished from consulting firms by the concept of 'performance contracting', wherein the compensation they receive is directly linked to the amount of energy actually saved by the client, which means the ESCO assumes the risk that a project will save a guaranteed amount of energy. Although there has been some growth in the ESCO industry in India during the last 5 years, the industry remains comparatively smaller than in countries like the US, Brazil and China (WRI, http://www.wri.org/stories/2009/03/energy-efficiency-opportunities-india)

A major challenge facing *public transportation* infrastructure projects is the high upfront capital costs. Other issues include poor urban planning and inadequate institutional mechanisms to manage transport demand in urban areas.

6.1.3 Black carbon in the non-commercial energy sector

From a climate perspective, the most immediate barrier to tackling black carbon emissions from the non-commercial energy sector has probably been that aerosols are not included in the Kyoto Protocol. As well as being only recently recognised as an important climate forcing pollutant, this omission is probably also explained to a large degree by a number of uncertainties that make black carbon emissions difficult to accurately quantify and track, for instance delineating the major sources regionally as well as understanding regional transport and deposition. The result is that the carbon market has not provided a financial incentive for actions to reduce black carbon emissions. Despite aerosols being an important part of the global climate picture, therefore, aerosol-forcing has to date not been actively considered when evaluating options for mitigating climate change.

Barriers to action being taken from a health perspective, where there is already an awareness of the problem, are instead likely to be financial, technical and institutional resource constraints. Tackling the problems requires:

- the availability of suitable, locally appropriate and acceptable clean cooking technologies;
- the financial resources and institutional capacity to deploy such technologies on a large scale.
- awareness raising about the health impacts of indoor air pollution exposure and about the health-climate linkages and potential co benefits of addressing the problems; and
- institutional mechanisms at the national and regional level, for example air quality standards and the means to enforce them.

6.2 Overcoming financial barriers

There are different types of financial barriers which could constrain the uptake of projects that would reduce emissions, so it is necessary to identify how different mechanisms may work together to lower or remove each type of barrier.

6.2.1 Higher overall costs

For clean technologies such as renewable energy, the overall project costs on a 'net present value' basis are often higher than conventional alternatives. Where higher overall costs is a barrier, additional finance must provide a stream of funds to cover part or all of the cost gap if the lower emission alternative is to be incentivised. The carbon market plays this role up to a point by providing an additional revenue stream for cleaner projects, although the price of carbon credits is not always sufficient to fully compensate for the higher costs. In the case of solar energy, for instance, the carbon market has so far been of little benefit in catalysing projects. A reformed CDM, as well as other proposed carbon market mechanisms (discussed in section 5), could improve the effectiveness of international finance in overcoming this barrier. Grant financing mechanisms such as the GEF can also meet the incremental cost of cleaner alternatives, though to date the ability of the GEF to overcome financial barriers has been constrained by its level of funding. Proposals have been put forth by developing countries, including India, to create a new financing mechanism under the governance of the UNFCCC, to provide grants for developing countries to undertake nationally appropriate mitigation activities.

In some cases (for instance, solar energy), the additional cost of the technology is so high as to be inadequately captured by either the carbon markets or a grant financing mechanism alone.

Such technologies may need the different mechanisms working in tandem in order to be commercially competitive. Alternatively, such technologies could benefit more from efforts to lower the cost of the technology (see the next section for a discussion on addressing technology issues) or domestic regulatory measures that close the gap in financial competitiveness between options – either subsidising cleaner technologies or taxing polluting ones.

6.2.2 Higher upfront capital costs

Some activities or technologies may be competitive with alternatives on an overall (NPV) cost basis but may instead be constrained by higher upfront capital costs may be higher than alternatives. For example, advanced supercritical coal-fired plant is likely to be more capital intensive but have a lower operating cost[30] than a less efficient subcritical plant. Some projects may not easily be able to access the additional capital needed for such investments, or may experience that the cost of capital increases because of the greater amount of capital needed.

Addressing this barrier requires dedicated investment funds or lines of credit that provide upfront financing either in the form of equity or loans at concessional rates. Climate investment funds and other pooled finance vehicles (ODA, for instance) are therefore able to provide the incremental investment needed to overcome this type of barrier. Where loan finance can be provided at concessional rates it is able to offset the higher cost of capital resulting from higher debt-equity leverage. Such loans may also need to carry longer tenures than is commercially available, especially for projects where payback periods are longer than what may be acceptable to commercial lenders. Incentivising the private banks and investments companies to provide finance with such terms will probably need to be backed by domestic government institutions, or bilateral and multilateral investment agencies.

6.3 Overcoming technological and institutional barriers

Technology accessibility and institutions also play an important role in the accelerating or limiting the uptake of emission reducing activities.

Technology cooperation will be a key issue for a successful outcome to climate negotiations between industrialised and developing countries. The EU-India Summit in 2008 called for the exploration of “the potential for research and technology co-operation” and for “options for technology transfer”. The aim of technology transfer is to bring desirable technologies to market faster. There is no doubt that transferring production rights for low carbon technologies to developing countries could have a significant effect in bringing forward mitigation action. This is especially salient when you consider that countries such as India and China are at the beginning of a period of massive infrastructure investment in assets with long operating lives – coal-fired power stations, for instance. If technologies that are already available internationally but are too expensive for developing nations at present could be brought to bear immediately, the long term climate benefits would be very significant.

Various forms of financial and non-financial cooperation are vitally important for sectors where clean technologies are available internationally but are not accessible to domestic firms in India. This apparent lack of accessibility can arise from intellectual property rights (IPR) protection, which in some cases constrains the local manufacture and distribution of clean technologies in developing countries, where local manufacture would have major benefits in terms of reducing technology costs. Such barriers can potentially be addressed through technology sharing agreements or through financial support to cover the high costs of making the latest technologies more readily available in India.

[30] Higher efficiency means lower fuel needs per unit of electricity sent out.

Another blockage can be a lack of technology awareness or of the necessary links between industries and suppliers of cleaner technologies. In India, this is often the case for small- and medium-sized enterprises sector. Capacity building programs that enable the creation of a service industry (such as ESCOs) to facilitate the linkages between the consumers and technology suppliers, as well as the financiers, can help overcome this barrier.

Other challenges presented by available technologies are that they may be unsuitable for Indian conditions or they have negative externalities. Research to indigenize these technologies, supported by engineers and technical experts from industrialised countries, is important. In addressing negative externalities, such as the management of nuclear waste, sharing best practices between India and other countries would be a step forward.

Technologies such as energy efficient building materials, electric vehicles, carbon capture and storage (CCS) and solar energy are the focus of R&D efforts globally. Thus, involving India in collaborative R&D – through bilateral or multilateral frameworks and with the necessary arrangements for sharing intellectual property rights – could be productive not only as a way forward for engaging India in emission reductions but also of potentially lowering technology costs for industrialised countries themselves, thereby lowering the costs of achieving their own emission reduction obligations.

On the institutional side, the lack of domestic regulations and/or institutional capacities to implement policies can act as a barrier to the adoption of cleaner technologies or market transformations. The transport sector in India is a clear example. It presently lacks vehicle efficiency standards as well as the urban planning capacity to develop integrated transport strategies that can adequately meet growing urban transport demand. A sharing of best practice in transport planning could assist India in this respect, along with support for institutional capacity building. Financial support targeted at developing such standards and strategies would also enable their accelerated implementation.

It is evident that there are many barriers to tackling energy and transport emissions in India, however they are not insurmountable. Many can be addressed bilaterally, and some ideas that may be ripe for the forthcoming EU-India are discussed in further detail in Section 7.

7. Opportunities for collaboration between the EU and India

Key messages

- As an important first step in building a collaborative relationship with India, the EU should publicly articulate recognition of and support for India's actions to date in tackling emissions, not least through ambitious targets in the NAPCC. For efforts outside the UNFCCC to reduce emissions, such as through bilateral partnerships, a re-framing of initiatives in terms of sustainable development benefits would be highly productive in engaging India. Climate objectives should be highlighted as valuable co-benefits, but India's enthusiasm for specific initiatives will depend greatly on their alignment with domestic development objectives.
- International financial mechanisms for action on climate change are a key part of the Copenhagen negotiations, however the Summit is an opportunity to identify proposals which are of common interest to both parties as well as to better understand key reservations on India's side about, for instance, sectoral approaches.
- Specific areas recommended for concrete, near-term collaboration between the EU and India are in **reducing black carbon** in the non-commercial energy sector, **solar energy** and **energy efficiency**. *These are detailed in Section 7.3*.
- The Summit could also provide an opportunity for the EU to signal a willingness for future collaboration in the area of forestry, through implementation of some form of the REDD mechanism.

A number of key observations emerge from the discussion laid out in previous sections. Not least among these are i) that energy sector transformation will be vital if growth in greenhouse gas emissions is to be reigned in; ii) that India has introduced some sound domestic policy initiatives that, if successfully implemented, will have the effect of reducing emissions, and there is scope for parties such as the EU to assist India overcome implementation challenges; iii) that existing financial mechanisms have so far been inadequate in either catalysing large-scale emission reduction activities or in meeting India's objectives for co-benefits including technology transfer; and iv) India remains unconvinced of the merits of various sectoral approaches that are supported by the EU.

Looking forward, domestic policies and international support, including financial mechanisms and technology cooperation, must address the different types of financial and technological barriers if emission reduction opportunities are to be successfully fostered in India. A key challenge will be demonstrating technologies at scale as well as developing the mechanisms which can foster large scale replication.

With these points in mind, this final section looks forward to highlight possible areas of collaboration between the EU and India that could reduce greenhouse gas emissions, specifically in the context of the November Summit. The timing of the summit presents challenges, as well as opportunities. On the challenges side, India is very cagey about discussing new climate initiatives prior to Copenhagen negotiations in December, so it may be that if the EU wants to broach new partnership initiatives it would best frame these within the context of supporting sustainable development rather than climate change (see section 7.1). On the opportunities side, several of the detailed implementation plans for the various National Missions under the NAPCC are beginning to emerge, and these form a good platform for structuring collaboration. The details of two plans which are key in the context of this report –

i.e., solar energy and energy efficiency – are now relatively well known and their public release is anticipated in the coming months. The priorities embedded in these plans present a logical focus for EU engagement with India.

7.1 Bridging the Gap

Much is made of the differences between EU and India positions on issues of climate financing. From India's perspective, the difficulties within UNFCCC negotiations arise first and foremost as a result of paradigmatic differences between industrialised and developing parties. India is adamant that provision of climate finance is an obligation upon industrialised countries and that governance and delivery of the finance must therefore not follow the aid model. A donor-recipient model inevitably means that the quantum of financial support provided by developed countries is effectively decided by national political processes rather than obligations, and also that the donor has considerable influence over program priorities, criteria for receiving support (eg institutions) and the terms of 'assistance' (eg technology procurement requirements). Article 11 of the UNFCCC certainly makes clear that financial resources to tackle climate change can be channelled outside the Convention (in addition to through it). However, while welcoming such additional resources, India argues that these financial flows are not to be used in acquittance of obligations agreed through the UNFCCC process. This position, while understandable, presents a challenge to bilateral financial cooperation.

The EU and India share a common goal of rapidly addressing the challenge of climate change while respecting each other's ambitions of continuing economic growth. On the issue of how the burden of achieving ambitious global emission reductions should be shared between countries, there is more common ground than is currently acknowledged in the rhetoric of negotiations. Both the EU and India are already taking significant steps domestically to reduce emissions – the EU through its Emission Trading Scheme and India through its National Action Plan on Climate Change as well as other policies (discussed in chapter 3). While in India's case these actions are mostly driven by other domestic policy objectives like energy security and economic development, rather than a climate mitigation objective, these measures ought to be explicitly acknowledged as the costs of such actions are borne domestically. In EU parlance, such measures may be referred to as autonomous own action, while in the language of the Bali Action Plan as nationally appropriate mitigation actions.

A major area of difference lies in their views on the mechanism(s) by which the EU and other industrialised countries should be financing *further* emission reductions in India and other developing countries (ie, in addition to the domestic actions that are already being taken autonomously). The incremental cost of achieving further emission reductions can be broken down into the overall incremental lifetime costs of a project and the incremental initial capital cost of choosing a low carbon alternative over other baseline technologies. The EU prefers that the overall incremental cost is paid for through a carbon market mechanism while India prefers that the overall incremental costs are funded through grants or through a market mechanism that does not result in offsets that are used to meet the EU targets. Some newly proposed mechanisms outlined in chapter 5 that incentivise policy action and retire the credits may offer ways forward for the EU and India to find common ground and could be explored at the EU-India Summit in November (see section 7.2.1).

The EU also makes the case for partial financing where there may be co-benefits to India other than carbon abatement. The issue of financing partial versus full incremental costs will have to be agreed upon as part of a multilaterally negotiated agreement on the burden-sharing that is beyond the scope of the bilateral EU-India Summit. A burden-sharing agreement may open the possibility of experimenting with a number of new or modified market mechanisms that reflect appropriate burden-sharing, including through the use of benchmarks, target-cum-crediting

mechanisms, and sectoral approaches. Discussing such approaches without an agreement on burden-sharing could be counterproductive and could lead to deadlocks in areas where progress can otherwise be achieved.

Both parties agree that the incremental investment needs which manifest as higher upfront capital costs could be provided in the form of debt, equity or other commercial financing instruments that are financially engineered to offset higher capital costs. The difference between the EU and India positions here lies in how such funds are governed – should they be provided through the UNFCCC or through existing bilateral and multilateral financing institutions? The EU contends that the capacity of existing institutions must be leveraged and built upon wherever possible, while India feels that these institutions are not democratic and do not adequately represent the interests of recipient countries. India does not rule out the possibility of finance supporting climate change objectives flowing through such institutions but, as highlighted above, maintains that their use must be driven by the paradigm of "obligation". These are probably not intractable positions and some resolution which satisfies both parties may be possible during UNFCCC negotiations.

In the more immediate context of the November Summit, two important steps initiated by the EU could help bridge the gap between the parties and form a platform for more constructive engagement. The first is the EU *publicly articulating support for India's actions to date*, highlighting important initiatives in the NAPCC and various forthcoming implementation plans. The second, as recommended by diplomatic staff on the ground in India, is a *re-framing of the EU's climate discussion with India*, shifting from "greenhouse gas emission reductions" to achieving "sustainable development". Given the criticisms of existing financial mechanisms such as CDM for not delivering substantial co-benefits to developing countries, as well as the likelihood that international climate partnerships are unlikely to appear on the Indian agenda prior to Copenhagen, such a re-framing would be productive. India needs to feel confident that its own policy priorities are sufficiently represented in any collaborative arrangement. Badging is significant – replacing labels such as "mitigation", "adaptation" and even "climate change" with "sustainable development" and "energy security" would give greater focus to co-benefits, while still facilitating the EU's objective of catalysing emission reductions.

Going beyond these steps, there would appear to be space outside the UNFCCC process for cooperation between EU and India. It is important that efforts at collaboration should be specific and tangible, not just an agreement of objectives and principles. This is a view expressed not only in commentary on the effectiveness of existing forums (eg Luff and Runacres, 2009) but also raised by key figures in India during discussions with SEI. As highlighted, efforts should focus on actions that maximise co-benefits for both parties.

7.2 Frameworks for investment and financing

Financing is a key issue for both parties, both in relation to offset mechanisms operating as part of European carbon market and climate funds that flow outside the UNFCCC through various bilateral and multilateral finance institutions.

7.2.1 Carbon markets and international agreements

Much of the discussion about carbon market mechanisms is situated within the UNFCCC process and hence is likely to be beyond the scope of the November Summit. Although detailed agreements about design of carbon market mechanisms is therefore not possible, the Summit could however be an opportunity for political commitments to work towards reforms in a particular direction. This might help bridge the gap in political rhetoric between the parties. For instance, the outcomes of the EU-India summit could send strong signals on reforming CDM to

lower transaction costs and improve the environmental integrity[31], while leaving negotiations on these issues to take place under UNFCCC process.

A strong statement from EU and India that assures investors of the "continuity of an international carbon market beyond 2012 with demand for credits from developing countries including India" could be a driver of new investments in CDM projects. The scope and depth of such a market will still have to be negotiated under the UNFCCC but a political signal of such a nature would in itself be an important catalyst for private investments, since the uncertainty of whether a market for Indian emission reduction credits will exist beyond 2012 is presently affecting the development of new CDM projects.

The EU has expressed a strong interest in sectoral crediting mechanisms, while India has to date not been supportive of such approaches. The reasons given for India's opposition do not, on the face of it, seem an insurmountable barrier from a practical implementation perspective. Speculatively, India's real concerns may be that a sectoral-based finance mechanism will divert climate funding away from India and towards other developing countries (i.e., where a sectoral mechanism is more easily implemented). India may also fear future pressure from industrialised countries to convert negotiated sectoral baselines into binding targets. These are both speculative. However, if the EU wishes to engage in productive dialogue with India about "no lose targets", which are likely to be the most amenable to India of the options discussed in this report, it should first consider re-framing them not as "sectoral" since the term itself appears to have become a barrier. Fostering greater understanding of how a "no lose" mechanism would be established and implemented could reduce concerns on the Indian side, and to this end the Summit could establish a joint pilot project between the parties to work up a draft (and non-binding) "no lose mechanism". Such an exercise could flesh out some of the difficulties in an Indian context and also help both parties gain a clearer sense of the value in implementing such an approach, though could be administratively burdensome as an exercise.

The prospect of finding a way to link India's planned industrial energy efficiency certificate scheme with the EU ETS would have mixed implications for India, since India's scheme would probably be a "price taker" from the much larger EU ETS and this could drive up certificate prices – good for sellers, but could increase compliance costs for buyers. It may be too early to consider this possibility, though a dialogue with India's Bureau of Energy Efficiency may be a useful starting point to gauge Indian interest in such a proposal.

7.2.2 Multilateral and bilateral financing vehicles

The outcomes of the 2008 EU India summit called for the exploration of options for scaling up financing. With higher costs, in its various manifestations, figuring as a prominent barrier to investments in emission reduction opportunities in India, different kinds of finance will be essential. Thus an array of bilateral and multilateral financing instruments will likely play a role in complementing the carbon market if ambitious emission reductions are to be pursued.

Grant funding can play a catalytic role in demonstration, deployment and diffusion of pre-commercial technologies. Bilaterally, some EU member countries have financed demonstration projects though often these have supported only small projects with relatively low mitigation potential, and have not been sustained over long time-periods hence limiting the scale of replication. Grants have typically not been available to bridge gaps in financing for technologies at the deployment and diffusion stages with the expectation that the carbon market would fill the gap. Where the additional revenues from the carbon finance is inadequate to cover the higher cost of a cleaner alternative (for e.g. due to long payback periods), the EU could discuss with

[31] Note that there could be trade-offs between achieving lower transaction costs and improving environmental integrity

India the possibility of supplementing carbon finance with grant financing provided bilaterally or, perhaps more appropriately, through a multilateral mechanism.

The EU and its member states may also need to scale up infrastructure investments through the conventional aid route without compromising on investments in India's social sector. For example, investments in urban transportation infrastructure (e.g. integrated mass rapid transit systems) provide win-win opportunities enabling India to achieve its development and energy security goals and the EU to achieve significant emission reductions in a sector that is on the verge of explosive growth.

Although it is too early to assess the impact of the €150 million line of credit provided by the EIB to the Exim Bank of India for renewable energy and energy efficiency equipment imports, the November summit would be an opportune time for EU and India to assess the scale of such investments that may be needed. Conservative estimates[32] by the UNFCCC suggest that the incremental investment needed in India's power generation sector will be over $10 billion in 2030. Other India-specific studies[33] expected to be released ahead of the summit in November are likely to provide more accurate estimates. Moreover, given the challenge for India to meet investment needs in the 'reference' scenario itself, bilateral and multilateral finance streams could encourage shifts to lower emission technologies by scaling up the availability of capital for such purposes.

7.3 Specific initiatives for collaboration

The final section of this report points to specific sectors and/or technologies upon which the EU and India could productively collaborate in the near-term. These are areas that may yield fruitful dialogue at the Summit and could form a basis for developing concrete partnership actions.

Collaboration will necessarily be focused in areas of overlapping interest. From the EU's perspective, assisting India to reduce GHG emissions is a key objective of engagement. From India's perspective, pursuing economic development and enhancing technology transfer are key objectives. Areas of collaboration must therefore lie at the intersection of these different objectives. Both mitigation potential and India's current prioritisation of an approach or technology are therefore useful starting points in identifying potential areas of collaboration.

A logical first point of engagement for the EU is with the various relevant National Missions under the NAPCC that are presently being developed in more detail. Two Missions that are of particular interest from a GHG emissions perspective – solar energy and energy efficiency – are outlined in section 3. There is certainly a view within the Indian government that some of the finance to implement these plans could (and probably will need to) come from external sources.

Black carbon, although not directly covered in the framework of the National Missions, is considered an additional key focus area because of the very strong overlap in benefits for the EU and for India.

The intent is to point towards productive areas of engagement, while more detailed work in partnership with Indian actors is necessary to make work programs concrete and well directed.

7.3.1 Black carbon and clean cooking stoves

The strong overlap between climate change and local health concerns makes black carbon a highly appropriate topic for collaboration between the EU and India. This was also the

[32] The UNFCCC mitigation scenario is less ambitious than the mitigation scenarios in other global studies, but sector-specific investment estimates for India are not available for those studies.

[33] TERI, McKinsey and the World Bank are presently undertaking detailed studies on India, which are expected to be made public within the next couple of months.

conclusion of the High-Level India-EU Seminar in Delhi during February 2009, which recommended that the EU use its relationship with India to collaborate on addressing sources of black carbon by providing support for clean cooking stove initiatives (Luff and Runacres, 2009). It could be seen first and foremost an area that should be attended to for health reasons but one that also simultaneously delivers valuable climate co-benefits by taking action to address a potentially major climate forcing pollutant that is not covered by the Kyoto Protocol nor on the agenda at Copenhagen.

Sweden's presidency of the EU makes this a particularly opportune time to raise the possibility of a black carbon initiative with India, since Sweden is strategically well placed to take a lead role in any black carbon initiative[34].

Replacing traditional, inefficient cooking stoves with improved stoves and cleaner fuels that emit far less soot would be a major stepping stone to tackling black carbon in an Indian context. Therefore, concrete collaboration around a programme to replace inefficient biomass stoves with cleaner alternatives is recommended. A dialogue with potential partners in India prior to the Summit would enable more detailed mapping of the most promising opportunities for the EU and India to jointly develop an initiative

The initial financial requirement to implement such a program could be relatively small, particularly compared with the other options for collaboration presented below. However, a longer term financial commitment that builds upon the initial pilot phase, enables up-scaling and is backed by the EU playing a brokering role in bringing EU technological support to the table could achieve significant outcomes for both the EU and India.

7.3.2 Solar energy

The NAPCC prioritises a major expansion in solar capacity, to achieve a very ambitious target of 20GW of installed solar power by 2020. India is banking upon a significant reduction in the costs to be achieved by scaling up deployment, ramping up domestic manufacturing capacity and by financing research[35]. The implementation of the Solar Mission will be supported through a slew of incentives such as favourable feed-in tariffs, capital subsidies[36], tax and depreciation benefits, mandated deployment regulations and other similar measures[37].

A plan for the implementation of the Solar Mission is expected to be publicly released very soon. Unofficial estimates suggest the cost of implementation would be roughly Rs 100,000 crore (~€15 billion) over a 30-year period starting with roughly €1 billion in the 11th five-year plan (until 2012) and €2 billion in the 12th plan (up to 2017). The plan is expected to be financed through budgetary resources, via a new Solar Fund, and could be augmented with external resources if available.

[34] For instance, SEI is the Secretariat for UNEP's Black Carbon Assessment and has a 20 year history of involvement in energy access and household energy in developing countries. Through these roles, SEI has developed close links with key organisations involved in implementing energy and environment initiatives in India. In terms of climate measurements, Stockholm University's Bert Bolin Centre is currently running a programme to provide a much-improved estimate of the relative contribution to BC from biomass/biofuel burning versus from fossil fuel combustion. This is a Swedish-Indian collaboration with expertise that could potentially be tapped as part of the emissions monitoring component of an improved cooking stove programme.

[35] The government projects that costs of solar will need to fall from roughly Rs 18 crores per MW today to Rs 5 crores per MW by 2020, at which point it is hoped solar will achieve grid parity (interview with Deepak Gupta, Secretary, Ministry of New and Renewable Energy, Government of India).

[36] HSBC (2008) reports that the GOI 2007 semiconductor policy provides for 20-25% subsidy of capital expenditure for the manufacture of photovoltaics either in the form of equity, grants or interest subsidies.

[37] Interview with Deepak Gupta, Secretary, Ministry of New and Renewable Energy, Government of India.

The Solar Mission offers a collaborative opportunity for EU and India. The 2008 Summit Declaration called for both partners to "*foster cooperation on solar energy with a view to jointly developing a flagship programme in solar energy*". Such a programme could be developed jointly with India's Ministry of New and Renewable Energy. The EU could contribute financial resources to the Solar Fund as well as launch collaborative research to help bring down the costs of solar technologies.

Financial support

Both concentrated solar thermal and solar PV are more expensive than alternative technologies in terms of the initial capital costs as well as the cost of generation[38]. New thin film solar PV technology is expected to bring down the cost of solar PV but intellectual property rights protection may be limiting its widespread deployment in India. Thus, a combination of grants (and/or carbon revenues) to meet the higher overall costs and investment funds to meet the higher capital costs are needed to make these technologies cost-competitive with other alternatives. Further, resources may be needed to address the higher cost specifically associated with IPR protection.

One possibility would be for the various EU-based development banks (European Investment Bank (EIB), French Development Bank (AFD), German Development Bank (KfW), Nordic Environmental Finance Corporation (NEFCO)) to develop a dedicated climate finance package to deliver both grant and debt finance specifically to support the Indian Renewable Energy Development Agency's efforts at expanding solar capacity.

Collaborative research and technology cooperation

For solar technologies to be deployed at a wider scale there is a need to reduce the cost at which current technologies are available to developing countries. The launch of joint research activities on solar, with the prickly issue of property rights adequately addressed, will not only make a tangible contribution to the implementation of India's solar mission but also help change India's perception of the EU.

7.3.3 Enhanced Energy Efficiency

Enhancing energy efficiency in India will not only deliver climate change mitigation benefits but also energy security benefits by lowering demand and consequently the need for new capacity additions. With these benefits in mind, the GOI has set a target of reducing energy demand by 10GW by 2012 in its *National Mission on Enhanced Energy Efficiency* and hopes to achieve this target through various measures outlined in Section 3.

Three specific avenues for engagement on energy efficiency are particularly appealing:

1. Providing financial and technical support for the emergence of energy service companies (ESCOs);
2. Joint technology development and deployment in small and medium sized enterprises (SMEs); and
3. Financial assistance to overcome transactional barriers to programmatic CDM.

[38] The investment cost of CSP is estimated to be Rs 20-22 crores/MW (€ 3 – 3.3 million/MW) and solar PV Rs 27-32 cr/MW (€ 4.5 - 4.8 million/MW), while the cost of generation is Rs 20-25 KWh (€ 30-37 cents/KWh) and Rs 15-20 KWh (€ 22-30 cents/KWh) respectively (Luff and Runacres, 2009; GOI 2008). HSBC (2008) expects CSP costs to decline to Rs 16 crore/MW in 2008-12 and to Rs 11 crore/MW in 2013-2018.

Energy service companies

A key element of the National Mission on Enhanced Energy Efficiency is the promotion of ESCOs, which are a vehicle for bringing together both the finance and innovative energy efficiency technologies for industries, using replicable, sustainable business models. With ESCOs still nascent in India, their access to finance is limited as banks are uncertain about the return that these energy saving investments are likely to deliver. Thus, only those ESCOs that are able to borrow on the strength of their balance sheets or due to their past relationships with banks are able to secure finance, which is a severe constraint. To overcome this problem, the GOI plans to set up a Partial Risk Guarantee Fund (PRGF) to encourage commercial banks to lend to ESCOs. While the PRGF will guarantee the loan component provided by banks, a similar fund also in the works will guarantee the equity component in a bid to encourage venture capital investments in ESCOs and other EE projects.

The EU could provide finance to support ESCOs, either through capital infusions into these guarantee funds, through the use of bilateral and multilateral investment funds to provide venture capital for ESCOs, and/or through using dedicated lines of credit similar to the European Investment Bank's Framework Loan to India's EXIM Bank (which is to be used for renewable energy and energy efficiency investments). Such measures would be consistent with and build on the outcomes of the 2008 EU-India Summit, which calls for "*joint efforts to mobilise on mutually agreeable terms European Investment Bank funding to support investment projects in India that contribute to climate change mitigation*" (EU India, 2008b). The EU could also foster financial institutional partnerships that could transfer learning of energy efficiency activities to Indian banks, helping raise awareness of the commercial viability of such projects.

Small and Medium Sized Enterprises

One potential model of cooperation to tackle energy efficiency in the SME sector was raised in discussions with Indian agencies[39]. Switzerland has apparently established a program of engagement with various industrial sectors, including the glass manufacture and foundry sectors. The model places joint technology development at its core, partnering Swiss engineers with Indian companies to develop, over several years, higher efficiency plant that is suitable for local conditions. There are various components to this approach – an initial technology mapping of both Indian and world's best technologies; funding of pilot studies to develop and implement improved technologies locally; a training program for technology operators, consultants and manufacturers, in order to foster further development and deployment of the technology in future; and mediation with domestic financial institutions to secure access to the necessary capital to undertake technology upgrades.

The EU is in a position to develop models along these lines that would undertake technology assessments and implementation, via a matchmaking and/or technology brokering role with European companies. The first step, which could be discussed through the Summit, is a matching of key Indian sectors with European expertise.

Programmatic CDM applications

The Indian government has already implemented a project to provide compact fluorescent lightbulbs (CFLs) to domestic consumers at the same price as incandescent bulbs. It hopes to recover the costs of this programme, including the cost difference between the technologies, through programmatic CDM revenues, however it has experienced considerable difficulties using the CDM framework.

[39] Interview with Ajay Mathur, Director, Bureau of Energy Efficiency, India, August 2009.

To overcome the transaction costs barrier and improve the usefulness of programmatic CDM, the BEE have indicated that the Indian government is planning to set up a “revolving fund” that will be used to finance the transaction costs associated with CDM projects. Using the revolving fund, the government hopes to implement future programmatic CDM initiatives in the buildings and agricultural sectors.

The EU could provide financial support to the planned revolving fund, for instance through a form of framework loan to the Indian government. An alternative might be to provide a guarantee mechanism to encourage CER buyers or other financial institutions to provide upfront financing that covers the transaction costs of developing such projects. The BEE is well developed in its thinking on policy support measures for energy efficiency, so the first step would be soliciting engagement through the BEE to determine the most valuable forms of EU cooperation.

7.3.4 Supporting REDD+ implementation

India’s Ministry of Environment and Forests expressed a willingness to discuss ways in which the EU could support implementation of an international mechanism for enhanced forest protection along the lines of REDD+. REDD issues will be discussed during COP15 negotiations, so it would be premature to make commitments at the Summit about supporting REDD implementation. However, in the event that the EU is supportive of the REDD+ concept it is suggested that the EU makes a statement at the Summit which flags future support for implementation of measures targeting the forestry sector.

References

BEE (Bureau of Energy Efficiency), 2009. *Action Plan for Energy Efficiency*. Ministry of Power, Government of India. Available at: http://www.energymanagertraining.com/NAPCC/NMEEE-forPublicComments.pdf

Bond, T.C & Sun, H. 2005, Can reducing black carbon emissions counteract global warming? *Environ. Sci. Technol.* 39, 5921-5926.

Capoor, Karan and Philippe Ambrosi (2009), *State and trends of the carbon market 2009*, The World Bank, Washington, D.C.

CD4CDM, 2009. CDM Pipeline, www.cd4cdm.org accessed September 2009.

Chabra, A and Dadhwal, V.K. 2004. Assessment of major pools and fluxes of carbon in Indian forests. *Climatic Change* 64:341-360.

Erickson, Peter, Charlie Heaps, and Michael Lazarus, 2009. *Greenhouse Gas Mitigation in Developing Countries - Promising Options in China, Mexico, India, Brazil, South Africa, and South Korea*, SEI Working Paper, WP-US09-03, http://www.sei-us.org/WorkingPapers/WorkingPaperUS09-03.pdf

European Commission (EC), 2009. *Towards a comprehensive climate change agreement in Copenhagen*. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. January 2009.

EU-India, 2008a. *Joint Work Programme: EU-India Cooperation on Energy, Clean Development and Climate Change*. http://ec.europa.eu/external_relations/india/sum09_08/climatechange_workprog_2008_en.pdf

EU-India, 2008b. *Global Partners for Global Challenges: The EU-India Joint Action Plan (JAP)*. Report of the EU-India Summit, Marseille, 29 September 2008.

FAO, 2005. *Global Forest Resources Assessment Country Report India*. FRA2005/001.

Finnish Institute of International Affairs (FIIA), 2009. *Towards a New Climate Regime: Views of China, India, Japan, Russia and the United States on the Road to Copenhagen*. Anna Korppoo, Linda Jakobson, Johannes Urpelainen, Antto Vihma, Alex Luta. FIIA Report 19/2009.

Garg, Rajiv, 2008. IEA Workshop on Sectoral Approaches for International Climate Policy, Paris, http://www.iea.org/Textbase/work/2008/Sectoral/RajivGarg.pdf

GEF 2004. *Climate Change Program Study 2004*. Global Environment Facility (GEF) Office of Monitoring and Evaluation. September. Accessed on 23 June 2009. Available at: http://thegef.org/MonitoringandEvaluation/METhemesTopics/METClimateChange/2004_ClimateChange.pdf

GOI (Government of India), 2008. *National Action Plan on Climate Change*.

Hansen, J.E. et al., 2000, Global Warming in the 21st Century: An alternative scenario. *Proc. Natl. Acad. Sci*. 97, 9875-9880 (2000).

HSBC, 2008. *Wide Spectrum of Choices: India's Climate Investment Opportunities Revealed*. HSBC Global Research. November 2008.

IEA, 2008. *CO_2 Emissions from Fuel Combustion - Highlights – 1971-2006*. International Energy Agency, Organisation for Economic Co-operation and Development (OECD), Paris.

IEA, *Background to IEA-India Joint Workshop on Energy Efficiency and Standards Labelling.* Available at http://www.iea.org/textbase/work/2004/bangalore/background.pdf

Jacobson, M.Z. 2002, Control of fossil fuel particulate black carbon and organic matter, possibly the most effective method of slowing global warming, *J. Geophys. Res.* 107, doi: 10.1029/2001JD001376.

Leguet, Benoît and Ghada Elabed (2008), A reformed CDM to increase supply: Room for action, in Karen Holm Olsen and Jørgen Fenhann (eds.), *A reformed CDM - including new mechanisms for sustainable development*, Perspectives Series, UNEP Risø Centre, Roskilde.

Luff, Peter and Mark Runacres, 2009. *High-Level EU-India Seminar in Delhi, 3-4 February 2009*. Action for a Global Climate Community (AGCC), London.

McKinsey, 2009. *Environmental and Energy Sustainability: An Approach for India*. Mumbai, India. Available at: http://www.mckinsey.com/clientservice/ccsi/pdf/India_Environmental_Energy_Sustainability_final.pdf

MoEF (Ministry of Environment and Forests), 2009. *India's GHG Emissions Profile: Results of Five Climate Modelling Studies*. Climate Modelling Forum, India, for the Ministry of Environment and Forests, Government of India.

MoEF, 2004. *India's Initial National Communication to the UNFCCC*, Ministry of Environment and Forests, Government of India, New Delhi.

MNRE (Ministry of New and Renewable Energy), 2008. Annual Report. Available at: http://mnes.nic.in/annualreport/2007_2008_English/content.htm

Müller, Benito and Prodipto Ghosh (2008), *Implementing the Bali Action Plan: What Role for the CDM?*, Oxford Energy and Environment Comment, Oxford Institute for Energy Studies, Climate Strategies.

Ojha, Shanti 2009. *Development of bio-fuels and electric vehicles in Indian transport sector*. Powerpoint presentation delivered by Bishal Thapa, ICF Consulting, at the conference "Options to Reduce GHG Emissions through National Appropriate Mitigation," on 13 May 2009, Beijing. Available at: http://www.ccap.org/docs/resources/641/India%20-%20GHG%20reduction%20options%20in%20transportation%20sector.pdf.

Pande, Hem 2009. *Co-financing for GEF India Projects: Challenges & Opportunities*, powerpoint presentation made at the GEF Sub-regional Workshop for Focal Points from Asia, Bangkok, April 7 - 9, 2009. Accessed online on 23 June 2009. Available at: http://www.gefcountrysupport.org/docs/1039.ppt

Parker, C., Mitchell, A., Trivedi, M., Mardas, N. 2009. *The Little REDD+ Book*. Global Canopy Programme.

Seres, Stephen and Eric Haites, 2008. *Analysis of Technology Transfer in CDM Projects*, Prepared for the UNFCCC Registration & Issuance Unit, http://cdm.unfccc.int/Reference/Reports/TTreport/TTrep08.pdf

Smith, K, 2000, National burden of disease in India from indoor air pollution, National Academy of Sciences, Inaugural Articles, 13286–13293 PNAS, vol. 97 no. 24.

TERI, 2008, *Mitigation Options for India: the Role of the International Community*, The Energy and Resources Institute (TERI), New Delhi.

Tirpak , Dennis and Helen Adams (2008), Bilateral and multilateral financial assistance for the energy sector of developing countries. *Climate Policy* 8, 135-151.

UNFCCC, 2007a. *Investment and Financial Flows to Address Climate Change.* http://unfccc.int/files/cooperation_and_support/financial_mechanism/application/pdf/background_paper.pdf

UNFCCC, 2007b. SBSTA 26th session Bali, 3-11 December 2007. *Views on issues related to further steps under the Convention related to reducing emissions from deforestation in developing countries: approaches to stimulate action*. FCCC/SBSTA/2007/MISC.14/add.2

World Bank, undated. *Phase II: Development and Climate Change, A Strategic Framework for the World Bank*. Available at: http://go.worldbank.org/WWT4W1LH60.

WRI CAIT, 2009. On-line database of emissions. World Resources Institute. (http://cait.wri.org). Accessed 21 July 2009.

World Health Organisation, 2006, *Fuel for Life: Household Energy and Health*, Geneva, WHO.

Appendix 1: Inventories of India's greenhouse gas emissions

The following table presents data collated from two sources: India's official GHG emissions inventory for 1994 (MOE, 2004)[1] and the World Resource Institute's unofficial estimates for 2000 and 2005 (WRI-CAIT, 2009)[2].

Table A.1 GHG emissions in India ($MtCO_2$ equivalent)

Sector	**1994[1]**	**2000[2]**	**2005[2]**
Energy	743.8	1045.9	1238.5
Electricity & Heat	*355*	*556.6*	*694.8*
Manufacturing & Construction	*150.7*	*222*	*243.4*
Transportation	*80.3*	*92.2*	*97.5*
Other fuel consumption	*131.6*	*139*	*155.5*
Fugitive emissions	*26.3*	*36.2*	*47.4*
Industrial processes	102.7	57.3	87.8
Agriculture	344.5	375	402.7
LULUCF	14.3	-40.3	na
Waste	23.2	114	123.8
International Bunkers	na	7.4	10.5
Total	**1228.5**	**1559.3**	**1863.3**

Appendix 2. Comparative Assessment of Financial Mechanisms

	CDM	GEF	Bilateral/Multilateral Aid
Scale of (direct) annual investment/financing (through mechanism)	~ $300 million (since inception) (deduced from CER value)	$200 million (since 1991)	Bilateral: ~ $500 million[40] (1997-2005) Multilateral (incl. GEF): na (~ $600 mn[41]) (1997-2005)
Scale of total (leveraged) annual investment	Information not available	$1.4 billion (since 1991)	Information not available
Type of financing	Payment for commodity, i.e. CERs	Grant financing	Concessional loans
Extent to which it finances the incremental costs of GHG reductions?	Uncertain. Most projects are developed unilaterally by the project developer. However, extra CER revenues do increase a project's Internal Rate of Return and thus can serve as a driver for marginal projects.	High. Funds are provided as grants usually to cover gaps in financing.	Financing not focused on mitigation. Loans are made to commercially viable development projects that are likely to face barriers in accessing private financing.
Technologies / sectors most effectively supported to date	Renewable energy (biomass, wind, hydro) Industrial energy efficiency	Renewable energy Energy efficiency Technology demonstration and commercialisation Knowledge products, policy design	Renewable energy Energy efficiency Forestry Urban infrastructure Transport
Upfront financing	Very limited in India	Funds are usually provided upfront or in a phased manner	Funds are usually provided upfront or in a phased manner
Technology transfer?	Very limited; unilateral nature of projects points to the absence of technology transfer; Seres and Haites (2008) estimates the rate of technology transfer in India to be 16% in terms of the number of projects and 41% in terms of annual emission reductions.	GEF claims technology transfer in all of its projects but GEF projects have not explicitly focused on the acquisition and transfer of technologies	Information not available

[40] Computed based on the assumption that 20% of India's energy portfolio of $2.5 billion is devoted to clean energy projects

[41] Assuming India's share is roughly 10% and that 20% of the portfolio is allocated to clean energy projects

	CDM	GEF	Bilateral/Multilateral Aid
Development benefits supported?	Not directly, very limited.	Limited. A few projects have strong development benefits although the explicit goal remains GHG mitigation	Focused on development benefits while GHG mitigation benefits are secondary.
Key issues and criticisms	High transaction costs constrain participation by SMEs, which form the bulk of Indian industry. Short crediting periods (arising from uncertainty about the CDM post-2012) limit the capture of long-term projects (ie with long gestation financing needs). Difficulties setting project baselines. Low technology transfer occurring. Sustainable development outcomes not delivered to the extent expected.	At a mechanism level, inadequate funds to deliver major, transformative emission reductions. At a project level, inadequate funds to capture projects with high investment needs.	Capable of financing long-term, transformational activities such as public transport infrastructure, as well as activities with high capital costs such as large hydropower projects. GHG reduction benefits are secondary but can be significant. Most energy financing is still focused on conventional fossil fuel-based projects rather than clean energy.

Appendix 3. Barriers to reducing emissions

Barriers faced in realising mitigation potential	Applicable sector/technologies	Options to overcome the barrier faced	Potential financing and other cooperation mechanisms
Higher Costs			
Higher overall costs (capital and O&M combined)	Power generation - renewables like wind and solar - lower than expected efficiencies of wind turbines alters economics - rising costs of silicon and the lack of alternatives pushing up solar costs - carbon capture and storage (additional energy requirements also drives up costs at a macroeconomic level)	In projects where the overall costs (on an NPV basis) are higher than alternatives, the additional costs should be *fully* compensated by the industrialised countries based on the "polluter pays" principle, or *partially* if there are co-benefits other than GHG reduction that is accepted as part of an international burden-sharing framework. Such compensation can be provided directly to projects either through the expanded carbon markets or through the use of grants, or indirectly through government fiscal and regulatory mechanisms also compensated through international financing mechanisms. The additional cost of some technologies, such as solar, are so high as to be inadequately captured by either carbon markets or grants alone. Such technologies may need to benefit from both the carbon markets as well as grants to compensate for the full additional cost. Collaborative R&D and the development of domestic manufacturing capacity could also help to lower costs of technologies, address inefficiencies and lower the cost expensive materials.	Reformed/ Expanded CDM (e.g. programmatic or policy approaches), GEF grant funding or other grants provided under a new mechanism set up by the UNFCCC. Venture capital funds could be used to support the development of India's domestic manufacturing capacity in key mitigation technologies.
Higher capital/ upfront costs only	Power generation - more efficient coal-based technologies like	Additional financing is required to cover the higher capital costs. Such financing could be provided in the form of equity or loans at concessional/ subsidised	Funding mechanism may include an investment vehicle as part of any new funding mechanism created by

Barriers faced in realising mitigation potential	Applicable sector/technologies	Options to overcome the barrier faced	Potential financing and other cooperation mechanisms
	ultra supercritical, IGCC and others - technologies involving fuel-switching like CCGT - renewable energy technologies like wind, solar, hydro, etc. - nuclear Transportation - hybrid vehicles - public transportation infrastructure	rates. The need for concessional interest rates for additional debt provided is justified to offset the higher cost of capital resulting from higher debt-equity leverage. Such loans may also need to carry longer tenors than is currently available. Incentivising the private banks and investments companies to provide finance with such terms will need to be backed by domestic government institutions, or bilateral and multilateral investment agencies. As public transportation infrastructure projects tend to be natural monopolies, their development is usually government-led and based on economic cost-benefit analyses (i.e. from a macro perspective) based on development and other domestic public policy objectives (e.g. energy security). Where GHG mitigation objectives increase the cost of such projects, the incremental investment could come from dedicated bilateral and multilateral investment funds.	the UNFCCC (e.g. the Green Fund) or new investment funds such as the Climate Investment Funds. Bilaterally, the EU could provide equity or loans at concessional rates through private banks along the lines of the EIB loan to the EXIM Bank for renewables (discussed in chapter 5). Bilateral and multilateral agencies could set up funds to the
Higher O&M costs only	Industry - transportation and handling of fly ash in the cement sector and steel slag in the steel sector	Should be fully compensated through carbon revenues from CDM (or similar market-based mechanism) could offset the higher costs unless overall costs (on an NPV basis) is competitive with alternatives	Reformed CDM, GEF grant funding or other grants provided under a new mechanism set up by the UNFCCC.
Higher opportunity cost of capital	Industry	Addressing this barrier requires making investments that reduce GHG emissions financially more attractive than other investment opportunities. This can be done by increasing the incentives for such projects through concessional financing, higher carbon prices, frontloading of fiscal incentives or carbon revenues, or other similar measures that	Higher carbon prices can be ensured through deeper emission reduction commitments, and through the use of benchmarks and other measures that limit the supply of credits. Increased fiscal incentives could be compensated through policy CDM

Barriers faced in realising mitigation potential	Applicable sector/technologies	Options to overcome the barrier faced	Potential financing and other cooperation mechanisms
		increase the rate of return on mitigation investments. Alternatively, direct regulations mandating, for example, efficiency standards or the use of better technologies, may be an option. The risk of putting marginal firms out of business is very low or negligible as the barrier points to a choice between profitable investments. Implementing measures that lower returns on competing investment opportunities would be politically unpalatable as it would lower the profitability of firms and eventually the GDP.	approaches. Relaxing financial additionality requirements would allow mitigation investments to benefit from the carbon market, where it may have otherwise been inaccessible. Direct concessional/ subsidized capital financing through climate funds (e.g. CIF or Green Fund) would lower the cost of capital for climate mitigation projects making them more attractive than alternative investments.
Low prices for carbon assets	Across sectors	Measures could be put in place to limit the use of the carbon market such that marginal projects benefit more from it.	Stronger additionality tests for CDM projects to ensure resources are used more efficiently. Limiting the supply will increase the prices that marginal projects will get for the credits generated thus improving their viability.
Limited access to private capital	Buildings & appliances	Encourage lending by private banks and investment companies by backing private loans with government guarantees, and dedicated international investment vehicles	
Split incentives (cost-benefit mismatch)	Buildings & appliances - energy efficient buildings		Sharing best-practices in the EU
Technology			

Barriers faced in realising mitigation potential	Applicable sector/technologies	Options to overcome the barrier faced	Potential financing and other cooperation mechanisms
Cleaner technology options unavailable either domestically or internationally	Buildings & appliances - energy efficient construction material for buildings	For technologies that are available internationally but not domestically, technology agreements could facilitate the access and transfer of such technologies. Where technologies are not available internationally and need to be developed, joint R&D cooperation agreements can be established to develop new technologies and bring it to market with IPR sharing addressed at the outset.	EU and India already have relevant forums under the bilateral framework to address both energy and technology issues (see section 1 on the panels/working groups in place). The work of these forums needs to culminate in general agreement on technology cooperation with the parameters for cooperation clearly defined, and supplemented with specific agreements on the acquisition and transfer of available materials/ technologies in identified sectors such as buildings and appliances. As part of such an agreement, a joint R&D protocol could be crafted to develop new materials/ technologies, with property rights clearly defined.
Lack of technical know-how and human capacity to adopt more advanced technologies	Power generation - more efficient coal-based generation - renewable - CCS - nuclear Industry	Requires bilateral and multilateral cooperation agreements that also includes the sharing and transfer 'soft' technology (i.e. know-how) other than the hardware supplied. Such cooperation should also include the training of staff to operate new technologies.	Grant funded capacity building activities and technology agreements (bilateral or multilateral). A multilateral Technology Acquisition Fund (as proposed by China) could ensure that the acquisition includes knowledge as well as the equipment/ hardware.
Technology has negative	Transportation - biofuels compete with	Requires intensive R&D to improve plant varieties that consume lesser water and to develop second	Technology-specific cooperation agreements and capacity-building

Barriers faced in realising mitigation potential	Applicable sector/technologies	Options to overcome the barrier faced	Potential financing and other cooperation mechanisms
externalities	food crops for arable land and irrigated water Power - nuclear waste - carbon leakage at storage sites of CCS projects	generation biofuels such as cellulosic biofuels as well as to address issues associated with leakage of carbon from CCS storage sites. India can also draw on best practices from other regions on the management of nuclear waste.	programs.
Technology uncompetitive	Transportation - electric vehicles (low distance travelled & weight capacity)	Requires joint R&D to bring down the costs of electric vehicles and improve performance parameters. This could be mutually beneficial in bringing electric vehicles to market faster in both regions as well as other parts of the world.	The joint R&D protocol discussed earlier could be extended to include research on electric vehicles. Alternatively, given the benefit to several countries/ regions, EU and India could consider promoting an international research partnership with other key countries along the lines of the ITER or the International Partnership for the Hydrogen Economy.
Technologies available internationally are not suited to Indian conditions	Power generation - efficient cleaner coal technologies Industry - range of technologies especially in the SME sector	Requires indigenous research supported by human technical capacity from developed countries (like the Swiss work on development of energy efficient kilns in the glass industry), and where relevant also co-financed internationally.	Technology agreements supported by financing to execute such research programs could be developed bilaterally.
Technology not proven	CCS	Technologies like CCS that are not proven at the scale envisaged even in developed countries. Further	CCS could be a part of a bilateral joint R&D protocol. Further, the EU

Barriers faced in realising mitigation potential	Applicable sector/technologies	Options to overcome the barrier faced	Potential financing and other cooperation mechanisms
		research is needed to bring down the costs of CCS and address other risks factors associated with the technology. Further, India could be a site for a demonstration plant but the costs of such experiments may need to be borne by industrialized countries to enable the buy-in of the Indian government.	could finance fully or partially, the costs of setting up a CCS demonstration plant in India.
Institutional			
Uncertain carbon market	Sectors/technologies amenable to CDM or other trading mechanisms	A long-term commitment to the carbon market is required, which could come in the form of an agreement at Copenhagen. Other political signals from the EU-India Summit regarding the continuity of the carbon market beyond 2012 can partially alleviate this problem. Alternatively, long-term funding commitment by industrialized countries to support renewable energy development in developing countries could offset the uncertainty in the carbon market.	Bilateral funds may serve as an alternative or an interim arrangement as a global climate change deal is negotiated. The EU, through the EIB and other financing vehicles, could commit to providing long-term financing for renewable energy projects in India, and to linking India carbon offset projects to the EU cap-and-trade system.
CDM institutions (EB and DOEs) overburdened	Sectors/technologies amenable to CDM	Reforming these institutions with the necessary infrastructure and resources in the case of the EB, and the right incentives for the DOEs will be essential for the smooth functioning of an expanded carbon market	Requires reform at the UNFCCC level although bilateral efforts can be made to improve the capacities at DOEs in the interim period.
Lack of clear regulations	Transportation - vehicle efficiency standards Nuclear	India will need to draw on international best practices in developing regulations in these areas.	Grants provided bilaterally or multilaterally to support for the development of standards/regulations

Barriers faced in realising mitigation potential	Applicable sector/technologies	Options to overcome the barrier faced	Potential financing and other cooperation mechanisms
	- accident liability		
Inadequate institutional mechanisms	Transportation - urban planning for demand management	India could learn from urban planners in EU countries that have been successful in integrating modes of transport and in the implementation of policies to discourage the use of private transport	Capacity-building and sharing best practices
Inability to access more efficient technologies and finance	SMEs	Requires the creation of intermediary entities (such as ESCos) to support SMEs in creating linkages between themselves, the technology providers and financiers.	Risk capital and guarantee mechanisms to support the creation of such service companies