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Incentive-Based Approaches for Mitigating Greenhouse Gas Emissions: Issues and Prospects for India

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by Shreekant Gupta

1. Introduction

As a consequence of the flexibility mechanisms incorporated in the Kyoto Protocol (KP), incentive-based policies such as emissions trading and the clean development mechanism (CDM) are being widely discussed in the context of greenhouse gas (GHG) abatement. Whether developing countries such as India will ratify the Protocol or not 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 in either case these countries will be affected by any global architecture for GHG abatement that emerges.

It is therefore important that the issues surrounding the use of incentive-based approaches such as emissions trading are clearly understood and their implications for India are spelt out. Some of the specific questions that arise are: does India stand to gain or lose if emissions trading becomes a reality even if it remains outside such an arrangement? What are the terms under which it would be advantageous for India to take part in such trading? Are there any other incentive-based approaches, e.g., carbon taxes that India can/should adopt, either as part of an international collective effort or *suo moto*?

The following section sets the context for incentive-based approaches for addressing environmental problems in general. It briefly describes these policies as well as the international and national mandate for their use in the Indian context. Section 3 focuses in particular on incentive-based policies in the context of climate change. It examines mechanisms in the short-run such as CDM, as well as policies that could play a role in the longer-term,

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e.g., emissions trading. A key issue with respect to the latter is the initial allocation of permits and the potential gains from trade that could accrue to India. Section 4 examines domestic actions that India could undertake to complement an international agreement on GHGs. In particular, it focuses on the possibility of using a domestic carbon tax and its synergistic effects with a global emissions trading regime. Section 5 reviews problems in implementing incentive-based policies such as taxes and tradable permits in India in general and possible solutions. The final section concludes. It should be mentioned that this paper focuses on carbon dioxide emissions and does not address other greenhouse gases such as methane[1].

2. The context for incentive-based approaches

Economists have advocated the use of incentive-based policies (IBPs) to address environmental problems for over three decades. This advocacy is primarily on grounds of cost-effectiveness[2]. In other words, IBPs are a more cost-effective means of achieving a given environmental quality than alternative approaches such as direct regulation of polluters.

Essentially, IBPs work through the market system to influence the behaviour of economic agents such as firms and households, by creating economic incentives/disincentives, which in turn affect the pollution or other environmental impacts generated by these agents. For this reason IBPs are more commonly referred to as market-based instruments (MBIs)[3]. By contrast, the conventional approach to environmental regulation is through a set of “dos” and “don'ts” such as mandatory emission standards, equipment or process requirements. Thus, regulators attempt to determine both how much pollution is generated and also how it is abated. Occasionally these measures are combined with an outright ban or prohibition of activities that are deemed to be detrimental to the environment. This approach allows little flexibility to the agents being regulated in complying with the regulations. Hence it is referred to as "command and control" (CAC).

MBIs can be broadly classified in two groups: *price-based instruments* and *quantity-based instruments*. While all

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1. For an early attempt to address the issue of other greenhouse gases using a multi-gas framework see Reilly and others (1999).

2. A policy is cost-effective if it achieves its objective at least-cost compared to alternative policies.

3. A variety of terms has been used to describe MBIs. Some of these are "economic incentives", "economic instruments", "economic approaches", "market-oriented approaches", "market-based incentives", and "incentive mechanisms".

of these instruments can be used to address a wide range of environmental problems, they are discussed below primarily in terms of their application to greenhouse gas (GHG) abatement. Within the first group, one can further differentiate between *direct* and *indirect* price-based instruments. The former induce generators of pollution to reduce pollution by charging for the use environmental resources, e.g., air and water. Indirect price-based instruments on the other hand, increase (decrease) the prices of outputs and inputs that are complementary (substitutes) to the polluting activity. For example, a tax on petrol (or a subsidy to mass transit) is an indirect price-based instrument to address vehicular air pollution[4].

Quantity-based instruments create transferable/saleable rights for the use of environmental resources such as air and water, which are assigned/sold/auctioned to polluters. The major instrument in this category is <u>marketable permits</u>[5]. Under this approach, a target level of environmental quality is translated into the total amount of allowable emissions/effluent that can be discharged. The regulator then allots/sells/auctions the right to discharge in the form of permits which can be bought and sold (i.e., traded), subject to an overall ceiling of allowable discharges which has been fixed *a priori*. Given that this ceiling is less than the current aggregate level of discharges, there is a scarcity value to the permits and this puts an initial price on them. This price would increase over time as economic activity increases and more agents bid for the permits[6].

In fact, Article 17 of the Kyoto Protocol specifically allows emissions trading among Annex B (mainly industrialised) countries as a means of fulfilling their commitment to reduce GHG emissions[7]. As mentioned earlier, this proposal has attracted a huge amount of attention from economists, policy makers and non-governmental organisations (NGOs). It is also possible that a global emission trading system may emerge in the

4. From this example it will be clear that the effectiveness of indirect instruments crucially depends on the strength of the linkage between the transactions to which it is applied and the environmental problem that the instrument seeks to address.

5. Also known as tradable permits, tradable pollution permits, transferable permits, emissions permits, emissions trading or pollution licenses.

6. It is important to note two additional aspects of tradable permits. Firstly, tradable permits are not a "license to pollute," as is sometimes argued: while purchase of permits does allow the buyer to discharge more, this is matched by an equal reduction by another agent which has sold the permit, and thus forfeited its right to discharge by that amount. Secondly, if permits are designed so that they expire annually (or every few years) and have to be repurchased, the regulator can even tighten ambient environmental standards over time by *reducing* the amount of permits it sells each time.

7. This is sometimes also referred to as "cap and trade" since emission limits or quotas are allocated to Annex B countries which can then be traded.

long run that includes all nations and not simply the industrialised ones. Emission trading is discussed in greater detail in section 3 below.

Despite the longstanding advocacy by economists, it is only recently that MBIs have been endorsed both by the international community and by the Indian government. Principle 16 of the Rio Declaration on Environment and Development, which was adopted at the UN Conference on Environment and Development (UNCED) in 1992, and to which India is a signatory, states:

> National authorities should endeavour to promote the internalisation of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment.

The action programme to implement this declaration (better known as *Agenda 21*) which has been adopted by more than 178 nations including India, also reiterates this principle. In Chapter 8 it states "environmental law and regulation are important but cannot alone be expected to deal with the problems of environment and development. *Prices, markets and governmental fiscal and economic policies also play a complementary role in shaping attitudes and behaviour towards the environment*" (para 8.27, emphasis added). The document goes on to cite the increasing use of economic approaches not only in industrialised countries but also in Central and Eastern Europe and in developing countries. It further states "within a supportive international and national economic context and given the necessary legal and regulatory framework, economic and market-oriented approaches can in many cases enhance capacity to deal with the issues of environment and development" (para 8.29)[8]. Finally, *Agenda 21* also calls for more effective and widespread use of economic and market-oriented approaches to reinforce the synergy between environment and development.

A few months before the Rio conference in 1992 the Government of India also came out with a Policy Statement for Abatement of Pollution that, *inter alia*, declared that market-based approaches would be considered in controlling pollution. It stated "economic instruments will be investigated to encourage the shift from curative to preventive measures, internalise the costs of pollution and conserve resources, particularly water" (para 7.3). In particular, effluent charges for water pollution were singled out as an example of an economic instrument.

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8. Note the emphasis on the legal and regulatory framework as a prerequisite. I address this issue in section 5 below.

More recently, in 1995 the Ministry of Environment and Forests (MoEF) of the Government of India constituted a task force to evaluate MBIs for industrial pollution abatement. The task force submitted its report in January 1997. It recommended that MBIs such as taxes and permits be introduced at least on a pilot basis. There have been a number of government-sponsored workshops and meetings on MBIs since then and there are indications that some such instruments may be introduced in the near future[9].

In sum, the underlying principle of MBIs (not specifically in the context of climate change) has been cautiously endorsed by the international community as well as by the Indian government. As we see below, however, there are still a number of misgivings about MBIs both in the context of GHG abatement and for overall environmental protection[10].

3. Incentive-based approaches for climate change: short-run and long-run issues

In the context of India, the clean development mechanism (CDM) proposed under Article 12 of the Kyoto Protocol is the only policy that approximates an incentive-based approach in the short-run (that is, during the 'first' commitment period 2008-2012)[11]. In the long-run (beyond 2012), India might participate in GHG abatement through IBPs such as emissions trading. This, of course, would depend on a number of factors such as whether India accepted a cap on GHG emissions, how the permits were allocated, and so on. In this section, therefore, I examine issues related to IBPs in the short- and long-term from India's perspective.

Looking at the short-run: CDM as an incentive-based policy

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CDM is the only Kyoto flexibility mechanism that explicitly attempts to engage developing countries in international GHG abatement efforts[12]. It is similar in nature to joint implementation (JI) except that JI takes

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9. Remarks to this effect were made by the Special Secretary, Ministry of Environment and Forests (MoEF), Government of India at the joint MoEF-USEPA workshop on "Market Mechanisms for Air Pollution Control", New Delhi March 12-13, 2002.

10. For recent surveys on the experience with MBIs (in the US and internationally) see U.S. EPA 2001, Stavins 2001a, Stavins 2001b and Huber 1998.

11. This is often refereed to as the 'first' commitment period though it is not clear as to when the next commitment period will start and how long it will be. Thus, so far it is the only commitment period.

12. Joint implementation (formerly AIJ) and emissions trading being the other two. For an overview of Kyoto flexibility

place between developed (Annex B) countries, whereas CDM refers to cooperative agreements in which the host is a developing country (Karp and Liu 2000). Specifically, under CDM developed countries (or firms in those countries) 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 (see Toman 2000 and Babu 2002 for details).

There are two issues relating to CDM that are important in the context of IBPs. First, it should be noted that 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 1 country. However, the key feature of a market--a competitively determined price--is missing under CDM. In a permit market even inframarginal units of abatement are sold at the prevailing market price. Thus, in Figure 1 with maximum level of unconstrained carbon emissions E_f, at price P* emissions reduction would $E_f E^*$, and the shaded area to the left of E_f would be the surplus for a seller of permits from selling inframarginal units of abatement. Similarly, a buyer of permits (not shown) would also gain from buying permits at P*. Unlike permit markets with an observable price, division of gains from trade (the difference between MACs) will 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 2002). On the other hand, Babu and others (2002) 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.

[insert Figure1 about here]

Thus, while a project-specific basis for defining and creating CERs under CDM does 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. It is for instance possible that developing countries produce CERs for their own account and sell them at prevailing market prices into an active international exchange system.

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mechanisms see Weiner (1999).

While bilateral exchange with monopsony by rich buyers is a possibility, also eminently possible is a situation in which a big CER supplier (like China) could act like a dominant firm monopolist, especially if Russian "hot air" were constrained.

Though one would expect bargaining theory to shed light on this issue, unfortunately CDM does not lend itself to easy application of bargaining theory. For instance, in several bargaining models the outcome depends on relative bargaining power—a concept that is difficult to operationalise. In non-cooperative bargaining in particular, the models hinge critically on the exact bargaining protocol. It is, therefore, difficult to apply them to real world situations such as CDM without knowledge of how actual bargaining will be implemented. Further, several of the 'clean' theoretical results are based on two person bargaining, as also on the assumption of no collusion, whereas CDM will involve many players and may have coalitions (e.g., EU countries might act as one). One should, however, mention here that some robust experimental regularities have been observed in bargaining games of which a fair (50-50) division is the most prominent[13]. These empirical findings are contrary to what received theory predicts and only recently have there been attempts to develop a positive theory of the 50-50 division of the gains from trade[14]. This is useful to bear in mind in the context of CDM projects.

The second issue *vis-à-vis* CDM as an IBP is that if developing countries were obliged to take on emission reductions in the future, implementation of low cost abatement projects (the so-called low hanging fruit) now would leave them with higher cost options later. As Karp and Liu (op. cit.), however, rightly 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[15]. 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

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13. Most notable is Güth and others (1982) who studied experimentally the two-player ultimatum game and found that the average proposal by first-movers was roughly in the neighborhood of 60-40.

14. See for instance Lopomo and Ok (2001).

15. 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 globalization 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.

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 (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 and others 2000). This would facilitate faster economic growth in developing countries (Chander 2002).

The prospects for CDM in the near-term, however, are uncertain due to several developments post-COP 5 (1999). These are, *inter alia*: (i) US pullout from the Kyoto Protocol and (ii) granting of Article 3.4 sinks[16]. While the first development reduces global demand for GHG abatement drastically, the granting of sinks (combined with Russian and Ukrainian hot air) relaxes the abatement targets substantially. If Russia and Ukraine did not exercise market power (e.g., cartelize), Annex B emissions in 2010 would actually *increase* by 9% over the 2000 level and the carbon-equivalent price would fall to below $5 per ton C--in effect, not significantly different from zero![17] This is to be expected given a sharp drop in demand for abatement coupled with a huge increase in supply (sinks and hot air). On the other hand, if Russia and Ukraine were to cartelize in order to maximize revenue, Annex B emissions between 2000 and 2010 would roughly remain unchanged and the carbon-equivalent price would be around $25 per ton C (Babiker and others 2002). In either event, despite fungibility of emission reductions under the Kyoto flexibility mechanisms, there do not appear to be many takers for CDM in the short-run.

Looking beyond CDM: equity and tradable permits

International negotiations to decide on the architecture of GHG abatement regime beyond 2008-2012 will start in earnest by 2005. 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'[18]. It could also retain the option just to participate in project-based credit trading. In the long-run,

16. Under the Bonn and Marrakech agreements a total of about 70 MMtc of sinks have been allowed (see Babiker and others 2002 for details).

17. These results are consistent with several other studies cited by Babiker and others (2002).

18. 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. In other words,

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). I return to this point later.

In the discussion below as an illustration I trace out the implications for India should it take part in global emissions trading that meets the commitments by Annex B countries (see Table 1 for Kyoto emission reduction targets). While this relates to the scenario prior to the US pullout from the Kyoto Protocol and before the developments at COP 7 at Marrakech in 2001[19], the exercise is nevertheless useful in highlighting the potential volume of permit trading and the resulting permit prices.

[insert Table1 about here]

Likely prices of permits under alternative trading scenarios to implement Kyoto commitments are estimated using the Emissions Prediction and Policy Assessment (EPPA) model developed at MIT[20]. Under full global trading, emissions trading would not be restricted to Annex B countries (as proposed under the Kyoto Protocol) but would include countries such as India and China[21]. Since the latter have many more low-cost abatement options, the market price of permits would be much lower ($24/ton of carbon) compared to $127/ton under Annex B trading only. The gains from trade for India and China would be about $1.5 billion and $6 billion, respectively

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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 this year.

19. Following the Kyoto Protocol at COP 3 in 1997, a three year negotiation under the Buenos Aires Plan of Action (on the details needed for implementation) was launched by COP 4 (at Buenos Aires) in 1998. After the election of President George Bush in November 2000, however, the United States withdrew from the pact with Bush calling the treaty "deeply flawed". Other countries/groups such as EU, Japan and Canada pushed ahead and resumed negotiations at Bonn in July 2001 (COP 6 Part II). The so-called Marrakech Accords were agreed to at Marrakech (COP 7) in November 2001. See Babiker and others (2002) for details.

20. This is a multi-sectoral, multi-regional, computable general equilibrium (CGE) model of global economic activity, energy use and carbon emissions. The model can be used to generate MAC curves for different regions and countries which in turn are used to analyse various emissions trading scenarios. See Ellerman and others (1998) for details.

21. Though the issue of allocation of quotas to these countries is not explicitly addressed, it is assumed that their emissions will be as in the business as usual (BAU) scenario. This is consistent with other modeling exercises of this nature such as the MS-MRTS model and the G cubed model discussed below.

(Table 2). Moreover, the gains from trading worldwide would be $109 billion as compared to $66 billion from Annex B trading only.

[insert Table2 about here]

In this context, it is important to realise that India would not be the only player from the South if global emissions trading to implement Kyoto were to emerge. In fact, since India's emissions are relatively small compared to those of China, the latter would have a much larger amount of permits to sell. Basically, three countries would account for the bulk of exports: China (47%), FSU (23%) and India (11%), for a total of 81% altogether (Ellerman and others 1998). It is also important to note that compared to projected emission levels in 2010 of about 1790 million tons and 490 million tons for China and India, respectively, the amount of permits sold by each country would be much less--440 and 100 million tons, respectively (Tables 1 and 2).

Several other models such as the MS-MRT model and the G-cubed model also produce broadly similar results[22]. In the MS-MRT model, under the global trading scenario, non-Annex 1 countries assume an emissions target equal to their emissions under the no trading scenario (BAU). Similarly, in the G cubed model the allocation of permits to non-Annex 1 countries is consistent with their baseline emissions. As with the EPPA model, permit prices are lower under full global trading ($31 and $23 per ton, respectively) compared to restricted trading among Annex B countries only.

More generally, 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 windfall, at least in the short run[23]. For instance, on the basis of the per capita criterion, India could potentially increase its emissions in 2010 by 722 percent over the

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22. The Multi-Sector Multi-Region Trade (MS-MRT) model is a dynamic, multi-region general equilibrium model that is designed to study the effect of carbon restrictions on trade and economic welfare in different regions of the world. Unlike EPPA, China and India are grouped as one region in the model so it is not possible to look at their trading activity separately. See Bernstein and others (1999) for details. The G cubed model is also a multi-sector, multi-region intertemporal general equilibrium model of the world economy. See McKibbin and others (1999) for details. These models are among 13 that were used to compare the outcomes of a set of post-Kyoto scenarios in a special issue of the *Energy Journal* (Weyant 1999).

23. Of the Annex B countries, year 2010 emissions for Russia, Ukraine and the Baltic states (principal constituents of the former Soviet Union, FSU) are predicted to be below the aggregate level to which they committed at Kyoto. The difference between the FSU commitment (873 Mton) and predicted emissions (763 Mton) is known as "hot air" (111 Mton), a *de facto* right to emit (Ellerman and others 1998). See also Table 1.

1990 level (Gupta and Bhandari 1998, Table 6). *Actual emissions*, however, may not increase even three times over the same period (Table 1)[24]. This creation of Indian "hot air" may not be acceptable internationally and some compromise may be required[25].

More important, the implications of technical progress for permit prices and for alternative allocation criteria needs to be carefully thought through--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 in revenue for permit exporting countries (Bertram 1996). 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.

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.

[insert Figure2 about here]

Figure 2 (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 emissions are measured from O^N and increase to the right. Thus, maximum unconstrained emissions for the North are $O^N N$ and its marginal abatement curve (MAC_N) is drawn sloping up from N. The South's emissions are measured from O^S and increase to the left and its marginal abatement cost is MAC_S. Since aggregate business-as-usual emissions ($O^N N + O^S S$) 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

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24. It should be noted that 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.

25. 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 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 the per capita rule.

price P*.

Technical progress, e.g., through CDM leads to a downward shift in the South's MAC curve to MAC_S'. 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 $O^N B$ and $O^S B$ 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)[26]. 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[27].

4. The role and potential for economywide/sectoral policies in India to reduce GHG emissions

If India were to undertake to sell emission reductions as indicated above, how could these reductions be achieved efficiently? Again, rather than the project-by-project approach of CDM, it may be better to use an incentive-based approach such as a carbon tax and/or to remove energy subsidies. These steps would not only be more transparent but would also be more broadbased in their impact. In addition, such measures would be easily verifiable and implementable. A key issue of how to make these measures politically implementable is addressed below.

Removal of energy subsidies

Strictly speaking, this is not a tax since what is essentially proposed is the *elimination* of a negative tax, i.e., the

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

27. "...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.

subsidy[28]. While one could view this as a sectorwide CDM project, there is an ongoing debate about whether something like this would be eligible for CDM credit, that is, whether it would be “additional” enough. The same issues are also likely to come up in negotiating a national growth baseline.

It is true that these subsidies have been declining—during the first half of 1990s total fossil fuel subsidies in 14 developing countries declined by 45%. During the same period, OECD subsidies declined by 21% (Reid and Goldemberg 1998). In India, with the dismantling of the Administered Price Mechanism (APM) for petroleum products and ongoing economic reforms, these subsidies are set to decline even further. In general, energy price reforms in developing countries should be acknowledged as positive steps towards addressing climate change (op. cit.). There is, however, still a long way to go--the International Energy Agency estimates that in eight largest energy producing countries outside the OECD (China, India, Indonesia, Iran, Kazakhstan, Russia, South Africa and Venezuela), end-use energy prices are about 20% below their opportunity cost (Fischer and Toman 2000). Larsen (1994) estimated world fossil fuel (coal, natural gas and petroleum) subsidies in the range of $210-220 billion (with the former Soviet Union accounting for more than two-thirds of the total), or 20-25% of the value of world fossil fuel consumption. The importance of focusing on a few key countries is underscored by the fact that 90% of the world coal is consumed by 15 countries; almost 80% of world petroleum products by 28 countries and almost 90% of the world natural gas by 18 countries (Larsen 1994). Further, these countries emit 85% of global carbon from fossil fuels (op. cit.).

More important, this study and an earlier one by Larsen and Shah (1992) estimates the environmental benefits associated with the elimination of these subsidies[29]. As mentioned earlier, in determining the level of energy subsidy border prices are used as the benchmark (a surrogate for the marginal opportunity cost of production). The subsidy is simply the ratio of the domestic price to the world price times the domestic consumption of the fuel. Removal of these subsidies is expected to lead to reductions in fossil fuel consumption and therefore carbon emissions. The size of the reductions would, of course, depend on the price elasticities. The studies use a partial equilibrium approach that assumes factor prices, other than energy prices, and the level of aggregate output remain constant. They also assume constant price elasticity of demand for each fossil fuel. Long-run

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28. Subsidy is defined as the difference between domestic fossil fuel prices and their (private) opportunity cost evaluated at end-user prices. When fuels are traded internationally border prices serve as opportunity cost, which is the case for petroleum products. In this case end-user opportunity cost would be border prices plus a distribution markup.

29. The main difference between the two is that the more recent study by Larsen allows for the possibility of interfuel substitution (between coal, petroleum and natural gas) whereas the earlier one does not.

own price elasticities of energy demand for various countries are obtained from Bohi (1981) and other studies.

In the case of India subsidies for coal were $2.55 billion (based on a domestic price to border price ratio of 0.62). For petroleum products the figure was $4.25 billion (based on a price ratio of 0.33 for kerosene and 0.79 for diesel) for a total energy subsidy of $6.8 billion, or 2.3 percent of GDP (Larsen 1994, Tables 2 and 5). Further, an increase in prices of these fuels would result in a reduction in CO_2 emissions by 9 percent in the year 2010 relative to the baseline (that is, without removal of subsidies)[30].

The study by Larsen and Shah (henceforth L-S) estimates the welfare gain of removing fossil fuel subsidies in 13 non-OECD countries/regions as approximated by the Harberger triangle[31]. Total welfare gains in subsidizing countries from removing fossil fuel subsidies is $33 billion, i.e., 15 percent of world subsidies. As expected, welfare gains are largest for the former Soviet Union ($29.3 billion) and the welfare gain for India is $74 million. These figures could be an underestimate for various reasons. First, as a measurement issue the Harberger triangle would understate welfare gains because the approach uses linear approximations to nonlinear demand and supply functions used by L-S. More important, however, these figures may significantly understate true welfare gains if *costs of local pollution* and alternative uses of revenue from subsidy removal are not taken into account.

On the other hand, however, if all countries removed these subsidies at the same time there would be large reductions in their fossil fuel demand <u>and</u> a fall in world energy prices at the same time[32]. On account of the latter, energy exporting countries would lose and energy importers would gain. Thus, welfare gains for the former Soviet Union would be reduced to $22 billion but for India they would increase to almost $21 billion (L-S op. cit., Table 4). For the world as a whole (that is, including subsidizing and non-subsidizing countries) the welfare gain would be $22.5 billion (down from $33 billion earlier).

From a practical viewpoint, removal of subsidies in developing countries such as India may be difficult to implement politically. This is due to the fact that large constituencies have been created (such as truckers) who

30. For India, the own price elasticity used for coal is 0.6 and for petroleum products it is 0.25. It should also be noted that emissions without the subsidies do go up but not by as much—thus, emissions increase by 2.5 times over 1989 levels without subsidies compared to 2.8 times if the subsidies were not removed (Larsen op. cit. Table 6).

31. An important caveat is that welfare calculations are based on estimating producer and consumer surpluses of fossil fuel production and consumption, respectively, and this assumes full employment of resources. It should therefore be considered as a *long-run approximation* to welfare gain (Larsen and Shah op. cit.).

32. Removal of subsidies leads to a downward shift in world energy demand and results in a lower equilibrium price and

benefit from these subsidies. The environmental benefits, however, of reduced carbon emissions would be a good reason for doing so. In this context, it is useful to note that an OECD carbon tax that would achieve the same world emission reductions as those resulting from subsidy removal in non-OECD countries, would be quite substantial—in the range of $50-90/ton (L-S op. cit., Table 5). Therefore, as an alternative to (or in conjunction with) emissions trading with countries such as India, it might be possible for OECD countries to substitute some of their own carbon taxes by compensating non-OECD countries for removing fossil fuel subsidies. Though removal of subsidies is welfare improving in the long run even in the absence of this compensation, transfers from rich countries would help mitigate short run adjustment costs and the distributional consequences (of removing subsidies) in poor countries, and make this step more feasible. This also assumes OECD countries could get credits against their emission reduction obligations for doing so.

A more recent study for coal-based electricity generation in India also shows that policies that remove price distortions (namely, marginal cost pricing and elimination of subsidy to producers) combined with freer imports of high quality coal, could reduce carbon emissions by 6.6% (Khanna and Zilberman 1999). Further, this reduction in carbon emissions is accompanied by an increase in the volume of electricity generated, lower coal consumption and an increase in social welfare by 8.6%. This reinforces the beneficial impact of the removal of trade and domestic policy distortions on carbon abatement.

The potential for using carbon taxes

Though recent discussion on economic responses towards climate change has been dominated by tradable permits, there has also been considerable work on the role of carbon taxes (see Baranzini and others 2000 for a recent survey). The world's first carbon tax was introduced by Finland in January 1990 ($6.10 per ton of carbon on all fossil fuels). Since then, five other countries--Sweden ($45/ton), Norway, the Netherlands, Denmark and most recently, Italy--have implemented taxes based on the carbon content of energy products[33]. These are certainly the most direct price instruments to reduce carbon emissions.

An early study estimated that even a modest tax of $10/ton on the carbon content of fossil fuels, imposed individually by all countries could raise $55 billion in the very first year of its operation (Shah and Larsen 1992, henceforth S-L). In this context, India's carbon emissions estimated at 148.2 million tons in 1990 could have

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quantity (but this quantity is greater than what would have prevailed if world price effects had not been considered).

33. Austria and Germany recently introduced energy taxes but these are not based on carbon content.

yielded potential tax revenue of $1482 million[34]. It is also true that carbon taxes in general are easier to administer than taxes on personal and corporate income and thereby less prone to tax avoidance and evasion. The issue is one of their relative efficiency and equity *vis-à-vis* other taxes.

S-L examine the *incidence* of such a carbon tax for Pakistan and conclude that under partial forward shifting of the tax, it is roughly proportional or progressive in incidence (depending on whether income or expenditure is taken as a base). Given that a tax on personal income is also not necessarily progressive in developing countries (due to widespread evasion and exemption of rural incomes) they conclude "regressivity of carbon taxes should be less of a concern in developing countries than in developed countries" (op. cit., p. 11).

They also estimate the *efficiency costs* of carbon taxes for five countries including India[35]. These costs are defined as the *net* marginal welfare cost of replacing other taxes by a carbon tax. The two taxes considered are personal income tax and corporate income tax. With respect to the personal income tax, a revenue neutral switch to a $10/ton carbon tax leads to a *net welfare loss* in all countries studied. For India this figure is $129 million. For corporate income tax, however, there is a *net increase in welfare* of $250 million for India[36].

It is also of interest to consider welfare costs of carbon taxes with <u>no change</u> in existing taxes. In this case L-S find that welfare costs for India are $130 million, that is, about 8.8 cents per dollar of revenue from the carbon tax ($1482 million). In other words, welfare costs represent only a small fraction of carbon tax revenues. It is also interesting to note that the welfare loss ($130 million) is almost the same as that in the previous case where carbon tax revenues were recycled to reduce personal income taxes ($129 million). In other words, personal income taxes are so ineffective and tax evasion is so widespread that the welfare effect of a reduction in these taxes is negligible.

Any discussion of a carbon tax in the Indian context must also bear in mind subsidies that already exist on fossil fuels. In fact, as mentioned above a large proportion of the carbon tax would go towards neutralising these subsidies. For instance, the price of coal in India was only 85 percent of long run marginal cost (LRMC) in 1990

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34. Since the amount of tax being considered is small the authors believe that a partial equilibrium approach is reasonable, unlike taxes of $100/ton or higher that are frequently discussed in global models.

35. The other countries were USA, Japan, Indonesia and Pakistan.

36. This increase is incidentally the highest among all the countries studied. In fact, these results "lend support to the widely-supported view that corporate income taxes are far more distortionary than labor income taxes." (op. cit., p. 19).

(Bates and Moore 1991), implying a subsidy of 15%. Thus, a carbon tax of $10/ton would lead to an approximately 26 percent increase in coal prices in 1987 (the reference year). Thus, to the extent that a carbon tax eliminates these subsidies it should be considered a welfare gain.

In light of this result, S-L re-examine the welfare cost of a revenue neutral switch from a personal income tax to a $10/ton carbon tax. The difference as compared to the earlier case is that now a welfare gain of $33.8 million (from removing the subsidy on coal through a carbon tax) is explicitly included in the calculations[37]. This gain is exactly offset by a welfare loss of $33.9 million due to the carbon tax on petroleum products[38]. In sum, the efficiency cost of a revenue neutral switch to a carbon tax is zero, *provided welfare gains from removal of other price distortions are accounted for*.

Last but not least, in addition to abating emissions of greenhouse gases (GHGs), a carbon tax could also result in *reduced emissions of local and regional pollutants* such as oxides of sulphur and nitrogen, carbon monoxide, and particulates (SO_2, NO_x, CO, and PM, respectively). This is due to its effect on the level and composition of fossil fuel use. In other words, such a tax would not only address a global externality, but also help in addressing regional and local environmental problems. Since coal is the predominant fossil fuel consumed in India, emission reductions due to a carbon tax would be the highest here (compared to other countries). Comparing the welfare cost ($130 million) of a $10/ton carbon tax (no change in existing taxes) with various estimates of benefits of a reduction in SO_2, NO_x and PM emissions, the benefit-cost ratio ranges from 1.9 to 9.5 (S-L op. cit., Table 4.1)[39].

A more recent study by Bussolo and O'Connor (2001) uses a CGE model to specifically examine the ancillary benefits of limiting CO_2 emissions for India. Ancillary benefits are defined in terms of reduced mortality and morbidity due to reduced particulate concentrations and are estimated at 334 lives saved per million tonnes of carbon abated (or $58/ton of carbon emissions reduced in monetary terms). These benefits are juxtaposed against the welfare costs of CO_2 abatement through a tax to arrive at the level of "no regrets" abatement (the

37. In these calculations interfuel substitution is ignored as in previous cases, thus under/over stating the true welfare gain/loss.

38. The authors do not consider the removal of subsidy in the price of petroleum products in this simulation.

39. The wide range for this ratio is due to the uncertainty/imprecision in arriving at a monetary value of the benefits of emission reductions. The main monetary benefits come from improved health and reduced corrosion but the estimates are "likely to be crude at best" (op. cit., p. 23).

level of abatement where ancillary benefits are at least as much as the cost of abatement). This level ranges from 13-23 % of baseline CO_2 emissions in the year 2010 (depending on the values of statistical life and substitution elasticities used in the analysis). In other words, just on the strength of ancillary benefits CO_2 emissions could be reduced by at least 12-13% over the baseline in the year 2010 without any net cost.

Unlike the partial equilibrium approach and small levels of carbon tax in the S-L study cited above, a more recent exercise by Fisher-Vanden and others (1997) uses a multi-sector computable general equilibrium model for India to examine the impact of rather large carbon taxes on carbon emissions. Three scenarios are analysed over the modelling horizon (1990-2030), namely, varying carbon taxes to ensure stabilization of carbon emissions at 1990 levels in each time period (the so called 1X case), at most a doubling of carbon emissions in each period (the 2X case), and at most a tripling of carbon emissions in each period (the 3X case). In the 1X case, carbon taxes start at $40 per ton of carbon (TC) and go up to $1100/TC in the year 2030[40]. The corresponding figures for the year 2030 are $162/ton and $25/ton in the 2X and 3X case, respectively. Though the revenue received from these taxes is recycled back to households as additions to personal income, there is a fall in GDP and consumption—in the 1X scenario for instance GDP and consumption in 2030 decline by 6.3% and 14.6 %, respectively. These taxes also imply a significant increase in fuel prices—a $100/ton carbon tax would translate into an increase of 98% in crude oil prices and 276% in coal prices over 1985 levels (op. cit. Table 11).

What this analysis suggests is that a national carbon tax large enough to stabilize carbon emissions would be costly for India[41]. Thus, it may be desirable to couple a stabilization target with global emissions trading where permit allocations are either grandfathered (at 1990 levels of carbon emissions) or decided on a per capita basis. In the former case, due to rapid future economic growth India would be a net *buyer* of permits. But on the whole this approach would still be less expensive ($50 billion in 2030) than domestic abatement through a national carbon tax ($72 billion in 2030). With a per capita allocation, however, India would be a net *seller* of permits and would have a *net gain* of $57 billion in 2030. Thus, an allocation of permits in between these two cases would make India indifferent to participation in a global carbon stabilization agreement.

5. Problems in implementing MBIs in India and possible solutions

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40. All figures are in 1985 dollars.

41. Unlike S-L or Bussolo and O'Connor this study does not consider the additional benefits of reduced emissions of local and regional pollutants.

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. In the Indian context, these policies include not only emissions trading but also carbon taxes and other economic policy reforms. 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). There is a reluctance to consider MBIs even for local environmental issues such as vehicular or industrial pollution. No matter how compelling the case for MBIs, and notwithstanding the mounting evidence of their use globally, their implementation is far from certain in India. 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 a bloated and 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.

To begin with, I focus specifically on issues of monitoring and enforcement. I then examine barriers to implementation of MBIs in India more generally and classify these barriers into three groups. It is important to keep in mind that some barriers particularly institutional and organisational, are not unique to MBIs and apply equally to a CAC regime. I also suggest possible solutions to problems in implementing MBIs. Finally, I address concerns of equity *vis-à-vis* MBIs.

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[42]. 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.

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

42. 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.

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 NOx 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 sulfur of its fuels, should ideally be refunded presumptive sulfur 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 subsidized (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

Monitoring and enforcement regime in India: stylized 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 emphasizes 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*[43].

- The monitoring capabilities of SPCBs should be strengthened. Pecuniary incentives could be offered to

43. This distinction was made 16 years ago by Russell and others (1986) in their seminal study on enforcing pollution laws in the United States.

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[44]. 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[45]. The role of NGOs and other independent groups in assisting self-reporting by firms should be examined.

- 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[46] 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[47]. 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.

I now turn to barriers to implementation of MBIs more generally and also propose possible solutions. The barriers are grouped into three categories as described below:

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

45. 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.

46. 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.

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

Policy barriers

These mostly pertain to shortcomings in the current environmental policy framework that potentially hinder the introduction of MBIs:

(i) The biggest policy barrier is inadequate understanding of MBIs among all stakeholders (industry, NGOs, government and the general public). This results in a number of misconceptions about MBIs, not only among the general public and NGOs, but among industry and policymakers as well. While there are a number of legitimate concerns about MBIs such as the problem of thin markets[48], it is not true that MBIs are a "license to pollute" as is often argued. A better understanding of what MBIs can and cannot do and their actual track record in other countries (particularly developing countries), is vital for their general acceptability.

(ii) More generally, market-based approaches are part of an overall economic approach to environmental problems. While regulatory agencies and industry in India have a number of competent technical staff such as environmental scientists and engineers, there is a paucity of economists working on environmental issues.

(iii) There is an interest among stakeholders in favour of status quo. Many industries favor fine tuning of the current environmental policy regime rather than a major paradigm shift entailed by MBIs. For example, firms that have invested heavily in pollution abatement equipment do not stand to gain much out of differential abatement implicit in MBIs[49]. Firms that are still in the rent-seeking mindset of the 'license-permit *raj*' are more comfortable with a CAC regime where they can lobby regulators than with a market-based regime where they have to operate in a competitive market. Similarly, bureaucrat-

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48. More generally, advantages of permits may not be fully realised if market imperfections prevent the permit market from functioning smoothly. For example, if the flow of information is imperfect, potential buyers and sellers of permits will not be able to engage in profitable trades. In the presence of this and other distortions in the permit market (e.g., large search costs, strategic behaviour on part of the players), an emission tax system may be preferred. Further, in the United States it has been noted that much of the permit trading involves large corporations, perhaps since it is only feasible for larger firms to absorb the *high transaction costs* without jeopardising the gains from trade (Tietenberg 1991, p. 105). Also, with large transaction costs, the final equilibrium allocation of permits, and hence the aggregate costs of control, also become sensitive to the initial permit allocation (Hahn and Stavins 1992, p. 466).

49. Under <u>differential abatement</u> firms can reduce/abate pollution by varying amounts depending on their costs of pollution abatement. In other words, high cost firms may prefer to abate less and pay the pollution charges or buy permits, whereas low cost firms would do just the opposite. By contrast, in a CAC regime all firms have to abate

dominated regulatory agencies in India are more comfortable with CAC and suspicious of markets. In short, it is not apparent that there is a serious commitment to MBIs among stakeholders.

(iv) In addition to a bias towards direct regulation, environmental agencies such as the central environment ministry, the pollution control boards and state environment departments lack policy analysis capabilities. This makes it difficult for them to take a holistic and long-term view of environmental issues whether they be trade and environment, transboundary environmental problems, or MBIs. Most agencies are too caught up in day-to-day administration, public interest litigation and answering legislative questions. Due to these short-term pressures they are unable to focus on 'big picture' issues, and even if they would like to they lack the capability to do so.

(v) A major legal barrier is that enabling changes are required in current legislation to allow differential abatement entailed by MBIs. Since the CAC regime is enshrined in the current legislation new legislation to supersede/modify existing laws may be required. For example, Schedules I, II, and VI of the Environment (Protection) Rules, 1986 specify environmental standards for various air and water pollutants such as particulates and BOD. Thus, a tax on emissions where firms had the option of paying the tax rather than abating would violate these rules.

<u>Institutional and organisational barriers</u>

Broadly speaking, the issue here is of *governance* that is a major barrier to successful implementation of MBIs. Good governance, however, is required not for MBIs alone but for any regulatory regime. One aspect of governance not mentioned below but which is a constant backdrop is corruption. Bribing of regulators at various stages of monitoring and enforcement can render MBIs ineffective. Again, this problem is not unique to MBIs:

(i) In particular, state pollution control boards (SPCBs) are not autonomous of the state government in their staffing and day-to-day functioning. This limits their effectiveness. Moreover, non-specialists who may be unfamiliar with the complexities of environmental management often manage these boards.

(ii) Monitoring and enforcement are areas where institutional deficiencies could be critical with respect to the use of MBIs in India. As stated earlier, however, it is incorrect to argue that MBIs require more

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pollution uniformly.

intensive monitoring and enforcement as compared to command and control (CAC). A well functioning CAC requires as much monitoring and enforcement as MBIs.

Political and cultural barriers

These are largely problems of political economy that militate against MBIs:

(i) Recent reforms notwithstanding, India has a tradition of direct state intervention in various spheres of the economy and society. For a number of historical and other reasons Indian policymakers and intelligentsia have viewed markets with suspicion. This is also true in the context of environmental policies. Given this mindset it is not surprising that traditional CAC approaches have been relied on so far.

(ii) In addition to regulatory agencies, politicians too would lose discretion and influence under a market-based regime and are therefore reluctant to embrace it.

(iii) Government agencies typically do not have a tradition of openness and public participation. This could be a problem for MBIs, particularly when they are being phased-in and when dialog and discussion are required.

(iv) India is a pluralistic society where interest groups (industry, labour, farmers, etc.) jostle to extract concessions from the state. Further, a sense of being entitled to a free lunch is ingrained among various interest groups. Both of these features result in a reluctance to pay for services be it higher education or a clean environment. Thus, there is resistance to pay for the 'use' of water or air as would be the case under MBIs.

Possible solutions

These range from specific measures to broad policies and are not listed in any particular order below:

(i) It is necessary to strengthen the knowledge base for MBIs. Information on best practices *vis-à-vis* MBIs around the world could be compiled and analyzed for possible lessons for (and application to)

India. This information should be regularly updated since the application of MBIs around the world is increasing rapidly.

(ii) Maintaining (and perhaps even accelerating) the deregulation and opening of India's economy would help in the adoption of MBIs. A more market-oriented mindset on part of Indian industry would also help in acceptance of MBIs. Similarly, pressure to reduce the fiscal deficit by reducing government expenditure should result in downsizing of government. In the overall context of deregulation, there should be a review of environmental functions the government could withdraw from--a knee-jerk response of trying to solve environmental problems by enacting laws and regulations should be avoided.

(iii) Resources such as water should be rationally priced to discourage dilution. Since water is a state subject this will require consensus building among the states.

(iv) There should be a comprehensive overhaul of the functioning of SPCBs and they should be made autonomous of state governments. It should also be ensured that environmental professionals rather than generalists manage these agencies. While some boards face resource constraints lack of autonomy is a greater problem.

(v) Existing environmental laws should be amended and/or new ones enacted to empower central/state governments to prescribe MBIs. Before this can happen, however, it will be necessary to convince the political establishment at the highest levels about MBIs.

(vi) A key requirement for bringing about greater transparency and accountability (which are critical for effective functioning of MBIs) is right to information. It is necessary to integrate something like the Freedom of Information Act (FOIA) in the United States into environmental laws and to implement it seriously.

Distributional consequences of market-based instruments

As is the case with CAC policies, the benefits and costs of MBIs will vary by income class and by region. Here I briefly touch upon the distribution of the *costs* of environmental policies in general, and MBIs in particular. Most empirical studies on the distribution of pollution control costs have been in the context of existing environmental policies that are largely CAC in nature. Thus, studies in the US during the 1970s-80s show that abatement costs were shifted by industry to consumers through higher prices, and these in turn reduced the real incomes of various income classes differently[50]. Typically, the incidence of these costs was regressive. While these studies do not directly examine the distributional effects of MBIs, *per se*, it seems likely that these effects could be regressive as well (perhaps less so since total costs of abatement would be lower) since the same dirty industries would have to undertake the bulk of pollution abatement under both regimes.

Such undesirable distributional effects of the costs of environmental policies, however, can be corrected through other accompanying measures. For example, pollution taxes could be applied together with reductions in other distortionary taxes as discussed earlier. Transitional reallocation problems (such as output and job losses due to higher costs in polluting industries), will arise when the economy is moving towards a more environmentally-friendly production and consumption structure. These problems should be addressed by targeted programs of assistance rather than by a general dilution of environmental goals.

Since the main objective of MBIs (and environmental policy in general), is efficient allocation of resources they are not very well suited for redistribution objectives. To quote a leading environmental economist, "it is important to remember that the basic objectives of taxes on pollution (or other environmental programs) are allocative in nature; their purpose is to achieve important targets for environmental quality. ..... Where their adverse redistributional impact can be easily addressed, it is surely important to do so, but environmental measures should not, in general, be side-tracked on redistributional grounds" (Oates 1994, p. 129).

6. Conclusions

Incentive-based approaches for mitigating GHG emissions in India cannot be viewed in isolation from a broader commitment to MBIs to address environmental problems. Despite national and international mandates there are a number of obstacles to implementing MBIs in India. It is possible, however, to address these problems and to articulate broad principles for using MBIs. In general, incentive-based policies (IBPs) are more flexible than command and control regulation and are also more cost-effective. Thus, IBPs can help growth and/or free up resources that could address distributional concerns.

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50. See Cropper and Oates (1992, pp. 727-728) for highlights of some of these studies.

In the specific context of GHG emissions there is considerable scope for using incentive-based polices in the short and long-run. There is some uncertainty as to how the gains from trade under CDM would be divided between the North and the South and also about the demand for CDM projects in the short-term. It is therefore desirable for India to engage in emissions trading coupled with other incentive-based economywide/sectoral policies such as carbon taxes and energy price reforms. It is unlikely, however, that entitlements purely on the basis of a per capita criterion will be internationally acceptable, particularly since this would give India entitlements much in excess of its actual emissions. Some compromise on this issue is therefore inevitable in the long-run.

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Table 1. Emissions levels corresponding to Kyoto commitments

	USA	JPN	EEC	OOE	EET	*FSU*	Non-Annex B	CHN	IND
Reference emissions 1990 (Mton)	1362	298	822	318	266	*891*	2022	833	183
Reference emissions 2010 (Mton)	1838	424	1064	472	395	763	4142	1792	486
Kyoto commitments / 1990	93%	94%	92%	94.5%	104%	*98%*	NA	NA	NA
Emissions target in 2010 (Mton)	1267	280	756	301	273	873	4142	1792	486
Reduction/reference emissions (Mton)	571	144	308	171	118	0	0	0	0
Reduction/reference emissions (%)	31	34	29	36	30	0	0	0	0
"hot air" (Mton)	0	0	0	0	0	*111*	0	0	0

Source: Ellerman and others 1998, Table 1

Annex B regions: USA, Japan (JPN), European Union (EEC), other OECD countries (OOE), Eastern Europe (EET), former Soviet Union (FSU)

Non Annex B regions: China (CHN), India (IND), energy exporting countries (EEX), dynamic asian economies (DAE), Brazil (BRA), rest of world (ROW)--only selected non annex B regions are shown in table.

Table 2. World emissions trading

	USA	JPN	EEC	OOE	EET	*FSU*	World	CHN	IND
Reductions / ref 2010 (Mton)	182	12	73	59	52	101	1202	437	102
"hot air" (Mton)	-	-	-	-	-	111	111	-	-
Permits market price ($/ton)	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**24**
Cost of abatement ($billion)	1.66	0.14	0.71	0.41	0.43	0.81	11.15	4.22	0.95
Permits exp (-) / imp (+) (Mton)	390	132	234	112	66	-211	0	-437	-102
Flows exp (-) / imp (+) ($billion)	9.27	3.15	5.57	2.67	1.57	-5.03	0.00	-10.40	-2.44
Total cost ($billion)	10.94	3.29	6.29	3.09	2.01	-4.22	11.15	-6.17	-1.49
Gains from trade ($billion)	26.69	31.08	24.00	9.73	2.66	4.22	108.61	6.17	1.49

Source: Ellerman and others 1998, Table C

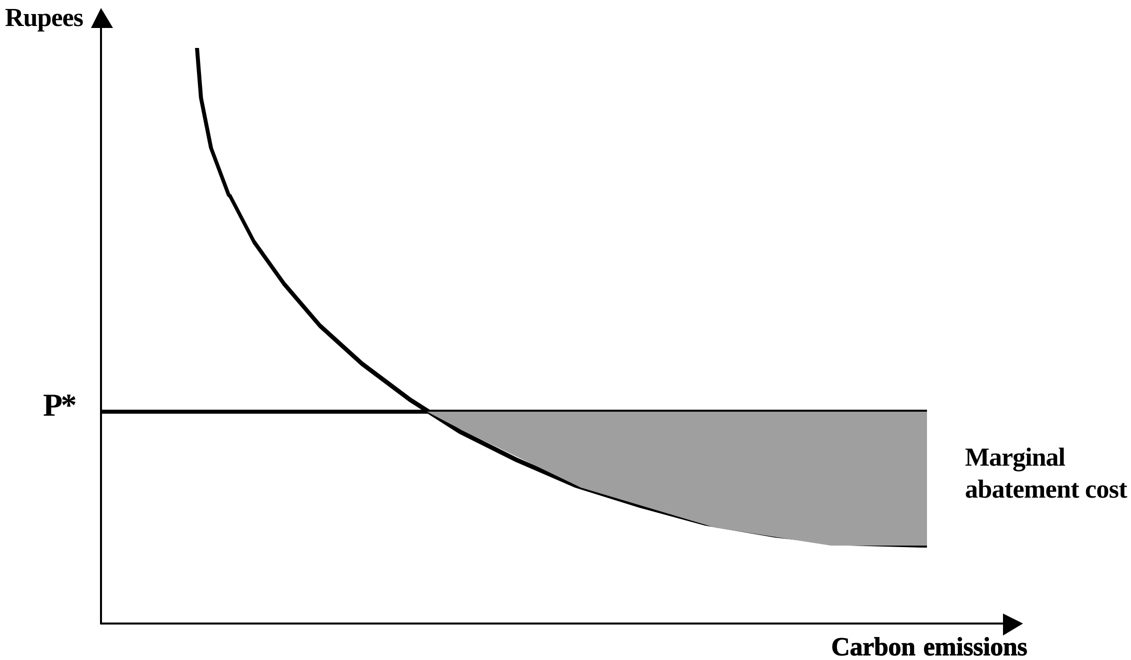

Figure 1

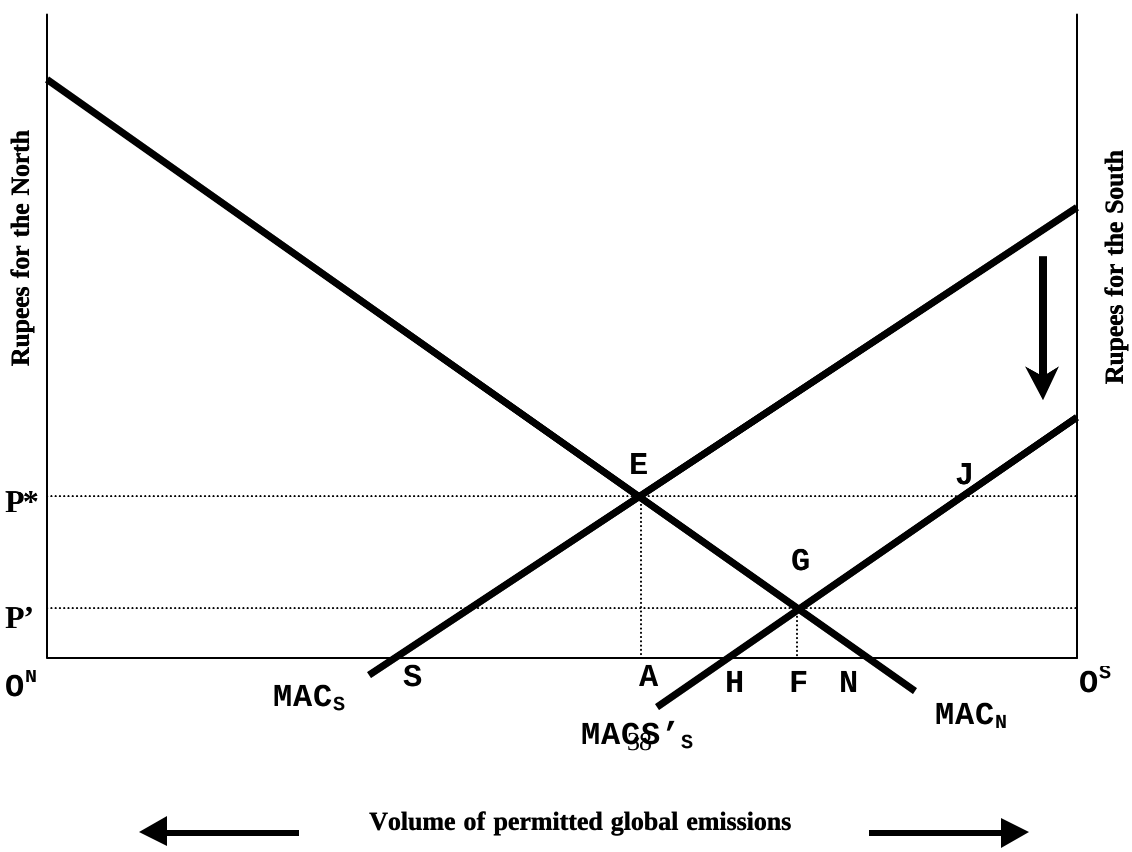

Figure 2