PART I

EXPERIENCE AND LESSONS FROM EMISSIONS TRADING AND PROJECT-BASED MECHANISMS IN DEVELOPING AND TRANSITION COUNTRIES

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IMPLEMENTING KYOTO-TYPE FLEXIBILITY MECHANISMS FOR INDIA: PROBLEMS AND PROSPECTS

by

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1. Introduction

With the incorporation of 'flexibility mechanisms' in the Kyoto Protocol (KP), namely, emissions trading, joint implementation (JI) and the Clean Development Mechanism (CDM), incentive-based (IB) policies are being widely discussed in the context of greenhouse gas (GHG) abatement[1]. This paper examines various aspects of these incentive-based approaches for India, particularly the linkages among them and issues related to their implementation.

Whether developing countries (DCs) such as India will take on commitments to reduce GHGs in the long-run and whether they will eventually take part in a global emissions trading system is something that will only become clear as time passes. It is clear, however, that these countries will be affected by any global architecture for GHG abatement that emerges. In this context, this paper reviews recent developments (Bonn and Marrakech and beyond) and the implications of these for India. Thus, it examines the market for KP flexibility mechanisms, particularly emissions trading and CDM. For instance, it has been argued in light of various concessions, the market for CDM projects will be small (compared to GHG emissions in developing countries) and that it will be characterised by low demand and low prices (Halsnaes 2002, Jotzo and Michaelowa 2002).

The following section presents a brief overview of the nature and composition of greenhouse gas (GHG) emissions in India. This sets the context for the discussion that follows. Section 3 examines the likely nature and extent of India's involvement in CDM activities. It also addresses the division of gains from implementing CDM projects between host and funding parties as well as banking of CERs from 'low fruit' projects. Section 4 focuses on emissions trading and addresses the questions of equity and whether India stands to gain or lose if emissions trading is realised even if it remains outside such an arrangement during the initial commitment period. In the longer run, however, it is inevitable that

1 Both JI and CDM, are project-based mechanisms that are included in the Kyoto Protocol under Article 6 and Article 12, respectively. JI enables countries with specific emission reduction target under the Kyoto Protocol (Annex B countries) to obtain credit for implementing GHG reduction projects in other Annex B countries. CDM is broadly similar but pertains to abatement projects implemented in non Annex B (developing) countries. Article 17 of the Protocol allows emissions trading among Annex B countries.

India along with other rapidly industrialising countries will have to take on GHG reduction commitments. In this context, Section 5 examines the possibility of convergence across Kyoto-type flexibility mechanisms, particularly emissions trading and CDM, and issues of monitoring, enforcement and verification for these mechanisms. With regard to the latter, the pros and cons of emissions trading and CDM are compared from a conceptual and practical point of view. In the ultimate analysis, however, market-based instruments (MBIs) for GHG abatement in India cannot be viewed in isolation from an overall incentive-based orientation towards environmental policy as well as broader economic and legal reform that creates a suitable milieu for MBIs. Therefore, Section 6 examines problems of implementing MBIs in India in general, particularly those related to monitoring of emissions and of enforcement. Several specific solutions are also proposed. The final section concludes.

2. GHG emissions in India

It may be useful to begin by briefly reviewing the nature and composition of GHG emissions in India[2]. India has the world's second largest population and is the world's sixth largest emitter of carbon dioxide (CO_2). It is estimated that India emitted 908 million tons of CO_2 in 1998, four percent of the world's total (UNEP 2002). However, per capita emissions are 0.93 MT of CO_2 per annum were well below the world average of 3.87 MT per annum. The rate of growth of GHG emissions in India is 4.6 percent annually, compared to a two percent world average.

The most recent and most comprehensive national GHG inventory for India was prepared under the ALGAS (Asia Least-cost Greenhouse Gases Abatement Strategy) project of the Asian Development Bank (ADB 1998). In sum, its main findings were: (i) on a CO_2 equivalent basis, CO_2 emissions account for 53% of the total emissions, whereas methane (CH_4) and N_2O contribute 39% and 8% respectively; (ii) the energy sector is the main emitter of CO_2, accounting for 87% of total CO_2 emissions, the rest coming from the cement industry (4%) and land conversion (9%), and (iii) biomass burning and agriculture sector are the main sources of CH_4 and N_2O emissions with a small portion contributed by the transport sector (TERI 2001).

Further, among sectors of the economy that account for CO_2 emissions from energy, prominent are fuel combustion in industry (41%), electricity production (34%) and transport (17%). The main source of energy in India is coal mainly used for producing electricity and industrial energy requirements, and accounts for 62% of CO_2 emissions. During 1990-95 emissions in electricity grew at 8.6% annually and industrial sector emissions grew at an annual rate of 4.7%.

With respect to CO_2 emissions, therefore, the focus of CDM projects (and/or emissions trading in future) has to be in electricity production, industry and transport. The industrial sector consumes about 50% of the total commercial energy produced in the country. The most energy-intensive industries are fertilisers, iron and steel, aluminium, cement, and paper and pulp, collectively accounting for about two-thirds of total industrial energy consumption. There is significant scope for improving energy efficiency in these sectors as also in electricity production and transport (see TERI 2001 and RFI 2003 for details).

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2 For a detailed discussion on India's emission inventory see Garg and Shukla (2002).

3. Some issues for CDM in India

As mentioned earlier, under CDM, developed countries (or firms in those countries) can fund GHG abatement projects in developing countries where abatement costs are much lower. In turn, the developed countries receive credits ("certified emission reductions" or CERs) that can be used to offset their emission reduction obligations (for details see Toman 2000, Karp and Liu 2000 and Babu 2003 among others). There are two issues relating to CDM that are important in the context of incentive-based policies. First, CDM will be implemented on a project-by-project basis-the basic rationale for undertaking a CDM project is the difference in marginal abatement costs — (MACs) between the host country and the Annex B country. A key feature of a market, however, is a competitively determined price that is missing under CDM[3]. Thus, unlike a tradable permit market where inframarginal units of abatement are also sold at the prevailing market price, this may not always be the case under CDM and division of gains (the difference between MACs) could be an important issue for CDM projects. Some researchers have suggested that rather than receiving a competitive market price for emission reductions, developing countries may simply be paid the actual cost of abatement, perhaps with some markup (Chander 2003). On the other hand, Babu and others (2003) posit that the total gains from CDM as well as the share of developing countries will depend on their relative bargaining power vis-à-vis developed countries. This result holds whether CDM projects take place between individual firms across countries or through bilateral negotiations between governments. Thus, while a project-specific basis for defining and creating CERs under CDM may imply bilateral transactions (betweens firms or governments), a situation where the host country is required to accept payment at its MAC (or a small markup over it) is only one of a set of possible outcomes. The actual outcome would depend to a considerable extent on how well CDM itself is defined as an institution and how well market institutions (e.g., brokerage for secondary transactions) evolve.

The second issue vis-à-vis CDM as an incentive-based policy is that if developing countries took on emission reductions in future, implementation of low cost abatement projects (the so-called low hanging fruit) now would leave them with higher cost options later. However, as Karp and Liu (op. cit.) point out, the main problem with CDM is not that the most lucrative projects would be taken up first (as they should be) but the possibility that the host country receives inadequate compensation. The latter of course, is a function of the way CDM is set up as argued above. Thus, if host countries could create and bank their own CERs (if they thought the current price was too low) this would solve the problem[4]. More fundamentally, the question facing developing countries in this context is whether to cash in on CDM opportunities now or to wait. In any event, it would perhaps be more desirable to have global emissions trading where developing countries such as India could sell their emission reductions at a competitive market price. This is discussed in greater detail below. In passing, it should be noted that even if competitive trade in emissions were not established, developing countries

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3 Some modelling exercises, however, treat the flexibility mechanisms as fungible and assume CERs will be traded in a perfect international market along with other carbon emission credits such that there is a single global price (Jotzo and Michaelowa 2002). While this assumption may be useful in estimating likely prices under different model scenarios, until the Kyoto Protocol comes into force and CDM projects start getting implemented widely, it is not clear what will exactly happen. We come back to this issue later in the paper.

4 It is a moot point whether additional 'low fruit' opportunities would keep arising. This would happen only if convergence of technologies between North and South did not occur. This (lack of convergence) seems unlikely especially with deregulation and globalisation taking place in several economies in the South particularly India and China. Most of the old technologies in the energy intensive sectors in the South (power and transport for example) are being replaced by state of art technologies. Therefore, it seems more plausible to view the 'low fruit' as a one time opportunity.

(other than energy exporters) would still benefit from the implementation of the Kyoto Protocol since international prices of fossil fuels would fall due to cuts in Annex B consumption (Babiker *et al.*, 2000). This would facilitate faster economic growth in developing countries (Chander 2003).

We now turn to an examination of the likely nature and extent of India's involvement in CDM activities. There have been several recent exercises post-Marrakesh to estimate CDM potential and likely prices of CERs (Chen 2003, Halsnaes 2002, and Jotzo and Michaelowa 2002). The overall consensus of these studies is that the inclusion of sinks, hot air and withdrawal of the United States have changed the picture considerably. Nevertheless, it is also agreed that a host of factors could lead to wide variations in future carbon quota prices and CDM potentials. Broadly, one may classify these factors as either affecting supply or demand in the market for CDM projects. For example, carry-over of assigned amount units (AAUs) by transition economies to the subsequent commitment period would reduce effective supply of hot air thus increasing demand for CDM projects (and price of CERs). A similar impact could work through the supply side if carry-over of CERs reduced the effective supply of CDM projects. Other factors that could impact on CDM would be the extent of domestic action in Annex B countries, the extent of market power exercised by Russia and Ukraine, transactions costs, and such like. We do not go into details of these scenarios but refer the reader to the studies cited above. As an illustration of the impact of these factors, however, Jotzo and Michaelowa (2002) estimate in their standard case about one-third (32%) of effective emission reduction requirements of 1.2 Gt/CO_2 per year would be met through CDM projects at a price of USD 3.78 per ton of CO_2.[5] But in the same study the share of CDM in the global carbon market could vary from as much as 44% to 15% across different scenarios. Similarly, the international price of CO_2 according to the study could range from USD 6.24 to USD 1.33 per ton of CO_2 depending on the assumptions used. As and when the Kyoto Protocol comes into force and as negotiations for the second commitment period commence and unfold, it will become clearer which of these scenarios will prevail.

Irrespective of this, the relative ranking of marginal abatement costs and transactions costs will most likely determine the distribution of CDM projects across countries. Thus, countries that rely heavily on coal for their energy needs and/or countries where the major energy users (e.g., power plants and heavy industries) are relatively energy intensive and inefficient would have the greatest potential for large and cheap CDM projects (Jotzo and Michaelowa op. cit.). By this token, both China and India can expect a relatively large share of the CDM market—together, they are projected to account for about 60% of non-sink CDM projects (47% and 12% respectively). It is, therefore, certain that whatever the nature and scope of CDM projects that emerges globally, major coal-based GHG emitters such as China and India will play an important role.

Sector specific studies conducted for India indicate a significant potential for CDM projects in the power sector and in enhancing energy efficiency in industries (to the tune of about USD 1.05 billion each) over the next decade (CRISIL 1999). The investment potential for CDM projects in the transport sector is estimated at USD 23.5 billion over the same period (op. cit.). In contrast, non-CO_2 gases such as methane that are an important constituent of GHG emissions (39%), come from widely dispersed sources mainly in the agricultural sector. Thus, livestock and paddy cultivation account for 42% and 23%, respectively of total methane emissions in India. It is generally believed given the dispersed nature and small size of such sources, they will not be cost-effective as CDM projects.

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5 As stated earlier, in this study the international price is same across the flexibility mechanisms due to fungibility of credits.

4. Looking beyond CDM: equity and tradable permits

In the short-run, if emissions trading among Annex B countries is realised (under the Kyoto Protocol or otherwise) India would stand to gain even if it remained outside such an arrangement, at least during the initial commitment period. As noted earlier, a decrease in fossil fuel demand by industrial countries triggered by cuts in CO_2 emissions would lead to a reduction in world energy prices and benefit major energy importers such as India (Babiker *et al.*, 2000). In effect this would facilitate faster economic growth in developing countries other than energy exporters (Chander 2003). In addition, developing countries such as India also stand to gain through arrangements such as the Clean Development Mechanism.

Looking at the long-term horizon, international negotiations to decide on the architecture of GHG abatement regime beyond 2008-2012 will start in earnest by 2005. Even though India's annual per capita emissions are well below the global average, in the aggregate its emissions are large and growing rapidly. Thus, it is quite likely that India in particular (and developing countries in general) will have to take on some commitments to reduce GHG emissions. In fact, some experts have argued "the size of its (India's) aggregate emissions makes its participation in any future developing country commitment regime a *foregone conclusion*" (Sagar 2002, p. 3925, emphasis added). If India decided to accept a voluntary national commitment (which is what it would need to do to participate in Article 17 emissions trading) the basis for establishing this commitment would be vital. In addition to the widely discussed (but unlikely) per capita criterion, another possibility would be a 'growth baseline'[6]. It could also retain the option just to participate in project-based credit trading. In the long-run, however, there would have to be some international consensus on allocation based on equity, howsoever that were defined. Cazorla and Toman (2000) provide a useful survey of various concepts of equity and how these concepts could be applied in the context of climate change. According to them, while the concept of equity can be interpreted in many ways, "any criteria that might be used to distribute current and future burdens of GHG mitigation *must be based, explicitly or otherwise, on some concept of equity*" (op. cit., p. 5, emphasis added).

In particular, an allocation based on the per capita rule would give India permits in excess of its actual emissions much like Russian "hot air", which would be a financial windfall, at least in the short run[7]. For instance, on the basis of the per capita criterion, India could potentially increase its emissions in 2010 by 722 percent over the 1990 level (Gupta and Bhandari 1998, Table 6). Actual emissions, however, may not increase even three times over the same period[8]. This creation of Indian "hot air" may not be acceptable internationally and some compromise may be required[9]. As an

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6 This is an approach to developing country emissions commitments that would not cap emissions in absolute terms but would require countries to increase their GHGs emissions at a slower rate than their economies (Hargrave and Helme 1997). In other words, emission intensity (the ratio of GHG emissions to gross domestic product) would decline—very much like the Clear Skies Initiative announced by President Bush in February last year.

7 Some writers refer to this as 'tropical hot air' since it originates in developing countries (Philibert 2000). In general, hot air implies giving allowances for emissions that could be reduced at no cost.

8 In calculating per capita entitlement in year t, population is not pegged at some reference year but is taken at the actual level that prevails in year t. Thus, India with an increasing population gains disproportionately as compared to countries such as China that have stabilised their population. The "hot air" that India would acquire would be less if the reference population level were fixed at year 1990 or 2000.

9 In this context, it should also be noted that China's emissions are projected to roughly double (from 833 Mton in 1990 to about 1800 Mton in 2010). However, under the per capita criterion it can

extreme case, if all developing countries were successful in obtaining more emission allowances through a per capita criterion than what a "no-regrets" baseline would provide, huge amounts of tropical hot air would be generated undermining the UN Framework Convention on Climate Change (Philibert 2000). Even if a tighter cap on global emissions were agreed upon but allocated on a per capita basis, large financial transfers could result from countries with actual per capita emissions above this allocated level, to countries with actual per capita emissions below it. It is unlikely that there would be international consensus on such transfers.

In this context, however, it should be mentioned that such worse case scenarios may not come to pass. For instance, as we argue below, technical progress in abatement technology may depress permit prices and revenues for the South. Similarly, experience with the US sulphur dioxide trading program and with the nascent GHG market have led some to predict that prices for GHG permits will be below USD 10 per ton of CO_2 in 2010 (Springer and Varilek 2003). Thus, resource transfers to developing countries associated with emissions trading will be relatively low.

A recent study by Leimbach (2003) provides new insights on how the equal per capita allocation principle of emission rights influences the intertemporal path of emissions and the distribution of mitigation costs in the long run. For a variety of assumptions, the study shows that several developing countries (particularly India and those in sub-Saharan Africa) could benefit considerably from joining an international emissions trading system, thereby becoming potential collaborators in post-Kyoto climate agreements. The important variables considered are: (i) the point in time at which a complete per capita distribution of emission rights is realised (that is, early as in the year 2025 or late as in the year 2100), (ii) the share of allocated emission rights that can be sold (all or sale is limited to 30%), and (iii) the portion of emissions that can be covered by purchased emission rights. As expected, the highest gains for African countries and for India arise if the per capita rule takes effect sooner than later (op. cit.).

This result is corroborated by an earlier study by Manne and Richels (1995) that compares the impacts of a faster and slower transition to an egalitarian rule (that is, by year 2030 and 2100, respectively). Under the quicker transition scenario the burden would fall on the more industrialised regions (OECD and former Soviet Union), whose share in global CO_2 emissions falls from 66% in 1990 to 22% in 2030, whereas the less industrialised countries (China and Rest of the World) would gain. A slower transition, however, would lead to a preferential treatment of industrialised countries, since it would still allow them to emit 60% of total CO_2 emissions in 2030. An interesting point to note in the paper by Leimbach (and already alluded to in a footnote above) is that China's high rate of economic growth and its entry into middle income country status over the model horizon, implies under all scenarios it would be purchaser of emission rights. Of course, a shorter transition to the per capita allocation rule would still be slightly more beneficial to it.

More important, the implications of technical progress for permit prices and for alternative allocation criteria needs to be carefully thought through. An important result in the literature is that once the South has secured a quota allocation based on the per capita principle, it stands collectively to lose from progress in abatement technology because of the strong link from technical progress to the world market price of quota (Bertram 1996). A more restricted business as usual allocation rule gives the South smaller gains from the quota system, but enables it to retain some of the rents from its own technical progress. In other words, diffused technical progress of the kind that leads to a downward shift in the marginal abatement cost (MAC) curve of developing countries, could actually lead to a fall

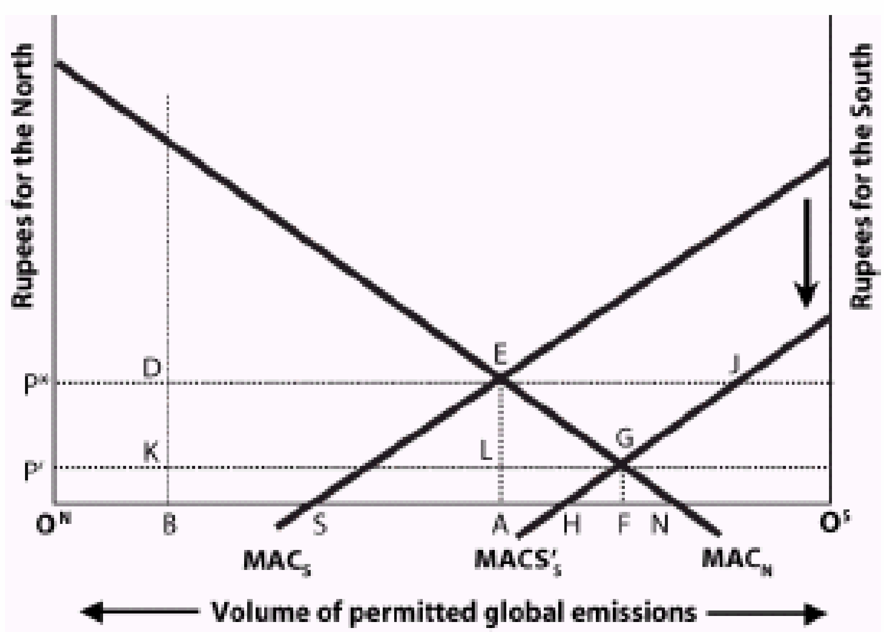
increase its emissions by 162% over the same period (Gupta and Bhandari op. cit., Table 6). Thus, it does not stand to gain as much by creation of "hot air" and may therefore be a less enthusiastic supporter of allocations on a per capita basis.

in revenue for permit exporting countries, and this result is particularly true when quotas are allocated using the per capita rule that gives developing countries such as India a large number of permits.

To elaborate, a downward shift in the MAC curve for developing countries has three effects which are relevant to their gains and losses from technical progress for a given global emissions budget: (i) abatement costs fall which frees up resources for other uses, (ii) the volume of quotas sold by developing countries to developed countries increases, and (iii) the world price of quota falls (Bertram op. cit.). The first two effects represent gains for developing countries whereas the third is a loss. The net result depends on the slopes of the MAC curves as well as the rule used to allocate quotas.

Figure 1 (cf. Bertram, op. cit., Fig 1) depicts MAC curves for two regions — the industrialised North and the developing South with the global emission budget fixed as the length of the horizontal axis. Emissions in the North are measured from ON and increase to the right. Thus, maximum unconstrained emissions for the North are ONN and its marginal abatement curve (MACN) is drawn sloping up from N. The South's emissions are measured from OS and increase to the left and its marginal abatement cost is MACS. Since aggregate business-as-usual emissions (ONN+OSS) would violate the global emission budget, under a tax or a permit system both regions would move up their MAC curves to E with a corresponding emissions tax/permit price P*.

Figure 1. Technical progress and permit prices



Technical progress, e.g., through CDM leads to a downward shift in the South's MAC curve to MACS'. As Bertram shows, if the North's MAC curve is sufficiently steep over the relevant range, then the decline in price of quotas will mean a fall in revenue of the South. For instance, the per capita rule would allocate ONB and OSB of quotas to the North and South, respectively. In the original situation (before technical progress) the North would abate to point E and buy BA of quota from the South paying a sum of BDEA. After technical progress, the North would abate less (to point G) and buy BF of quota from the South paying a sum of BKGF. Total revenue for the South would fall since BDEA > BKGF (effectively, KDEL > ALGF)[10]. Further, if this fall in revenue is greater than the reduction in the South's abatement costs then the South will lose overall from its own technical progress. He further shows that the slope of the North's MAC curve varies directly with the quota allocated to the South. In other words, with a liberal allocation rule such as the per capita rule the South could lose revenue due to technical progress[11].

5. The way forward: convergence across flexibility mechanisms?

In light of the forgoing discussion it appears likely that India could undertake CDM projects in the short-run and in the long-run take on some commitments (howsoever they were defined) and also possibly participate in an emissions trading regime. In this context, there exist various possibilities of linking project-based mechanisms such as CDM and more generic flexibility approaches such as emissions trading. Here we distinguish between convergence across these mechanisms in the long-run and the short-run.

With respect to long-run convergence for instance, there could be banking and carry-over of CERs by India beyond the first commitment period. This would particularly apply if some CERs were created suo moto by India (not through funding from Annex B parties) and banked with a view to future utilisation. Such a step would also address concerns about excessively low prices for CERs under current conditions and would also prove useful if a large potential buyer such as the United States came on board later. With fungibility across flexibility mechanisms and with eventual participation of India in an emissions trading regime, the CERs could be merged and traded along with permits. Thus, notwithstanding the vexatious problem of initial allocation of permits, it is possible to view India's participation in CDM activities as a bridge to taking part in full-blown emission trading in future.

Another way to think about long-run convergence of CDM and emissions trading would be to approach the issue from the other end, that is, to examine how a system of international emissions trading would be implemented by India, if it were to participate. Presumably, total permits allocated to India, howsoever this allocation were determined, would have to be distributed internally. If these permits were not sold, auctioned or grandfathered (or otherwise distributed in some hands-off manner) to firms, but instead were given away by the government to firms on a case by case basis in return for specific GHG abatement activities (with surplus permits retained by the government) this would de facto become a project-based mechanism. In effect, then the government could convert its (presumably generous) emissions cap into an 'exactly fitting cap' domestically and attain it through CDM type project-based mechanisms.

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10 It can be easily verified that an alternate allocation rule such as OSS to the South (in effect covering the South's baseline emissions) would lead to less loss in revenue to the South from technical progress.

11 "...with an exogenously set global budget allocated by the per capita rule with a consequent large redistribution of global permanent income towards the South, inhabitants of the South would lose from technical progress wherever in the world it takes place" (Bertram op. cit., p. 480, emphasis added). It is important to note that as a permit exporter the South would also be a net loser from technical progress in the North alone or from uniformly diffused technical progress. Thus, given the possibility of technical progress it would be better for the South to opt for a more conservative quota allocation rule such as one that covers its business-as-usual emissions-that is, a NRFTS (no-regrets for-the-South) rule.

With regard to convergence in the short-run, as argued earlier both India and China offer the greatest scope for a large class of CDM projects. But is also true in general that countries with stronger institutions and better capacity for CDM, more streamlined project approval process and lower transaction costs, would have a competitive edge in acquiring and implementing CDM projects. Thus, it is these areas that India could focus on and improve upon and this is where CDM and emissions could be linked in the short-run.

A possible organising principle here would be to conceive of CDM projects as broadly and at an aggregate level as possible. For instance, an umbrella CDM project for abating GHG emissions for coal-based thermal power sector as a whole could lower transaction costs and also garner a large flow of funds. There could be two possibilities here. First, an aggregate reduction in emissions could be agreed upon ex-ante (say by an association of industry or power producers) on the basis of specific interventions that are already under consideration such as improved operation and maintenance, coal washing and use of better coal, and employing energy efficient conversion technologies such as boilers, integrated gasification combined cycle (IGCC) and pulverised fluidised bed combustion (PFBC), (see TERI 2001 for details on these technologies and their CDM potential). The umbrella project then in turn could be implemented by instituting emissions trading or some other flexibility mechanism domestically across the power plants. At the plant level, actual reductions in GHG emissions could comprise a combination of specific interventions mentioned above. However, there would be flexibility in using specific technologies across plants and over time. Better information on costs and technology could alter the mix of measures that plants instituted. Further, as with all market-based instruments this approach would not require knowledge of plant specific marginal abatement costs—each unit would on its own adopt the most cost-effective combination of technologies. Thus, an umbrella approach would offer several advantages over a 'project by project' approach where each project at each plant is scrutinised and approved individually. For one, it would save time and lower transaction costs. Second, depending on the scale of the umbrella project the CDM funds acquired could also be substantial.

A second possibility would be for the plants (or an entity acting on their behalf) to collectively and ex-post present an aggregate amount of emission reduction as a CDM project. In other words, projects undertaken in consonance with CDM procedures could be aggregated and collectively put up for consideration for CDM funding. While less flexible than the ex-ante approach, this would still reduce transaction costs associated with case-by-case approvals and funding.

Another advantage of an umbrella approach both in the ex-ante and ex-post variants, would be that it would facilitate collective bargaining, and prevent individual project proponents from undercutting each other. While it may not be easy to achieve all these objectives, this suggestion is worth examining in greater detail. An important issue here would be the agency that would play the role of a coordinator or facilitator. Likely candidates could be the designated national authority (DNA) under CDM guidelines, industry associations or financial institutions. For instance, depending on the scale of the umbrella project financial institutions could implement such CDM projects unilaterally and get them funded later. This would be particularly useful for a collection of small projects that may be too small in themselves and may not have the resources to go through the CDM approval process.

Likely CDM scenarios with respect to the number of buyers and sellers may be summarised in a stylised manner below (Table 1). While there may be a continuum of buyers and sellers we simplify this into two categories—'many' and 'few'. Collective bargaining may be particularly relevant if there were many firms offering CDM projects within India but a few international funders, that is, the monopsonist market outcome. A situation with many 'buyers' and 'sellers' would be somewhat similar to emissions trading where CERs could be traded in something resembling a tradable permits market.

Table 1. Likely CDM Scenarios

CERs → ↓	**Many sellers**	**Few sellers**
Many buyers	'emissions trading'?	Monopolist market
Few buyers	Monopsonist market	Bilateral bargaining

Finally, an umbrella approach would avoid an ad hoc and eclectic portfolio of CDM projects that could result if these were taken up on a case by case basis. In the latter, the DNA would simply be in a reactive rather than a proactive mode. Whereas in the former it (or other agencies such as industry associations working under its guidance) could guide the process such that India maximised its share of CDM projects.

Thus, in the short-run (first commitment period) too there may be convergence of a different kind, namely, combining CDM internationally with emissions trading domestically. The experience with the phaseout of ozone depleting substances (ODS) under the Montreal Protocol may be instructive in this regard. Both India and China were major producers of ODS and thus eligible for funding of ODS phaseout projects under the Multilateral Fund (MF). The typical approach would be for individual projects to be screened by national steering committees and forwarded to the MF secretariat for funding on a case-by-case basis. In the case of China, however, for some sectors such as halon producers a sectoral approach was adopted and funding for an umbrella project was obtained. In turn, a tradable permit scheme was initiated domestically for phasing out production of halons, (see "Sector Plan for Halon Phaseout in China" at http://www-esd.worldbank.org/mp/whatsnew/fin-ap97.shtml for details). It is likely that a more comprehensive approach rather than forwarding projects on a case-by-case basis enabled China to garner more funds from MF than India.

With regard to monitoring, enforcement and verification, both CDM and emissions trading throw up their own challenges. The nature of the problem would be quite different for CDM projects approved and implemented on a case by case basis, than for sectoral or umbrella CDM projects. For the former, elaborate guidelines and procedures have been specified. In the latter case, the nature of monitoring and enforcement would be similar to market-based instruments (MBIs) in general. Similarly, monitoring and enforcing under emissions trading is a subset of similar issues under market-based instruments (MBIs) in general. As such, it is considered in detail in the following section.

6. Problems in implementing MBIs in India and possible solutions

The preceding discussion indicates that, the vexatious problem of carving up the global commons aside, incentive-based policies are beneficial both for India and for developed countries. It should not, however, be presumed that implementation of MBIs by India is an easy task. To begin with, the framework for environmental regulation in India is predominantly command and control (CAC). In the ultimate analysis MBIs for GHG abatement cannot be viewed in isolation from an overall incentive-based orientation towards environmental policy as well as broader economic and legal reform that creates a suitable milieu for MBIs. The following discussion applies to MBIs in general and not specifically to those targeted at GHG abatement.

Given the growing number of MBIs that are being used by countries around the world, the question is whether India is so different that none of the country experiences can be replicated here. And if so, what are these differences? In this context, note in particular the experience of China, Thailand, Malaysia, Indonesia, and other developing countries including the formerly planned economies of Europe. Many of these countries have (or had until recently), problems similar to those that are cited in the Indian context against the use of MBIs: imperfectly functioning markets, problems of monitoring and enforcing standards (due to an inefficient bureaucracy, shortage of resources, large number of micro and small-scale firms), and so on. While these difficulties are real and cannot be ignored, it is also true that the Indian situation is amenable to the implementation of well designed MBIs.

The implementation of MBIs has certain prerequisites like well-functioning markets, information on the types of abatement technology available and its cost (O'Connor 1995, p. 23-24). In addition, the collection of an emissions charge depends on a reasonably effective tax administration and monitoring of actual emissions. Tradable permit schemes require an administrative machinery for issuing permits, tracking trades, and monitoring the actual emissions. Since the development of these capabilities is crucial for the effectiveness of the instruments, MBIs cannot be considered as a short cut to pollution control. In other words, MBIs have institutional requirements just like regulatory measures.

It is important therefore, to examine potential problems in using MBIs in India and how they could be addressed. In the following discussion, we focus specifically on issues of monitoring and enforcement. We also suggest possible solutions.

6.1 Monitoring of discharges: conceptual issues and suggestions

Moving from a CAC regime to MBIs implies that attention has to be paid to the problem of monitoring emissions. For MBIs such as tradable permits to work well, the credibility of the system is important. If holders of permits cheat (by discharging more than their permits allow them to, and/or sell their permits and still continue to emit), then the confidence of players in the permit market will be undermined. Further, it is argued that since the effectiveness of MBIs depends crucially on the ability to successfully monitor discharges, till such time as the capability to monitor plant-level emissions/effluents is in place in India, it is not feasible to introduce MBIs. In response, it can be argued:

– Monitoring of discharges is also required under a properly functioning command and control regime. The emphasis on the phrase "properly functioning" is deliberate: the current practice of merely confirming that pollution abatement equipment is installed and working is not enough[12]. This "checklist" approach to ensuring compliance does not provide much information about actual emissions/effluents. Therefore, monitoring of discharges is not a problem unique to MBIs.

[12] In some cases, all that is required is that pollution abatement equipment is installed, not even whether it is operating properly. This is particularly true when courts are deciding whether to shut down polluting units.

In cases where direct monitoring of discharges is not possible (or is expensive), both theory and practice suggest several "second best" alternatives. To begin with, there are a number of ways to indirectly estimate these discharges. For instance:

- Data on inputs and/or output can be used to estimate emissions/effluents as long as the production function relationship between these variables is known. All that is required to implement these methods is detailed data on output in physical units or in monetary values. Of course, the more disaggregated the data, the more fine-tuned are the pollution coefficients, and the more accurate are the estimates of pollution.

- The example of Sweden shows that it is possible to promote a system of self-monitoring among large firms. In this case standard emission rates were used for determining NO_x charges for firms whenever emissions were not measurable. These rates were greater than the average actual emissions, and consequently encouraged the installation of measurement equipment by firms (OECD 1994, p. 59). This could be a feasible monitoring mechanism for large plants in India.

If it is not possible at all to estimate emissions/effluents (even indirectly), the following options are still available to regulators:

- They could use indirect instruments aimed at the outputs and inputs of the polluting industry or substitutes and complements to its outputs. For example, a tax on leather products would be an indirect method of addressing pollution from tanneries. These indirect instruments should be fine tuned to the extent possible, based on the pollution potential of different products/processes. For instance, a presumptive emissions tax on fuels should be differentiated by the emissions coefficients in different industries — thus, the cement industry which does not discharge the sulphur of its fuels, should ideally be refunded presumptive sulphur taxes on fuels (Eskeland and Jimenez, 1992).

- If emissions are fully determined by the consumption of one good, then that good can be taxed (e.g., carbon taxes based on the carbon content of fuels). By the same token, substitutes to the polluting good should be subsidised (e.g., mass transit if private vehicles are a cause of urban air pollution), and complements to the polluting good should be taxed (such as parking space).

Finally, in the context of GHGs particularly CO_2, it should be noted that monitoring of emissions is intrinsically easier — consumption of fossil fuels (and their carbon content) such as coal, oil and gas should be easily verifiable at an aggregate level

6.2 Monitoring and enforcement regime in India: stylised facts and directions for reform

Specific suggestions are offered below for modifying the current monitoring and enforcement regime. Again, these observations are made in the context of pollution in general and not GHGs in particular.

- While emission standards are set at the central level the responsibility for monitoring and enforcement rests with state pollution control boards (SPCBs).

- There is too much reliance on "pseudo-monitoring and enforcement", namely, verifying that pollution control devices are installed (also known as initial compliance), rather than on monitoring actual discharges (i.e., continuing compliance).

- For firms, the probability of being monitored is low. The same is true for enforcement. This is not only due to a shortage of resources and underfunding of SPCBs, but also due to the manner in which the Acts have been framed (see next point).

- The monitoring procedures are cumbersome. There is no provision for on-the-spot or remote monitoring. Samples have to be physically collected and sent to approved laboratories for analysis. In order for these samples to be used as admissible evidence in a legal case, elaborate procedures have to be followed. Thus, there is excessive burden of proof on the SPCB to prove that a violation has occurred. This reduces the expected penalty and weakens enforcement.

The following recommendations on changing the current monitoring and enforcement rules and practices are made with a view to introducing MBIs such as emissions trading. These recommendations, however, would also make the current CAC regime more effective:

- The definition of monitoring and enforcement should be changed from the static one used at present to a dynamic one that emphasises emissions discharged per unit of time. This implies that in addition to monitoring the ability to meet discharge standards, attention should also be given to frequent measurement of actual performance[13].

- The monitoring capabilities of SPCBs should be strengthened. Pecuniary incentives could be offered to SPCB staff such as rewards for detecting violations that ultimately result in conviction.

- The laws should be amended to allow on-the-spot measurement of pollution parameters where technically feasible, with portable monitoring equipment for quick detection of violations. The Acts should also be amended (particularly the Air Act), to allow the use of remote monitoring as admissible evidence where technically feasible.

- Self reporting of discharges by firms should be encouraged[14]. To this end, the Environmental Statement (an annual report required from firms on their environmental performance) should be implemented in a mandatory manner. In fact, this statement should be a part of the company's Annual Report, and the Companies Act should be appropriately modified to reflect this. If firms do not submit these statements, a presumptive value could be used for the amount of pollution generated by them[15]. The role of NGOs and other independent groups in assisting self-reporting by firms should be examined.

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13 This distinction was made by Russell and others (1986) in their seminal study on enforcing pollution laws in the United States.

14 Even in developed countries such as the United States with extensive monitoring of point sources self reporting is widely used.

15 One method would be to assume that the pollution intensity (i.e., pollution per unit output) of non-reporting firms, was equivalent to the highest decile of pollution intensity for firms in the same industry using similar processes. This figure could then be multiplied by the actual output of the non-reporting firm to arrive at a presumptive value of the amount of pollution generated by it.

– Regular monitoring of discharges by firms is essential. Often, however, due to paucity of resources random monitoring may be required. In this context, to use the resources available for monitoring and enforcement efficiently, it could be announced that firms detected violating the rules[16] would be placed on a special list and put on probation for a specified period. During this period they would be subject to a higher than average frequency of inspection[17]. If they followed the rules during this period they would be removed from the list. However, if they violated the rules during this period they would be treated as habitual offenders and action would be taken against them.

7. Conclusions

Despite near-term uncertainty about the size of the CDM market and the price of CERs, it is very likely that India will be a major player. This is also true in the long run where India along with other developing countries may take on some commitments and where emissions trading may be an important component of the GHG abatement architecture. While there are several issues of concern such as the impact of technical progress in abatement technologies on the gains from emission trading for India, on the whole it may stand to benefit from participating in such trading. Further, there are good prospects of convergence across CDM and emissions trading both in a short-run and in the long-run. However, it is important that we understand and address the problems in using a broad market-based approach to environmental management in India, particularly with respect to monitoring and enforcement.

[16] Under MBIs, violation of rules by a firm would include, inter alia, discharges in excess of levels allowed by permits held by the firm, non-payment of effluent taxes, non-reporting/under-reporting of discharges, etc.

[17] In other words, once a firm is caught a history is created and increases its chances of being caught again.

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