

*Article*

## **Economic instruments of environmental management**

Firuz Demir Yasamis

Istanbul Aydın University, İnönü Street, No:38, Sefaköy-Küçükçekmece, 34295 Istanbul, Turkey

E-mail: fyasamis@gmail.com

*Received 29 March 2011; Accepted 20 May 2011; Published online 28 August 2011*

IAEES

### **Abstract**

There are three main environmental management strategies so far developed to deal with the environmental quality concerns: command-and-control (CAC) strategy, voluntary measures strategy (VM) and economic instruments (EI) or market type environmental management tools strategy. For an effective environmental management all these strategies should be utilized in a harmonized manner depending on the strengths and weaknesses of the surrounding economic, social and institutional circumstances of the societies such as availability of financial funds, status of internal market and citizen awareness over environmental issues. Individually all of these strategies do have their own superiorities and disadvantages as a tool to upgrade the environmental quality and to maintain it. However, when compared, it is observed that the environmental management tools which are mainly economic and financial in nature are gaining more recognition due to their efficiency and effectiveness. The article tries to introduce the economic and financial instruments of environmental management.

**Keywords** environmental management; economic instruments.

### **1 Introduction**

Environmental management has two major objectives: to control the amount and level of pollution and to upgrade the environmental quality to an acceptable level. So far, these objectives are tried to be achieved mainly through two different management strategies: command-and-control and economic instruments.

Since the 1990s the nature of environmental management thinking has witnessed a major transformation. The considerable cost advantage of enforcing the environmental rules and regulations through economic instruments (furthermore will be abbreviated as EI) over command-and-control (abbreviated as CAC) has opened a new horizon for environmental policy designers. It is now shared by the majority of the environmental policy designers and the public environmental organizations that the cost of EIs is much less than the cost of the implementation of CAC measures. Furthermore, the effectiveness of the EIs is not less than those of CAC tools.

The major difference between the CAC and EI strategies refer to their impacts on the relevant markets. While CAC sends direct signals or rather orders to the markets to secure the environmental expenditures and investments; the EIs send indirect signals to indicate the preferred mode of behaviors for both consumers and producers.

Although the implementation cost is at the acceptable level for the EIs, it creates a big burden for the environmental policy makers and environmental policy analysts. The establishment of a new market on

environmental goods and services and the determination of rules for the new market operation require economic justification. These justifications should be obtained through cost and benefit analyses, economic impact analyses and the equity assessment either at intergenerational or at intragenerational level.

## 2 Theoretical Background

There are basically five main philosophies underpinning the EIs:

- (1) Tragedy of Commons: Unacceptable and irrational utilization of common resources which
- (2) has to be curbed for the sake of the future generations (Falk et al., 2001, Frischmann, 2005).
- (3) Negative externalities: Negative externalities are the examples of market imperfections. Harmful impacts of the production centers on the environment and ecology which have to be ameliorated and relieved (Eskeland, 1999).
- (4) Polluter Pays Principle: According to the principle developed by the OECD, the polluters of the environment or the users of the scarce resources should pay the cost. This principle will insure the sustainable, efficient and just utilization of scarce resources (Ems, 2005).
- (5) Environmental Justice: Unjust economic damage placed upon the environment and the living creatures by the users of the resources for their individual and unilateral enrichment has to be corrected and/or compensated.
- (6) Non-interference of Government to the Market: In free market economies, the governments should not interfere with the market mechanisms to protect the environment since they are counterproductive and do not lead to efficient allocation of scarce resources amongst the competing parties (Coase, 1960).

In his seminal paper on the *Tragedy of Commons*, G. Hardin (1968) has alarmed the resource users on the tragic outcome of the present pattern of utilizing scarce and common resources. As Hardin indicated, free and unlimited nature of common resources eventually leads to the rapid deterioration of the resources as a result of profit maximization attempts by the users. Being a rational economic decision maker, a user/producer always tries to minimize the cost of production by using free inputs to the maximum extent possible. Through such a procedure the user/producer will make himself a strong competitor in the market. Adopting the same analogy, the other competitors will behave the same manner and they will try to use the maximum amount of free inputs for their operations. The inevitable outcome of the race for free or cheap inputs will result in the rapid deterioration of the scarce resources, increasing pollution and the loss of biodiversity thus harming the environment and ecology which also should be sustained also for the needs of the future generations.

Economically speaking, such a result is not an optimal solution. The foremost runner and even pioneer of this economic process is Wilfredo Pareto (2007). Pareto defines the efficiency as an increase of one unit in the wealth of every individual in a given time period. In our case the present generation should not harm the chance of using the natural resources by the future generations. This bare fact enforces environmental policy designers to develop tools and systems which will secure the optimal use of scarce resources. Pareto believes that these types of effects known as the market imperfections must be corrected through the welfare taxes.

There is no doubt that such a suboptimal utilization may also be prevented through the CAC strategies. However, this requires the establishment of enforcement and legal institutions throughout the Country. On the other hand, as the above mentioned analogy has indicated that there is also an economic way of preventing the suboptimal utilization of the scarce resources: putting a price tag (mainly in the form of tax or charge) on them. Such a price tag will have two immediate results. The first result is the change in the property ownership understanding. The concept of common property (owned by all) will transform itself into public property (owned by the public) thus creating a new term of “semi-common” goods (Depoorter, 2008) in addition to the

common goods and anti-common (private) goods. The second outcome will be the introduction of a price (either under the form of a tax or charge) system for the semi-commons. Only those who will be ready to pay the price will be able to use the semi common goods. Naturally, the amount paid by the user will be reflected in the production cost thus increasing the price of the product. Depending on the price elasticity of the product, the demand will go down and therefore the production will be reduced thus alleviating the pressure on the scarce resources and saving them for the future generations.

Second, an economic activity of a producer may also create a favorable or rather positive impact on the surrounding environment, people and economic activities. A newly arriving timber factory may provide new employment opportunities for the local inhabitants. Such an economic impact is a positive impact on them simply no cost has been incurred by them. However, in the long run, as a result of the diminishing number of trees, an increasing amount of erosion and sediments on the slopes of the forest may be transported over the fertile lands of the valley thus hindering and even stopping the agricultural production. Such an impact is called negative externality, i.e., harm of an economic entity on other economic entities without their intention (Ryding, 1998).

Again economically speaking, negative externalities ought to be corrected by economic ways and means. In this regard, the pioneer of welfare economics Pigou has pointed out corrective taxes to be placed upon those resources creating negative and harmful impacts on other economic entities. The so called Pigovian taxes will have a corrective impact on the negative externalities by '*internalizing the externalities*' (Pigou, 1932). The tax/charge paying company will reflect the cost of the tax to the product thus increasing the unit price of the good. Again, depending on the price elasticity of the good the demand will go down thus forcing the producer to produce less which will eventually lead to a lesser amount of negative externality. This means that the cost of pollution will be reflected in the cost of production through the payment of a pollution tax/charge by the producer. The revenues obtained from the tax will be used as a new source of income for the overall budget or a source of income for a specific environmental impairment project thus alleviating the negative outcomes caused by the polluting industry. In both cases (price or tax/charge) the producers and consumers will be signaled on the preferred way of behavior by the public.

The producers will have three choices:

- to continue production and pay the tax/charge,
- to reduce the amount of production and pay lesser amount of tax/charge or
- to continue production but also take ameliorative or preventive measures by assuming the costs of amelioration or prevention measures in terms of constructing the treatment facilities and other corrective measures.

On the other hand, the consumers will also be signaled to the preferred mode of behavior through the increasing prices of the goods. These signals will force consumers not to consume such goods. Consequently, the lowering demand for the good will cause reductions in the amount of production thus diminishing the pressures on the environment, scarce resources and biodiversity.

Third, the concept of environmental justice is basically concerned about the intergenerational equity (Solow, 1974; Holberg and Baumgartner, 2011) over the utilization of scarce resources. Scarce resources should also be available for future generations as they have been borrowed from them. The need to ensure the future generations' rights over scarce resources of this Globe forces the economists to value the resources. Additionally, to be able to make rational decisions, the societies should be knowledgeable about their present and future values of the resources. Prior to that, a cost and benefit analyses (CBA) and cost effectiveness (CE) analyses should be performed to better understand the real value of the environmental amenities. (Pearce 2006) The technical requirements of decision making by the policy developers necessitate the development of

valuation techniques for scarce resources (GEF, 1998). Only upon these analyses, rational decisions which will resolve the intergenerational equity concerns can be made over the allocation of scarce resources for the generations to come. All these analyses are economic in nature. Therefore, economic analyses perform vital roles in environmental and ecological policy making procedures.

Finally, Ronald Coase has stated that governments should not intervene market mechanisms since they eventually will result in an inefficient allocation of scarce resources. According to Coase, the same levels of production are achieved whether “*the perpetrator of the negative externalities is legally liable for the externality costs or is the victims of the negative externalities make a payment to the perpetrator that is reduced by the amounts of the externalities*”. (Watkins) Therefore, the government’s role should be solely confined to the definition of property ownership rights and the protection of the property owners. The rest should be left to the market forces.

### **3 Changes in the Paradigm and the Outcomes of the Changes**

The theoretical background of EIs explained above means a radical paradigm shift in environmental management. This shift is from defending the environmental and ecological values with bans, prohibitions and using violence to upgrading the environmental quality and natural resources with the market forces (i.e. supply and demand). That also explains why EIs are also named as market based tools of environmental management.

The basic dynamism of the paradigm shift is explained below.

#### **(1) New understanding for property ownership**

The necessity to create a new terminology for property ownership with the addition of ‘semi-common’ goods is rather significant. With the introduction of this new concept, the overall context of common goods changes and a new owner of semi-common emerges: the public. Therefore, the old owners of the common goods who used them freely and without paying any price will not be eligible to use them anymore. Instead, the public will be the new owner and the new owner will regulate the semi common goods such as air, water, soil, forests, oceans and the space. Naturally, the potential users of semi common goods will pay their dues. With the acceptance of this new paradigm air quality will be protected by the owner, fish stock in the lake will be managed by the new owner and the grasses of the grazing land will be allocated by the new owner. Through this procedure a new property ownership understanding will be developed for the new scarce item of our own generation: the clean environment. Wherever the environmental scarcity occurs, the public officials will be able to re-arrange the market dynamisms by allocating the right of pollution or the right of natural resource utilization.

#### **(2) New prices for some new properties**

Consequently, the price of the clean environment and protected natural resources has to be determined. Users who want to use the scarce environmental/ecological goods should be ready to pay the price for them. Air to pollute, water body to be discharged, noise to be emitted, grazing land to be used and all others will be priced. Price will be in the form of a fee, a tax, a charge or an auction payment which will eventually take the form of environmental fees, permit fees, environmental (green) taxes/charges and tradable pollution quotas.

#### **(3) New markets for the new prices**

The values of the new scarce items will be determined by the economists carrying out CBA and valuation methods and will be finalized by the market itself. In this regard two basic markets will emerge: tradable pollution quota markets (national and international) and waste markets. In these markets quotas and the wastes will be sold and bought. The owners of the pollution quotas or those producers who have waste which has the characteristic of being an input for others will be exchanging goods, waste and money reciprocally. At the end,

the environmental quality will be maintained or the waste will be transformed into a new product thus saving the planet from excess amount of wastes.

(4) New operation systems for the new markets

New markets definitely require new operation systems. For instance, tradable pollution quotas require quotas to be traded. Quotas should be issued by a public agency. The amount and price of the quotas must be determined. And, eventually, the method of price determination (free distribution or auction) should be selected.

(5) New institutions for new operation systems

Finally, new institutions should be established to administer the operation systems such as monitoring the compliance, gathering the revenues, allocating or earmarking the revenues, setting up the rules for auction, administering the auction and keeping the tracks of records.

#### 4 Types of the EIs

EIs can work at two different levels both aiming at different scopes of policy development and decision making: macro level and micro level. Macro level EIs address to the country wide environmental matters such as refining and fine tuning of national accounts including sustainability issues. Micro level EIs attempt to correct and/or regulate the environmental issues at company/individual level. For the sake of the simplicity let us initially look at the macro level EIs initially (Barde, 1994).

##### 4.1 EIs at macro economic level

Macro economy mainly deals with growth issues such as economic growth, capital growth and population growth. However, these growth procedures have several negative impacts on the environment. In this regard macro economy is a part of the ecosystem and there are several important relations between the macro economy and the global ecosystem. Keynesian concepts of growth rate, savings, investments, inflation, foreign trade, sustainability and others are affected by the environmental expenditures. Reciprocally, the environment is also affected by the macroeconomic activities. Therefore, the relations between the macro economy and the global ecosystems have to be analyzed in order to develop meaningful conclusions for environmental policies to be pursued. This development has already been resulted in the creation of a new discipline called environmental macroeconomics. However, the aim of this section is not related so such an analysis. In this section only the types of EIs will be explained. Major EIs in macroeconomic nature are explained below.

###### 4.1.1 Environmental accounting

Macro economy, by its definition is related to the nation-wide resource allocation. Thereby, macro level economic analysis attempts to measure the national accounts, annual national production, distribution of wealth, per capita national income and others. The analyses made in this regard to indicate the net positive or negative enrichment in a given period. Till recently (and in most countries as it is at the present) the nations were carrying out these computations without taking into consideration the impacts made to the environment. However, the economic enrichment or development is being carried out at the expense of natural resources, ecology and the environment. During the production processes forests have been cut, air pollutants polluted our environment, lakes and seas are polluted and a considerable amount of green house gases emitted causing global warming and climate change. In sum, while we are getting richer, we are also harming the environment. Exclusion of the ecological and environmental values from the computation process of national accounts will not be perfect and accurate.

This bare fact has first been explained by Nobel laureate economist Robert Solow in a lecture given in Washington DC in 1992. *“Solow suggested that ‘an innovation in social accounting practice could contribute to more rational debate and perhaps more rational action in the economics of non-renewable resources and*

*the approach to a sustainable economy*’.” (Perman, 2003) This remark has initiated a new discipline called environmental accounting. Since then, the UN has developed a new national accounts model basing upon the environmental and ecological impacts of the national economic activities. Some countries have adopted the new system for their own national accounting systems. And, even some private companies began to include their positive and negative impacts on the environment into their national accounting system (UN, 2003).

Consequently at the macro level now it is easier to see the impacts of economic development on the environment and therefore it will be possible to make more rational decisions for a more effective and stronger sustainability within the country and all over the world.

#### 4.1.2 Environmental insurance

The Exxon Valdez tanker accident in the polar region, the tanker accidents in the Bosphorus, the Bhopal chemical leak in India and the Gulf of Mexico oil spill examples clearly explain the need for an environmental liability and insurance system to be established to cure the harms done by the environmental disasters and calamities. The Seveso Directive of the EU also has the same intention.

In most cases, the cost of such disasters is very expensive and exceeds the potential financial sources of the liable parties. Environmental insurance as a macro level EI is an appropriate counter measure to deal with such circumstances (Bratspies, 2001). At the first instance and environmental insurance may seem as a micro level tool since the basic of the system will be the protection of the individual companies. However, at the final analysis it is quite clear that liability and insurance systems are the major potential safeguards for the people at large, natural environment, ecological resources and the societies.

#### 4.1.3 Tradable pollution quotas (cap and trade systems)

The tradable pollution quota system (hereafter will be abbreviated as CAT) is the result of the changing understanding of the property ownership. ‘Commons, anti-commons (private) and semi commons’ are the items of the new classification of goods. As indicated earlier, semi common goods now have a new owner: the public. Public administration of any country is the sole responsible of protecting environmental and ecological values including scarce resources in order to prevent the damages which may occur as a result of irrational profit maximization motives of private developers. One rational way to insure the sustainability of the ecosystem is to calculate the optimum amount of harvesting/yielding of the concerned areas and let the people or companies do not exceed the allowable limit. This objective can be realized through the determination of the optimum level of production/emission which will not hamper the sustainable management of resources. Having the optimum level has been determined; the right of polluting/harvesting/yielding can be allocated to the users in certain quotas. The allocation can be free or can be sold at the auction. Those who intend to do the same but do not have any quota will be forced to buy quota from the original owners. Consequently, the optimum level will not be exceeded and sustainable production will be secured. Again at the first instance such a system can be seen as a micro level EI. However, since, at the end, damaging level of pollution and/or suboptimal utilization of scarce resources would be prevented, a macro level target would be achieved thus creating a macro level EI for environmental and ecological management. CAT is also used by the Kyoto Protocol through the clean development mechanism to protect the global air quality. CAT is also accepted as one of the major environmental management and policy tool by the EU since 2005. “EU Emission Trading System” has been accepted by the European Commission in 2001 after several years of successful implementation in the USA.

Tradable quotas are also known as the pollution rights. However, such a statement is not correct. Tradable quotas aim at creating a safe pollution or production limit. To better understand the tradable quota system, it will useful to give some information about the ‘bubble’ concept. A bubble is a presumed cap placed over an urban area or a limit of production for any scarce resource. As far as the air pollution is concerned, the air

quality beneath the bubble will be at the acceptable level and will not be harmful for human health, the flora and the fauna. Naturally, it does not mean that the area covered by the bubble is pollution free. The emitters in the region will be given a quota and/or permit to continue to emit/produce (Bardo, 1994; Böhringer et al., 2004; Capros, 2000; Chander et al., 1999; Coria, 2008; Fischer and Fox, 2009; Hahn, 2008; Hallegatte et al., 2008; Holt et al., 2009; Johnston, 2006; Kaswan, 2009; Klepper et al., 2008; Levine, 2006; OECD, 2003, 2004; Stavins, 2007; Sudo, 2006; Yang, 2008).

Theoretically, the new industries planning to come to the same region will either come with zero pollution technology or will buy the quota/permit of another owner. Therefore, the air quality beneath the bubble will remain at the safe level.

As far as the production is concerned, the amount of safe production (i.e. timber or fish) will be determined by the public officials and the producers will be given quota/permit to produce. The safe level of production is the sustainable production level. The producers who have not the permit will be obliged to buy the permits of the others.

Quotas/permits can be distributed freely or can be obtained through an auction. Later, a market will be established in which the quotas can be traded. Naturally, the price of the permit will be reflected to the cost of the product and eventually to the prices. This may initiate the discussions over the distributional impacts and intergenerational equity concerns (Solow, 1974).

Tradable quotas will force the companies to study the cost of the permit and its implications on the price elasticity of the products. If such an analysis indicates a potential loss, the company will refrain itself from making the investment.

To sum it up, it should be indicated that the tradable quota system creates a new property ownership concept. The common goods which are owned by the society at large and each individual is authorized to use without paying the price thus causing *tragedy of commons*, will furthermore be owned by the public and the authorized public administration will be able to manage the semi-common goods.

The same system can be applied to global resources such as oceans, polar caps and space provided that necessary administrative infrastructure is established (Risse, 2008).

#### 4.1.4 Funds

Naturally the environmental fund is one of the major EIs developed so far. The Global Environmental Feasibility (GEF) which has been established right after the Rio Conference (UNCED) is an excellent example of showing how financial resources can be obtained and used to protect the global environment and global biodiversity. The revenues/donations received from the global financial institutions and the donor countries are used to support the environmental projects of the Southern countries (Smyth, 2010).

Other than the GEF, the major political and financial international organizations have apportioned some of their revenues for similar purposes. Likewise, in almost every country, financial revenues are obtained from different sources and used for national and local environmental projects through the established environmental funds.

#### 4.1.5 Efficient and inefficient subsidies

Like environmental funds, the governments may allocate some of their national budgets to support the environmentally friendly investments and may share the cost burden with the investing companies. Due to the fact that environmentally clean technologies and environmental treatment and/or abatement infrastructures are expensive; the companies may have significant difficulties in financing such schemes. Establishment of such subsidies at the macroeconomic level will help to ease the cost burden on the national environment (Hymel et al., 2006).

The other mandate in this regard is the elimination of counterproductive subsidy schemes which may accelerate the pace of the investment but may have harm on the environment. These types of subsidies should be stopped to prevent their damages on environment and scarce resources. Therefore, subsidies are the major EIs for environmental management at the macro level (Fischer and Fox, 2009).

#### 4.1.6 Tax reductions and rebates

Tax reductions/rebates also perform in the same manner like subsidies. Governments may reduce the tax rate or even rebate some portion of the taxes to be collected to encourage the investments made or the equipments to be purchased for a secure environment. It is expected that, at the end, the pollution level will be diminished or scarce resources will be better protected and hence the governments will incur a lesser amount of environmental cleaning up services to be funded by the national budget. Therefore, an allocation of some public funds for tax losses should also be accepted as another type of EI for environmental management.

#### 4.1.7 Compensation for income losses

In a free market economy, producers intend to have production in a continuous manner. However, in the long run, continuous production may be harmful. Agriculture is a good example in this regard. In order to enable the soil replenish itself or in order to wipe out the excess stocks the production should be stopped temporarily causing income losses for the producers. Under these circumstances, the public may offer compensation to the producers not to produce for some certain periods. Governments should allocate financial resources to that end. The loss incurred by the public will be paid back by the improved quality of soil and stabilized market prices for the product.

#### 4.1.8 Performance bonds

Performance bonds are the pre-payment of any future potential harm to environment and ecology by not being able to achieve the targets set by the related regulations. If the target will be achieved at the end of the period the bond will be reimbursed to the issuer; otherwise, it will be accepted as public revenue. The revenues collected will either be spent for environmental problems or will go into the treasury.

### 4.2 EIs at micro economic level

Environmental economics have become mainly micro economics until recently. Micro economic EIs are related to the concept of market failures and negative externalities. The EIs so far developed are designed to '*internalize the negative externalities*' or to correct the market imperfections. Internalization basically means the social (ecologic, environmental) cost incurred will be reflected back to the accounting system of the producers of the harmful effect. There are basically two methods of internalization:

- fines, penalties, compensation and restoration,
- taxes or charges

#### 4.2.1 Fines/penalties/compensation/restoration

In most of the cases the environmental fines and penalties, environmental compensations or restoring the damaged environment have been seen as the policies of the CAC strategy. However, it should also be taken into account that these types of environmental policies will have an inevitable impact on the economic conditions of polluting firms or individuals.

Fines or penalties (even in terms of closing the facility temporarily or permanently) mean a direct and reciprocal harm given to the polluters. Since the polluters are creating negative and sometimes irreversible and immitigable impacts on the environment, they should be faced with the threat of compensating the harms made on the scarce resources and/or on the environment. Therefore, the company will pay the fine/penalty/compensation unless the acceptable remedies will be put into effect to alleviate the pressures on the ecosystems.



This procedure is also used by the EU. The Court of Justice of the EU penalized several member governments to pay compensation to the EU for not being able to comply with the EU's rules and regulations.

Restoring the damaged environment and cost of restoration imposed upon the responsible will also force the environmental wrong-doers to get the signals of the correct and desired behaviors by the public.

#### 4.2.2 Taxes and charges

The administrative costs of the EIs mentioned above are costly. Therefore, these types of EIs are supposed to be not cost effective. The green taxes or environmental taxes are cost effective because the cost of enforcement is considerably less than the benefits obtained. It is believed that the environmental taxes are cost effective to protect the environmental quality (André, et al., 2003; Baerde, 1994; Daniela, 2010; Görres and Cottrelli, 2003; Hahn, 2008; OECD, 1996a,b; OECD, 1999, 2010).

As a matter of fact there is no clear cut definition for environmental taxes and charges. Both of them are quite similar to each other. For the sake of the simplicity, it is accepted that the main criterion of differentiation should be the allocation of the revenues. If revenues obtained go to the general Treasury that is accepted as a tax; and if revenues are earmarked or directly allocated for some specific environmental purposes that revenue is accepted as a charge.

Green taxes, theoretically, are based upon the works of two important economists: Pigou (2007) and Pareto (1932). Pigou in his studies emphasized on the 'rent' issue right after the WW1. Construction, rebuilding and development works for the war that devastated countries have resulted in the emergence of rents. Pigou, considering that the rent is an unearned and unjust enrichment for the rent seekers and the rent should be returned to the public, proposed welfare taxes to be imposed upon renters to internalize the negative impacts of the rents on the society. Similarly, environmental polluters who are creating negative externalities are also having unjust, unjustified and unfair rents and costs are usually borne by the entire society. Therefore, the unjust enrichment obtained through negative externalities (all of the pollutions are the examples of negative externalities) should be internalized to the economy of the polluting industry.

Such a tax/charge will send signals to the markets, to the polluters and to the consumers on the desired mode of environmental behaviors. The consumers are reacting favorably to green taxes since they generally intend to protect the environment. Therefore, a different kind of demand is developing amongst the consumers favoring the protection of the environment. As for the polluters, a critical decision making procedure emerges. The polluter will have a choice: either the polluter will continue to pollute but pay the tax; or, make necessary investments to comply with rules and standards and not to pay the tax. If polluter chooses the first option the cost of the tax will be reflected to the price of the good and the good will be more expensive. The demand for the good will be reduced as a result of the increasing prices. Decreasing demand will decrease the level of production and hence alleviate the pressures on the environment. If the polluter chooses the second option, the cost of environmental investment will be reflected to the overall cost and the increasing cost of the product will result in an increasing commodity price. This will also alleviate the burden on the environment. This procedure is known as the internalization of negative externalities.

Wilfredo Pareto also contributed to the concept of environmental taxes by emphasizing on efficiency and optimality. Pareto indicated that efficiency means that in a society nobody will be worse off but at least one person will be better off at the end of a given period. This understanding later has been reinterpreted by Hicks (1939) and Caldor (1939). They both indicated that it would not be possible to calculate the income and losses of each individual; therefore, the society should be taken as a whole and society's net income and loss should be calculated. They proposed that if the net income of the society is bigger than the losses such a society should be accepted as using the resources in an efficient manner. In this regard, damages given to the environment and scarce resources should also be taken as a cost incurred during the production. Therefore, the

efficiency of a company should not only be seen as the difference between the revenues and the cost and the cost should also include the environmental and ecological damages caused during the process of production. Therefore, the Pigovian taxes imposed upon the negative externalities will eventually serve to the efficient utilization of scarce resources.

## **5 Issues Related to EIs**

Policy design and formulation for the EIs is not an easy task. There are several concerns over the EIs which make the selection and administration of the EIs rather cumbersome.

### **5.1 Distributional impacts**

The EIs of environmental management have several impacts on the individuals, companies, producers and the overall economy. Internalization of externalities, green taxes and CAP and trade mechanism and others will bring extra costs to the concerned parties by increasing the prices (Ysé et al., 2008). The question to be answered is: Who will assume the burden? If the item has to be used by the people whatever the price to be - such as electricity- all income groups will share the burden equally disregarding the ability of payment and level of income (Holberg and Baumgartner, 2011). Therefore the cost of protection of the environment will have more negative impacts on the budgets of limited/fix income families (Siedenburg, 2005; Perez, 2009) .This and similar other questions will bring the issue of distributional impacts of the EIs. Policy designers should take the income distribution impacts of the EIs into consideration during policy development and evaluation processes (Atkinson and Brandolini, 2009).

### **5.2 Intergeneration or intrageneration equity concerns**

As the Brundtland Commission (1987) defines it, the sustainable development means that scarce resources should be so used by the present generation that the chance of the future generations should not be restricted or eliminated. This definition underlines the significance of intergeneration equity concerns: the scarce resources should also be made available for future generations. EIs are rather effective in allocating the scarce resources between the present and future generations. The EIs explained above can be so designed that the chance of future generations using the resources can be secured. Therefore, policy designers of EIs should assess the impacts of EIs on the generations to come. In addition to the intergenerational impacts, the intragenerational impacts (distributional impact amongst the social classes of the present generation) of EIs should also be evaluated by the environmental policy designers.

### **5.3 Cost benefit approach**

The main analytical tool for the policy designers of EIs is the cost and benefit (CAB) analysis. In order to make a decision on environmental issues, policy designers will look at the benefits to be obtained through the implementation of the EI and then will try to calculate the cost of implementation of the EI. If the result is positive, the policy designers will be convinced to propose the EI to the decision makers. This approach is criticized by other experts who are claiming that the fate of the environment and ecology cannot and should not be left to the mercy of the economic calculations. There are so many precious assets in the World that they should be protected at every cost. The fate of the climate change, the global warming, and protection of biodiversity (such as whales and pandas), conservation of tropical rain forests cannot be solely decided basing upon the CAB analysis. Therefore, there are some areas that CAB cannot be used as the sole decision making tool (Alberini et al., 2010; Arnold, 1997; Pearce, 2006; Frey et al., 2004; Hayden, 1989; OECD, 2001; Rajan and Sinha, 2008; US EPA, 1987).

### **5.4 Environmental justice**

The above mentioned concerns will inevitably bring another concern into the consideration of the EI policy designers: If the above described concerns are right and accurate, the environmental justice cannot be

established amongst the social classes and generations (Burkett, 2007; Holberg and Baumgartner, 2011; Siedenburg, 2005; Perez, 2009). Both the benefits and costs should be equally distributed amongst the classes and generations. This is also true for the living creatures as described in the *'Should Trees Have Standing'* by Chr. D. Stone (Nellisen, 1997). Rachel Massey summarizes the environmental justice as follows: *"Just as poor communities often bear a disproportionate burden of pollution and environmental degradation compared with wealthier communities within the same country, poor nations may bear a disproportionate burden from toxic wastes that are exported from wealthier nations. Poor nations may also bear a disproportionate burden from global warming and other human-induced changes that affect the entire planet. For example, global warming is caused by fossil fuel use, which historically has been concentrated in developed countries; yet the adverse effects of global warming may be concentrated disproportionately in certain developing countries."* (Massey, 2004).

### **5.5 Valuation of environmental and ecological assets**

As indicated above, the CBA is the most effective analytical tool for the environmental regulation impact assessment. However, the CBA procedure has an inherent problem of valuation. It is sometimes very difficult to estimate the value that has to be taken into consideration in the analysis. What is the statistical value of a human life? How can we measure the pollution filtering value of a swamp? What is the value of a forest for her carbon sequestration function?

These types of questions have to be answered by environmental economists. On the other hand, the present value of an environmental amenity is certainly different than its future value. Therefore the present value of an environmental amenity should be discounted from its future value to be accurate during decision making (Alberini, 2010; Holt et al., 2009; Keohane, 2006).

In this regard, several techniques have been developed by the scientists. The following are the methods developed so far for the valuation of environmental and ecological amenities: the revealed preferences method, stated preferences method, random utility choice method, travel cost method, hedonic pricing, averting behavior, market prices, contingency valuation etc. These and others are rather helpful analytical methods for valuation, discounting and present value calculation.

### **5.6 Establishment of the market**

This is rather crucial for the less developed and transitional countries. These countries do not yet have well established and operational markets yet. Therefore, the implementation of EIs will be rather difficult in these countries and consequently appropriate measures should also be taken to relieve the pressures on these markets by environmental policy designers of these countries.

## **6 Conclusion**

The overall list of EIs is more than ones which are briefly explained above. There are similar others that can be added to the list. However, the above given examples should suffice to indicate that a new environmental management strategy is already available in the hands of the environmental management policy makers: economic instruments either at the macro or at the micro level. It is already seen that, in most cases EIs are more effective than the CAC strategy due to the low level implementation and administrative costs. The following sentences taking part in the UNEP's work titled as *'The Use of Economic Instruments for Environmental Policy: Opportunities and Challenges'* evaluates the relative importance of EIs in environmental management: *"EIs and CACs require many of the same baseline institutions and target the same reductions in environmental harm. Both approaches also attempt to shift the costs and responsibilities associated with pollution back onto the polluter (PPP). By forcing these costs into the production expenses of the groups causing the environmental damage, the polluter will be forced by competitive pressures to address*

*the societally-damaging aspects of its activities. However, differences between the policy types are extremely important in terms of how successful they are in achieving their environmental targets and at what cost. Empirical studies in the United States show that the efficiency gains associated with using EIs rather than CACs have been substantial. Tietenberg suggests that CAC approaches to regulate air pollution were as much as 22 times as expensive as the least-cost, market oriented (EI) alternative. For the eleven applications studied, CAC approaches were on average six times as expensive. Anderson et al. estimated that as of 1992, EIs for air, water, and land pollution within the US had saved more than US\$ 11 billion relative to a CAC baseline. Assessments of EIs in multiple countries by OECD also form strong evidence of cost savings. These cost savings have an important corollary as well: for a given environmental budget, EIs can buy more environmental protection than can CACs. This advantage rises over time, as the dynamic attributes of EIs, such as encouraging greater investments into new control technologies, bring down the unit cost of control.”* (UNEP, 2004).

However, some extra precautions should be taken for the less developed and transition countries of the ex-Soviet bloc in order to prepare them to fully utilize the advantages of EIs since their markets are not yet fully prepared for the satisfactory implementation of EIs.

## References

- Alberini A, Bateman I, Loomes G, et al. 2010. Valuation of Environment Related Health Risks for Children. OECD, Paris, France
- André FJ, Cardenete F, Alejandro M, et al. 2003 Performing an Environmental Tax Reform in a Regional Economy. A Computable General Equilibrium Approach. CentER Discussion Paper No. 2003-125. <http://ssrn.com/abstract=556965>
- Arnold F, Frances GS. 1997. Discounting in Environmental Policy Evaluation. EPA
- Atkinson A, Brandolini A. 2009. On Analyzing the World Distribution of Income. Temi di discussione. Working papers 701. Banca D'Italia. <http://ssrn.com/abstract=1357268>
- Barde JP. 1994. Economic Instruments in Environmental Policy: Lessons from the OECD Experience and their Relevance to Developing Economies. Working Paper No. 92. OECD. <http://www.oecd-ilibrary.org/docserver/download/fulltext/5lgsjhvj7f35.pdf?expires=1300529206&id=0000&accname=guest&checksum=DEDB334B9C11C9575DC42AFE94D2323D>
- Böhringer C, Hoffmann T, Lange A, et al. 2004. Assessing Emission Allocation in Europe: An Interactive Simulation Approach. Discussion Paper No. 04-40. ZEW. <http://ssrn.com/abstract=908498>
- Bratspies RM. 2001. Splitting the Baby: Apportioning Environmental Liability Among Triggered Insurance Policies. Brigham Young University. Law Review. (1215-1264). <http://ssrn.com/abstract=378940>
- Brundtland Commission. 1987. Our Common Future. Oxford University Press, Oxford, UK
- Burkett M. 2007. Just Solutions to Climate Change: A Climate Justice Proposal for a Domestic Clean Development Mechanism. Legal Studies Research Paper Series. 07-26. University of Colorado. [http://www.buffalolawreview.org/past\\_issues/56\\_1/Burkett%20Web%2056\\_1.pdf](http://www.buffalolawreview.org/past_issues/56_1/Burkett%20Web%2056_1.pdf)
- Capros P, Mantzos L. 2000. The Economic Effects of EU-Wide Industry-Level Emission Trading to Reduce Greenhouse Gases. National Technical University of Athens. [http://ec.europa.eu/environment/enveco/climate\\_change/pdf/primes.pdf](http://ec.europa.eu/environment/enveco/climate_change/pdf/primes.pdf)
- Chander P, Tulkens H, Ypersele JP, et al. 1999. The Kyoto Protocol: An Economic and Game Theoretic Interpretation. CESifo Working Paper Series. No: 229. CESifo. <http://ssrn.com/abstract=197068>
- Coase RH. 1960. The Problem of Social Cost. Journal of Law and Economics, 1-44
- Coria J, Sterner T. 2008. Tradable Permits in Developing Countries. Discussion Paper, RFF DP 08-

51. Resources for Future. [http://gupea.ub.gu.se/bitstream/2077/18720/1/gupea\\_2077\\_18720\\_1.pdf](http://gupea.ub.gu.se/bitstream/2077/18720/1/gupea_2077_18720_1.pdf)
- Daniela M. 2010. Trade, Technical Progress and the Environment: the Role of a Unilateral Green Tax on Consumption. *Temi di Discussioni. Working Papers. 744.* Banca D'Italia. <http://ssrn.com/abstract=1669987>
- Depoorter B. 2008. Never Two without Three: Commons, Anticommons and Semicommons. School of Law, University of Miami. <http://ssrn.com/abstract=1162189>
- Ems E. 2005. Environmental Liability in the EU – Application of the Polluter Pays Principle? Presentation at ENVECON 2005. London, UK
- Eskeland G. 1999. Externalities and Production Efficiency. The World Bank. <http://ssrn.com/abstract=630692>
- Falk A, Fehr E, Fischbacher U. 2001. Appropriating the Commons – A Theoretical Explanation. CESifo Working Paper No. 474. Working Paper No. 55. Institute for Empirical Research in Economics. [http://papers.ssrn.com/paper.taf?abstract\\_id=244403](http://papers.ssrn.com/paper.taf?abstract_id=244403)
- Fischer C, Fox AK. 2009. Combining Rebates with Carbon Taxes. Discussion Paper 09-12. Resources for the Future. <http://ssrn.com/abstract=1408692>
- Frey B, Luechinger, S, Stutzer A. 2004. Valuing Public Goods: The Life Satisfaction Approach. Cesifo Working Paper No. 1158. CESIFO. <http://ssrn.com/abstract=528182>
- Frischmann B. 2005. An Economic Theory of Infrastructure and Commons Management. *Minnesota Law Review* (89: 917- 1030). <http://ssrn.com/abstract=588424>
- GEF. 1998. Valuing the Global Environment. Washington DC, USA
- Görres A, Cottrelli J. 2003. Germany's Ecotax Reform 1999 - 2003: Implementation, Impact, Future Development. *Förderverein Ökologische Steuerreform.Germany.* <http://www.iges.or.jp/en/news/event/event9/pdf/Goerres.pdf>
- Hahn R. 2008. Greenhouse Gas Auctions and Taxes: Some Practical Considerations. Working Paper 08-12. Reg Markets Center. <http://ssrn.com/abstract=1132291>
- Hallegatte S, Henriot F, Corfee-Morlot J. 2008. The Economics of Climate Change Impacts and Policy Benefits at City Scale. *OECD Environment Working Papers No. 4.* OECD. <http://www.oecd-ilibrary.org/docserver/download/fulltext/5kz80412gbzt.pdf?expires=1300531308&id=0000&acname=guest&checksum=4B57153F8E7FB459D21BF3AC846E9F36>
- Hardin G. 1968. The tragedy of the commons. *Science*, 162(1968): 1243-1248
- Hayden G. 1989. Survey of Methodologies for Valuing Externalities and Public Goods. [http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1006&context=econfacpub&sei-redir=1#search="Survey+of+Methodologies+for+Valuing+Externalities+and+Public+Goods."](http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1006&context=econfacpub&sei-redir=1#search=)
- Hicks J. 1939. The foundations of welfare economics. *Economic Journal*, 49(196): 696-712
- Holberg N, Baumgartner S. 2011. Irreversibility, Ignorance and the Intergenerational Equity-Efficiency Trade-off. [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1764443](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1764443)
- Holt C, Myers E, Wråke M, et al. 2009. Teaching Opportunity Cost in an Emissions Permit Experiment. Discussion Paper. RFF DP 09-22. Resources for the Future. <http://www.rff.org/documents/RFF-DP-09-22.pdf>
- Hymel M, Mann RF, Wolfson BS. 2006. Trading Greenbacks for Green Behavior: Oregon and the City of Portland's Environmental Incentives. *Arizona Legal Studies* 06-44. The University of Arizona, USA
- Johnston JS. 2006. Tradable Pollution Permits and the Regulatory Game. Research Paper No. 06-07. University of Pennsylvania. <http://ssrn.com/abstract=881068>
- Kaswan A. 2009. Decentralizing Cap-And-Trade? The Question of State Stringency. University of San Francisco Law Research Paper No. 2009-19. University of San Francisco. <http://ssrn.com/abstract=1442052>
- Keohane N. 2006. Environmental Policy Design and the Distribution of Pollution Control Techniques in a

- Regulated Industry. Yale School of Management. <http://ssrn.com/abstract=907292>
- Klepper G, Peterson S. 2004. The EU Emissions Trading Scheme Allowance Prices, Trade Flows, Competitiveness Effects. *Nota Di Lavoro* 49. 2004 Kiel Institute for World Economics. <http://ssrn.com/abstract=525342> or doi:10.2139/ssrn.525342
- Lane L, Montgomery D. 2008. Political Institutions and Greenhouse Gas Controls. Related Publication. 08-09. Reg Markets Center. <http://ssrn.com/abstract=1296107>
- Levine NM. 2006. The Problem of Pollution Hotspots: Pollution Markets, Coase and Common Law. Legal Studies Research Paper Series. 06-01. Michigan State University. <http://ssrn.com/abstract=1089807>
- Massey R. 2004 Environmental Justice: Income, Race and Health. Available at Global Development and Environment Institute, Tufts University, Medford, USA. <http://ase.tufts.edu/gdae>
- Nellisen N, van der Straaten J, Klinkers L. 1997. Classics in Environmental Studies: An Overview of Classic Texts in Environmental Studies (Series Environmental Studies). International Books
- OECD. 1996a. Implementation Strategies for Environmental Taxes. OECD, Paris, France.
- OECD. 1996b. Environmental Taxes in OECD Countries. OECD, Paris, France.
- OECD. 1999. Economic Instruments for Pollution Control and Natural Resources Management In OECD Countries: A Survey. ENV/EPOC/GEEI (98)35/REV1/FINAL.
- OECD. 2001. Environmentally Related Taxes in OECD Countries, Issues and Strategies. OECD, Paris, France. <http://www.oecd.org/dataoecd/13/10/2385291.pdf>
- OECD. 2001. Valuation of Biodiversity Benefits. Selected Studies. OECD, Paris, France. <http://www.brc.re.kr/pdf/benefits.pdf>
- OECD. 2003. Greenhouse Gas Emission Trading and Project Based Mechanisms. OECD, Paris, France
- OECD. 2004. Tradable Permits. OECD, Paris, France.
- OECD. 2010. Taxation, Innovation and the Environment. OECD, Paris, France
- Pareto V. 1892-93. (English edition 2007) Considerations on the Fundamental Principles of Pure Political Economy. Routledge, London, UK
- Pearce D, Atkinson G, Mourato S. 2006. Cost-Benefit Analysis and the Environment: Recent Developments. OECD, Paris, France
- Perez O. 2009. Regulation as the Art of Intuitive Judgment: A Critique of the Economic Approach to Environmental Regulation. Bar-Ilan University Public Law and Legal Theory Working Paper. 09-02. Bar Ilan University, Israel. <http://ssrn.com/abstract=1305153>
- Perman R, Ma Y, Common M, et al. 2003. Natural Resource and Environmental Economics. Financial Times/Prentice Hall
- Pigou C. 1932. The Economics of Welfare. Macmillan, New York
- Rajan U, Sinha A. 2008. Equilibria in a Hotelling Model: First-Mover Advantage? Working Paper. No. 1114. Ross School of Business at the University of Michigan. <http://ssrn.com/abstract=1158605>
- Risse M. 2008. Who Should Shoulder the Burden? Global Climate Change and Common Ownership of the Earth. Faculty Research Working Papers Series, John F. Kennedy School of Government - Harvard University. <http://ssrn.com/abstract=1338257>
- Ryding S. 1998. Environmental Management Handbook. IOS Press
- Siedenburg JR. 2005. Environmental Economics and the Rural Poor: Distinct Challenges and Solutions. Paper for Envecon. Applied Environmental Economics Conference. University of Oxford. <http://www.google.com.tr/#hl=tr&source=hp&biw=1436&bih=641&q=Environmental+Economics+and+the+Rural+Poor:+Distinct+Challenges+and+Solutions&btnG=Google%27da+Ara&aq=f&aqi=&aql=&oq=&p=1f10a51c87ebe001>

- Smyth S. 2010. A Practical Guide to Creating a Collective Financing Effort to Save the World: The Global Environment Facility Experience. Legal Studies Research Paper Series. Research Paper No. 2010-11. Temple University. <http://ssrn.com/abstract=1580138>
- Solow MR. 1974. Intergenerational equity and exhaustible resources. *The Review of Economic Studies*, 41:29-45
- Stavins R. 2007. A U.S. Cap-and-Trade System to Address Global Climate Change. Faculty Research Working Papers Series. RWP07-052. John F. Kennedy School of Government, Harvard University, USA. <http://ssrn.com/abstract=1026353>
- Sudo T. 2006. Japanese Voluntary Emissions Trading Scheme (JVETS) Overview and Analysis. Climate Policy Project. Institute for Global Environmental Strategies (IGES). <http://www.iges.or.jp/en/cp/pdf/activity06/07.pdf>
- U.S. Environmental Protection Agency. 1987. Economic Studies Branch, Office of Policy Analysis, Office of Policy, Planning and Evaluation. EPA's Use of Benefit-cost Analysis 1981-1986. EPA-230-05-87-028. United States. Office of Policy (EPA), USA
- U.S. Environmental Protection Agency. 2000. Guidelines for Preparing Economic Analyses. EPA 240-R-00-003. U.S. Environmental Protection Agency (EPA), USA
- UN. 2003. Handbook of National Accounting. Integrated Environmental and Economic Accounting. In collaboration with the European Commission, the International Monetary Fund, the Organization for Economic Co-operation and Development and the World Bank
- UN ECE. 1998. Role of Economic Instruments in Integrating Environmental Policy with Sectoral Policies. ECE/CEP/60
- UNEP. 2004. The Use of Economic Instruments for Environmental Policy: Opportunities and Challenges. UNEP
- UNEP. 2009. The Use of Economic Instruments for Environmental and Natural Resource Management. UNEP
- Yang T. 2008. The Implementation Challenge of Mitigating Greenhouse Gas Emissions in the Developing World: The Case of China. Vermont Law School Legal Studies Research Paper Series. Research Paper No. 09-05. Vermont Law School. <http://ssrn.com/abstract=1112287>
- Ysé S, Edward E, Johnstone N. 2008. The Distributional Effects of Environmental Policy. OECD, Paris, France