ECONOMIC PERSPECTIVE TO THE AIR POLLUTION PROBLEMS

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ABSTRACT

There may be million planets harboring life, but at the moment we know only one- Our Earth. Unfortunately due to utter senseless greed we are treating our Earth – its Atmosphere, Lithosphere and Hydrosphere as our infinite personal property. Result is- multidimensional problem of pollution that is threatening the sheer existence of Biosphere.

Some of the recent findings by scientists have sent alarm bells ringing across nations. For example the rate at which we humans are adding carbon dioxide in to the atmosphere, polluting it even more, has resulted in it more than doubling since 1990. Findings of Australia's Commonwealth Scientific and Industrial Research Organization (CSIRO) shows that 2005 marked the fourth consecutive year of increased carbon dioxide emission, making four years in a row of above average carbon dioxide growth. This has become even more serious with U.K Met Office finding that there is a 60% chance that 2007 temperatures will top the previous hottest year.

The major cause of all this turmoil on Earth is 'Global warming', which has a direct and positive correlation with man's callous and indifferent attitude towards our globe. And the major source of global warming is the 'Air Pollution' problem that has exacerbated over the years. Man with his obsession for development, has been generating CFCs and Hydrocarbons or 'Environmental Baddies', which besides damaging the environment, has had far reaching health implications. For example a 10% decrease in stratospheric ozone will have a 20%-30% increase in skin cancer. There is a direct correlation between cataract formation in the eyes and UV radiation. Besides homosapiens, even plants exposed to UV radiation showed a 20%-50% reduction in growth, with adverse effects on their productivity. Also the process of photosynthesis will get affected which will damage the entire ecosystem.

But the solution to this problem is certainly not to shut down the process of economic development, but to find ways and means to identify and penalize the perpetrators. Environmental economists world over have suggested a way out that will not only help reduce the level of emissions in the atmosphere, but also be optimum from economic point of view. These include the Command and Control policies and Market Based Instruments that help to attain ambient air quality standards at least cost to the society. These regulatory policies try and treat the environment as any other commodity that has a market, so that a market price can be determined through the forces of demand and supply. So once the polluting industries are made to pay for the emissions, they will automatically cut down on the level of discharge and switch over to cleaner technologies. That is they will no longer be able to 'free-ride' on society's right to clean air. Once they compensate for the negative externality generated by them through economic instruments like 'Pollution Tax', 'Tradable Permits', 'Pigouvian Tax', etc., emission levels will fall and the victims of pollution will get compensated. This will also prevent further damage to our ecosystem.

Therefore, as in the words of Robert Orben, "There's so much pollution in the air now that if it weren't for our lungs there'd be no place to put it all". But fortunately, with the

myriad set of environmental laws, countries are trying to strike the right balance between protecting the atmosphere and continuing with the process of economic development.

Key Words: Environmental laws, Air pollution, Indian laws, Tradable permit, Economic development

INTRODUCTION

The problem of environmental pollution is as old as the evolution of homosapiens on this planet. The senseless greed of mankind has further exacerbated this problem. Excessive emissions into the atmosphere causing the depletion of the ozone layer, unplanned urban growth and felling of forests thus increasing the threat of landslides, waste dumping into the water resources, etc. can all inflict very grave long term penalties on the human race. The development of science and technology and ever increasing world population has caused tremendous changes in the human environment, thereby upsetting environmental laws and finally culminating into innumerable problems affecting our ecosystem. The most recent example is that of receding Gangotri glacier. According to the World Wildlife Fund the glacier is receding 23 meters every year. Environmentalists blame this on global warming and ecological changes in the region. And according to the head of the Intergovernmental Panel on Climate Change, in the next 25 years half of Himalayan glaciers will be lost to global warming.

This linkage between economic and ecological systems can be represented with the help of a diagram :

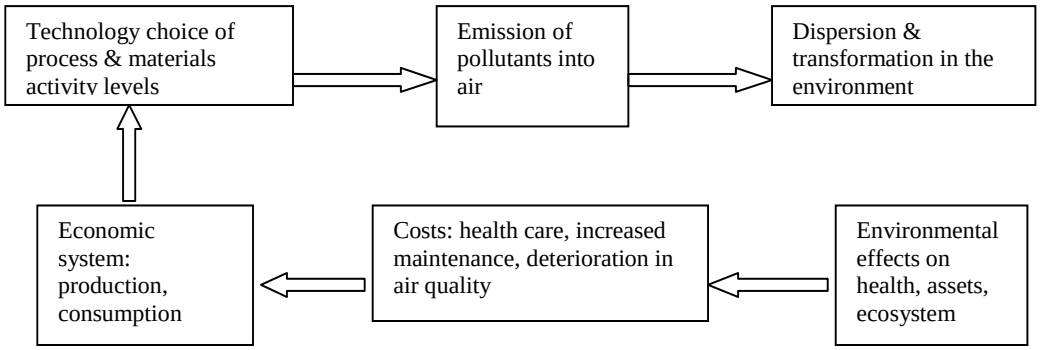

Fig.1 : Linkage between economic and ecological systems

Among the many facets of the environmental pollution problem, one of them is the problem of air pollution. Until the rapid industrialization of society, the introduction of motorized vehicles and the explosion of the population, Earth could absorb and purify minor quantities of pollutants. But the above mentioned factors caused excessive and incessant emissions of carbon monoxide, nitrogen oxides, sulfur oxides, hydrocarbons, and particulate matter into the atmosphere. This further brought about more serious problems like depletion of the ozone layer, global warming, health hazards like cancer, and damage to the body's immune, neurological, reproductive and respiratory systems, etc. In fact this problem acquired massive proportions in the first place because over the years we

have been abusing environment in general and air in particular as a commodity belonging to us, instead of treating it as a community to which we belong.

And in the words of Robert Orben, "There's so much pollution in the air now that if it weren't for our lungs there'd be no place to put it all".

So after being mute spectators and participants in its rampant exploitation, mankind has finally been compelled to have more focused and specific laws related to the environmental problem. Environmental Law therefore relates to the management of the environment and strategies for tackling the problems affecting the environment.

It has been rightly defined by Rodgers as "The law of planetary housekeeping, protecting the planet and its people from activities that upset the earth and its life-sustaining capacities".

But the question that arises here is that if we have understood the magnitude of the problem and realized our folly, then why do we need laws? Why not adopt the method suggested by Ronald Coase in his 1959 article?

According to the Coase Theorem[1], if property rights are well defined and transaction costs are zero, then the two parties can negotiate with each-other and arrive at a Pareto Optimum solution where the marginal damage equals marginal benefit, without a government or judicial or third party intervention.[9,10]

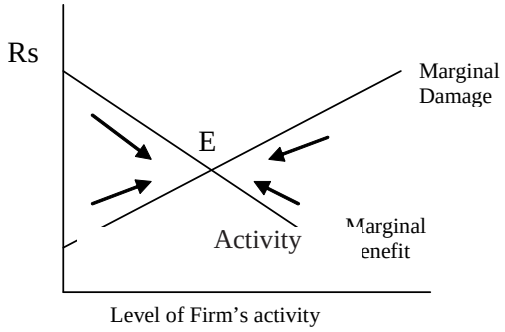

Fig. 2 : Activity

Diagrammatically, 'E' represents the Pareto Optimum point. But in the real world, application of the Coase Rule is difficult because :

- There are many practical problems in defining property rights for many environmental goods. Since natural resources like air, water, etc are public goods, they cannot be divided and parceled out among different individuals.
- It's appropriate only for a small number case, while most of the environmental problems are large number cases. Like when there is one polluter and many victims of pollution, even if property rights lie with the latter, the transaction costs of organizing the victims will be quite high, giving rise to the free-rider problem.
- When pollution arises from many sources, like air pollution, water pollution, etc., it is difficult to identify each polluter and measure the damages. Besides, some pollutants like the Greenhouse Gases (e.g. CO_2) cross national boundaries and hence international cooperation is needed to solve such problems.
- Privatization of environmental goods may not be socially desirable, like for oil fields, and may result in a faster rate of extraction and depletion.

Therefore, environmental laws become indispensable in solving the mounting pollution problems.

METHODOLOGY

In the Indian case, there are about 200 laws dealing with environment protection. However, even though India employs a wide range of policy instruments to deal with pollution problems, the law works badly. Government agencies are reluctant to use their powers to discipline violators. The judiciary had been a spectator to environmental exploitation for almost two decades. This could be because

of our overt dependence on "Command and Control" (CAC) type of policies.

Under this approach, the regulator determines the rules to be followed by individual polluters. These rules are expressed as explicit orders that control which technology/processes are to be used to attain compliance, the permissible content and concentration of emission discharges (emission standards) or when and where activities can take place (permitting and zoning). They are in a sense a set of 'dos and don'ts', which mandate how emissions are to be controlled. CAC measures apply uniformly to all polluters such that the same environmental quality has to be achieved by polluters irrespective of their abatement cost structure. Till recently CAC has been prevalent mainly because economists have played a minor role in administration.

However the greatest disadvantage with the above approach is that it is cost inefficient. Economists have long criticized the method as being conceptually unsound and difficult to administer because :

- Governmental involvement in micro management makes the system wasteful and over involvement of bureaucracy makes it cumbersome.
- It ignores costs and expects the same environmental quality to be achieved by polluters irrespective of their abatement cost structure.
- It discourages innovation
- It has 'technology-based standards' that specifies the method and even the actual equipment to be used by firms to control emissions. But due to differences in abatement costs, the appropriate technology in one situation may be inappropriate in the other.
- It implements 'performance standards' that sets a uniform control target for all firms. However, this may prove to be not only expensive, but also counterproductive.

Hence in place of the "One-Size fits all" CAC approach, there is growing support at the global level for a cost-benefit analysis to compare favorable and unfavorable policies i.e. the Market Based Instruments (MBIs) approach. This uses the market and price mechanism to encourage firms or households to adopt environmentally friendly practices. E.g. pollution taxes tradable permits, input taxes, product charges etc. By allowing flexibility in attaining environmental goals (such as reduction in emissions) MBIs offer potential cost savings. Therefore, in the context of pollution control, the logic of using MBIs rests on three main grounds :

1. MBIs allow the firms flexibility in selecting among various technologies to control the level of emissions, unlike the CAC approach that mandates the use of "end-of-pipe" waste treatment technologies only.
2. The CAC approach is suboptimal in terms of social welfare maximization, as it does not generate production-pollution abatement outcomes that equate Marginal Social Benefit of abatement with Marginal Social Cost.
3. MBIs use fewer total economic resources to achieve the same level of pollution control. Rather than equalizing pollution levels among firms, they equalize the incremental amount that firms spend to reduce pollution i.e. the marginal costs.
4. Since costs of pollution abatement differ across firms, MBIs allow for the possibility of differential abatement across firms, with high-abatement-cost firms reducing emissions by a smaller amount compared to low-cost firms while still meeting overall emissions reduction targets as in CAC. However, CAC measures require all polluters to make the same efforts for

compliance, irrespective of the abatement costs.[7-9]

The MBIs can be divided into three main broad categories: Optimum[2] solution where the marginal damage equals marginal benefit, without a government or judicial or third party intervention. But unfortunately its application becomes difficult because there are many practical problems in defining property rights for environmental goods. Besides this rule is appropriate only in small number cases, while most environmental problems are large number cases with many polluters and victims. And in many cases pollutants like the Green House Gases cross national boundaries.

Therefore, environmental laws become indispensable in solving the mounting pollution problems. In the Indian case, there are about 200 laws dealing with environment protection. However, even though India employs a wide range of policy instruments to deal with pollution problems, the law works badly. Government agencies are reluctant to use their powers to discipline violators. The judiciary had been a spectator to environmental exploitation for almost two decades. This could be because of our overt dependence on "Command and Control" (CAC) type of policies.

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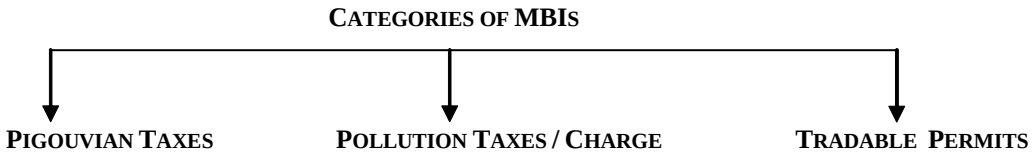
However the greatest disadvantage with the above approach is that it is cost inefficient. Economists have long criticized the method as being conceptually unsound and difficult to administer because governmental involvement in micro management makes the system wasteful and over involvement of bureaucracy makes it cumbersome. Secondly, it ignores costs and expects the same environmental quality to be achieved by polluters irrespective of their abatement cost structure. Thirdly it has 'technology-based standards' that specifies the method and even the actual equipment to be used by firms to control emissions. But due to differences in abatement costs, the appropriate technology in one situation may be inappropriate in the other. Finally it implements 'performance standards' that sets a uniform control target for all firms. However, this may prove to be not only expensive, but also counter productive.

Hence in place of the CAC approach, there is growing support at the global level for a cost-benefit analysis to compare favorable and unfavorable policies i.e. the Market Based Instruments (MBIs) approach. This uses the market and price mechanism to encourage firms or households to adopt environmentally friendly practices. E.g. pollution taxes tradable permits, input taxes, product charges etc. By allowing flexibility in attaining environmental goals (such as reduction in emissions) MBIs offer potential cost savings. Therefore, in the context of pollution control, the logic of using MBIs rests on three main grounds. Firstly it gives firms the flexibility in selecting among various technologies to control the level of emissions. Secondly it tries to obtain equality between Marginal Social Benefit of abatement with Marginal Social Cost. Thirdly, since the costs of pollution abatement differ across firms, MBIs allow for the possibility of differential abatement across firms, with high-abatement-cost firms reducing emissions by a smaller amount compared to low-cost firms while still meeting overall emissions reduction targets as



in CAC. However, CAC measures require all polluters to make the same efforts for compliance, irrespective of the abatement costs.

The MBIs can be divided into the following broad categories:

Pigouvian Taxes

A.C Pigou, in his analysis said that social and private optimum differs because while the former is based on the equality between Marginal Social Cost (MSC) and Marginal Social Benefit (MSB), the latter is based on the equality between Marginal Private Cost (MPC) and Marginal Private Benefit (MPB). The divergence between the two is an externality. Pigou recommended tax on

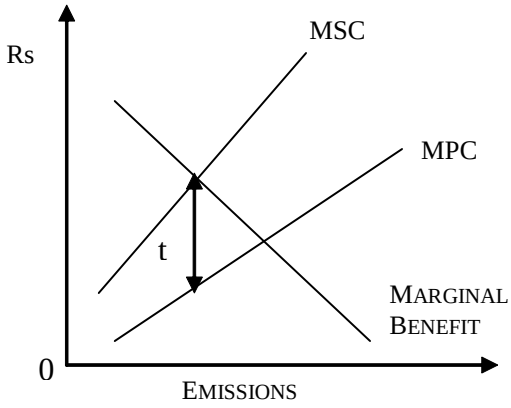


Fig. 3 : Explanation of pigouvian taxes

activities generating negative externalities and subsidy on activities generating positive externalities. This will internalize externalities and bring the firm in line with what is socially optimal.

t is the tax rate that equalizes MSC with MB. This is the first best solution and is Pareto Optimal. But because this requires monetization of damages and full information about the marginal benefit and cost curves, which may not always be possible, environmental policies usually work on the second best approach or the "Efficiency without Optimality" approach.

This brings us to the Standards and Charges approach, which is especially true for developing countries like India, where it's difficult to value benefits from environmental protection due to nonexistence of markets for most environmental resources and other imperfections. In that case, economic instruments like charges and permits should be combined with direct regulation measures like standards.

Pollution Charges / Taxes

This is based on the "Polluter Pays" principle. It will help to reduce pollution of the socially optimal level i.e. a level where pollution occurs only if it is beneficial to the society. Under this system firms are free to adjust their operations until they have minimized pollution-related costs i.e., charges plus the abatement costs.

Moreover, a pollution charge (t) not only cuts emissions but also generates public revenue. For any t_s > MAC, the firm will definitely abate, thereby reducing the emission levels. It will also take into account the differences in the abatement costs of the firms, as each firm aims to minimize the total cost. Diagrammatically, thereby reducing the emission levels. It will also take into account

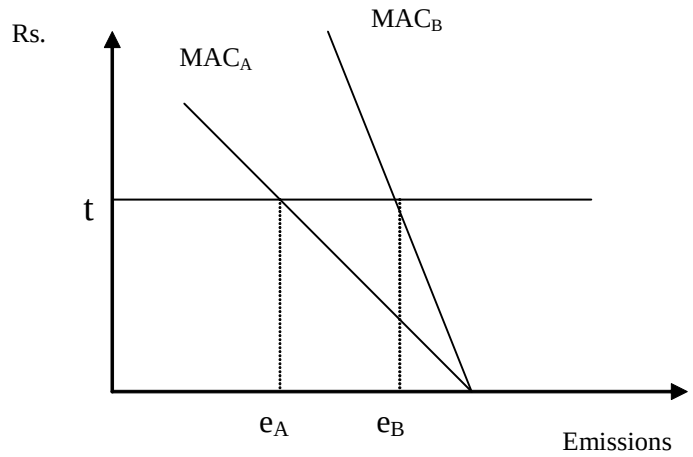


Fig. 4 : Explanation of pollution taxes

the differences in the abatement costs of the firms, as each firm aims to minimize the total cost.

So, as $MAC_B > MAC_A$, firm B emits more than A. Moreover if the regulator feels that the charges are too low and most firms prefer to pay and pollute, they can always adjust the charges to get the desired level of emissions at the aggregate.

But there is one problem with pollution charges. Note that Pollutants can be of two types:

Uniformly Mixed Pollutants

Impact same irrespective of the location

E.g. Green House Gases

Non-Uniformly

Impact depend

E.g. SO_2, Parti

For Non-Uniformly Mixed Pollutants, a single tax rate will no longer be efficient. It has to vary across firms/sources as per their marginal impact on ambient environmental quality since each source will have a different impact on environmental quality.[8]

Tradeable Permits

Under a tradable permit system, an allowable overall level of pollution is established and then allotted among firms in the form of permits. E.g. If the ambient air quality is X units, then this is converted into X number of tradable permits. Firms that keep their emission levels below the allotted level may sell or lease their surplus permits to other firms. So it allows trading between those firms who find it cheaper to buy additional permits to emit than to abate their emissions, and those who find it cheaper to reduce their emissions and realize the value of their now-unused permits on the market. This is efficient allocation. Emission permits are, in effect, property rights over environmental resources.

Initially these permits can be auctioned or can be distributed or can be "grand fathered" (i.e. permits allocated on the basis of historical pattern of emissions).

Cost-minimizing firms minimize the sum of (a) the costs of acquiring further legal rights to emit (the permits), and (b) the costs of

abating their emissions. In so doing, they will choose the most cost-effective outcome perhaps through investing in new technology.

However emission permits will only work perfectly where a reasonably efficient market can occur. The system will not work well (efficiently) when the cost of finding buyers and sellers is high, or when there is a market leader which might use its market power to engage in strategic squeezing of smaller emitting firms. Because of the need to monitor emissions, permits will work well with a small number of stationary sources of emissions, for example, electricity plants. They will not work well with a large number of moving sources, such as motor vehicles.

In practice this approach has had some success, for example USA's sulphur dioxide trading programme.

RESULTS AND DISCUSSION

The Indian Case

In India, there are about 200 laws dealing with environment protection. However, even though India employs a wide range of policy instruments to deal with pollution problems, the law works badly. Government agencies are reluctant to use their powers to discipline violators. The judiciary had been a spectator to environmental exploitation for almost two decades. This could be because of our overt dependence on CAC type of policies, as evident from some of the judgments for the various cases related to environmental pollution. The Indian law exhibits a "preventive" rather than a "proactive" role. The "command" includes laying down standards and pollution limits and the "control" being the power to withdraw water or power supply of erring units. These over ambitious laws and rules ignore the concept of social welfare maximization. For instance in the Taj Trapezium matter (TTZ) the Supreme Court's decision was too much monument-oriented and insensitive to economic realities as it ordered the closure of the coal-based industries. But the Vardharajan Committee report of 1994 did not find any pollution related damage to the monument and blamed nonindustrial sources like traffic, diesel generator sets, etc for the deteriorating air quality. Ironically the environment magazine *"Down To Earth"* reported a steady increase in SPM levels, despite the closure of 212 coal based industries. Emissions from about 70,000 generators due to daily power shortages after the Thermal Power Plant had been shifted out, increasing number of three wheelers running on diesel, etc were some of the reasons cited. This further reinforced the point made by the small industrial owners. Clearly the Court had not taken the repercussion effects into account.

Similarly in the Stone Crushing case, the Court asked the Haryana Government to allot alternative sites to the quarry owners relocated from Delhi. But there was no mention of the impact on the health of the people residing in and around the new crushing zones. Moreover, if pollution was to be controlled in the new zones by the use of pollution abatement equipments, it could have been done in Delhi as well. The decision also does not talk of the cost imposed on the quarry owners as a result of this displacement from Delhi. Therefore, form an economist's point of view; it's not a Pareto Optimal solution as it seeks to make one party better off (i.e. Delhi) at the expense of the other party (i.e. residents near the new zones).

But at the global frontier, we find that more and more countries are moving away from CAC policies and experimenting with MBIs. For example US also started with heavy reliance on CAC. However in the 1990s the costs of compliance with environmental regulations reached about $90 billion per year– an increase of nearly 40% since 1984. It was then that the government started to look for alternative means. US came up with the "Emissions Trading Program" in 1974, under which firms that reduced emissions below the

required level received "credits" usable against higher emissions elsewhere. Then the 'Offset Program', which began in 1976, allowed firms to trade emission credits. Firms wishing to establish new sources in areas not in compliance with ambient standards were to offset their new emissions by reducing existing emissions, either through internal sources or through agreements with other firms. Finally, under the 'Banking Program', firms were allowed to store earned emission credits for future use, either for future internal expansion or sale of credit to other firms. The "Lead Trading Program" came in the 1980s. If gasoline refineries produced gasoline with lower lead content than required, they earned lead credits. And in 1985 refineries were allowed to bank lead credits. This program was terminated at the end of 1987, when lead phase down was complete. And EPA's estimated savings from the lead trading program was about $250 million per year. Then under CFC Trading, a market in tradable permits was used in the US to comply with the Montreal Protocol. This required reductions in the use of CFCs and halons. The market helped to place limitations on production and consumption of CFCs by issuing allowances that limited these activities. And later on, a tax on CFCs was introduced which also proved to be an effective instrument. There is also the "RECLAIM Program" i.e. a tradable permit program launched in 1994 by the South Cost Air Quality Management District (SCAQDM) to reduce Nitrogen Dioxide and Sulpher Dioxide emissions in Los Angeles.

Other than the USA, many other developed countries are also moving away from direct regulation towards economic instruments for pollution control. Like Sweden introduced the "Carbon Tax" in 1991 as a part of "Eco-Taxation Program". This new tax regime placed a tax of $100 per ton on the use of oil, coal, natural gas, liquefied petroleum gas, petrol, and aviation fuel used in domestic travel. Consumer users had to pay the full tax, while industrial users were required to pay only 50% of the tax due to competitive reasons. In 1997 the tax rate was revised up to $150 per ton. Besides reducing carbon emissions, this tax has also increased the use of biomass by local heating districts and energy producers. Also the Swedish NO_X charge on emissions from combustion plants for energy production reduced NO_X emissions by 60% in 1990-2003. Then the 5 pound congestion charge introduced in Central London in 2003 to reduce traffic delays has helped to cut down NO_X and PM_{10} emissions by 12%. Other OECD countries have also favored the use of MBIs. Like France imposes charges on air pollution emissions. Under the Vert Plan for industrial firms that either have power generation capacity of 50MW or discharged more than 2500 tons of Sulpher Oxide or Nitrogen Oxide, the charge was calculated for the actual Sulpher Oxide emissions at the rate of EUC 19 per ton. Germany has a proposal for carbon tax designed to achieve 20% Carbon Dioxide emission reductions in 1990 levels by 2005, etc.

Going by the success rate and cost effectiveness of the MBIs, the UN conference on Environment and Development held at RIO in1992 highlighted the need to incorporate environmental costs in the decisions of producers and consumers and pass these costs to other parts of the society and to include, wherever appropriate the use of market principles in framing economic instruments and policies to pursue sustainable development.

In fact, in India too, the Policy Statement for Abatement of Pollution 1992 favours the use of MBIs for pollution control, wherever feasible. However it seems that we have not been very successful in implementing the same (as evident from the court decisions) and in practice CAC type regulations and enforcement of standards are still considered to be sacrosanct. Therefore given the bureaucratic hurdles in our case and the fact that the MBIs are still in the nascent stage, we should at least try and strike a balance between

two alternative interpretations of an environmental statute:

1. One that advances environmental protection.
2. The other that favors some other interest groups such as industry, jobs, need for energy, etc.

An exclusive reliance on MBIs in India is not possible, at least for now, because of the absence of institutional requirements like well-functioning markets, information on the types of abatement technology available and its cost, a reasonably effective tax administration and monitoring of actual emissions. Then the tradable permit schemes require administrative machinery for issuing permits, tracking trades, and monitoring the actual emissions. So there should be coexistence between MBIs and CACs. Moreover, there is no such thing as the one "best" instrument; there is usually a choice between many different instruments. The choice varies for each particular environmental problem in each individual socioeconomic setting.

CONCLUSION

India has made significant efforts in the field of environmental protection. However, in the absence of coordinated government efforts, including stricter enforcement, air pollution is likely to continue to worsen in the coming years as urbanization picks up pace and vehicle ownership increases. Consequently the Indian government should aim at a right mix of both CAC and MBIs as it will ensure compliance with the different emission standards (the determination of which cannot be left to the market or firms) with the help of fees, tradable permits, etc and using the best technology as perceived by the firms as per their different abatement costs. This will not only save scarce economic resources, but also help to attain targets in a much more efficient manner that direct government regulation alone cannot achieve.

Therefore, even though modern technology owes ecology an apology, still the present day environmental problem calls upon not for the stoppage of technological advancement, but for a new world order where we work to curb the misuse, prevent the abuse, regulate the nonuse and foster the reuse of our environment's resources for a maximum number of people and in a maximum number of ways.

As rightly said by Thomas Ehrlich *"There is an increasing sense of what can be called 'legal pollution."*

In conclusion one can say that we urgently need to devise laws that will lead to the coexistence of economic development and environmental balance.

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