INTER-AMERICAN DEVELOPMENT BANK

REGIONAL POLICY DIALOGUE STUDY SERIES

Environment Network

Economic Instruments for Water Management: Experiences from Europe and Implications for Latin America and the Caribbean

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November 2003

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November 2003

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Inter-American Development Bank
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The **Regional Policy Dialogue** was established in December 1999 by the initiative of the Board of Executive Directors. The objective was to create a forum of communication within the Bank to expand and enhance dialogue among the countries in the region by sharing experiences, preparing them to face the great challenges of globalization, and generating processes for regional cooperation. The Bank identified seven areas to be included on the Dialogue and created seven specialized networks in which government officials at the Vice-Minister level from Latin America and the Caribbean, who are responsible for decision making and public policy design, participate.

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Foreword

The II Meeting of the Environment Network of the Regional Policy Dialogue, held on February 11 and February 12, 2003 in Washington, D.C., focused its attention on the application of economic instruments for environmental management. This topic was identified as a priority by the Network members, who, as policy makers, recognize the importance of implementing incentive-based mechanisms to effectively and efficiently achieve environmental goals.

For the most part, Latin American and Caribbean countries have relied on the application of command-and-control instruments as part of their environmental management agenda, with limited success. In this regard, there is growing interest–but also much to be learned–about how economic instruments can properly complement and/or substitute traditional command-and-control mechanisms. This was the central topic of the policy discussions at the II Meeting of the Environmental Network. This report tries to capture the main elements of these discussions in the context of the water sector.

The report presents a sample of documents that have been prepared by professionals with significant experience in the areas of water resources and economic instruments. Their work shows that the selection, design and implementation of an appropriate economic instrument is a complex process, signaling the need for the expansion of knowledge and information on the function and application of these instruments.

The Inter-American Development Bank considers it important and necessary to disseminate the conclusions of the discussions that took place at the II Meeting of the Environment Network, and hence to enhance the regional dialogue surrounding this very relevant topic. This report is likely to be of particular interest to those seeking to draw lessons learned from global and regional experiences. Some cases described in the report may prove useful by providing information about possible options for the design of economic instruments. The extra-regional experiences discussed may be utilized particularly with respect to economic instruments that have not been applied previously or have seldom been applied within Latin America and the Caribbean.

The Regional Policy is pleased to release this report in concordance with its objectives of sharing relevant technical material useful to member countries while strengthening their capacities to respond to commonly-faced challenges and exploring opportunities for regional cooperation.

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Introduction

Economic instruments have gained particular attention in recent years as an important tool for reinforcing and implementing environmental legislation while simultaneously contributing to sustainable development. The advantages of economic instruments, when used under specific conditions, encompass the provision of incentives for behavioral change, the generation of revenue for financing further environmental investments, the promotion of technological innovation, and the reduction of pollution at the lowest costs to society.

The objective of this report is to present the main documents that were discussed during the II Meeting of the Environment Network of the Regional Policy Dialogue in the context of the topic "Economic Instruments for Water Management: Extra-regional experience and their applicability in Latin America and the Caribbean".

The report has been organized into four chapters based on separate works of individual authors. Each chapter reflects specific topics that the authors were commissioned to produce for the Dialogue.

The first chapter of this report provides an overview of the international literature and information on the application of economic instruments on water management, with particular analytical emphasis on the European experience. The first section of this chapter provides a brief description of the functions of economic instruments. The second section presents a taxonomy of economic instruments in water management, introduces the available instruments and defines their areas of applicability. Practical examples of experience with economic instruments in water management in European and OECD countries are described in the third section, while the fourth introduces the European Water Framework Directive and looks at how the use of economic instruments is supported and promoted by European legislation. The last section gives a brief evaluation of the current situation in Latin American and Caribbean countries and assesses which instruments described in the international literature and practiced in other countries are potentially attractive for replication in the region.

The second chapter contains a comprehensive case study of the Colombian experience with the use of economic instruments for water management. It includes a thorough description of the institutional context within which the instruments have been applied and an analysis of the policy process surrounding the implementation of the instruments. It also depicts some of the environmental effects derived from the use of economic instruments as a management tool.

The third chapter outlines the conclusions of a more recent analysis of the Brazilian and Mexican cases and discusses the applicability of the French experience in the Latin American context. The French river basin system has been used as a paradigm for Latin America experiences, mostly due to the fact that the French system was created by governmental mandate and implemented in a reasonable time with immediate results. However, praising of this experience has obscured the identification of its main difficulties and constraints that, once recognized, could be of great value for those seeking to learn from its example.

The fourth chapter critically discusses some of the main issues raised in the other chapters of the publication. The author points out a lack of connection between the focus of the environmental economics literature on instrument design and the reality of instrument application reviewed by these studies. It is further argued that the attention given in that literature to the instrument's ability–or lack thereof–to deliver the least-resource-cost solution in response to the problem of meeting regional or national environmental quality standards is not reflected in the selection and design of the real instruments.

Economic Instruments for Water Management: Extra-regional experiences and their applicability in Latin America and the Caribbean

R. Andreas Kraemer, Britta M. Pielen and Anna Leipprand

FUNCTIONS OF ECONOMIC INSTRUMENTS

The use of economic instruments (EI) in environmental policy has a number of advantages (Klarer, McNicholas and Knaus, 1999) that has made them indispensable tools in many European and other countries around the world. Through EIs, environmental or social costs can be incorporated into the prices of goods, services or activities that give rise to them, thus sending price signals to users or consumers to reduce inefficient and wasteful use of resources and foster their optimal allocation. EIs are important tools for the implementation of the "polluter and user pays" principle, as they make the polluter, rather than society as a whole, pay for the damage he causes. Moreover, EIs have the potential to be more cost efficient than traditional command-and-control instruments as polluters are given more flexibility in the way in which they achieve given targets. By raising costs of pollution or resources, EIs can also steer economic activities towards a more eco-efficient use of resources, thereby promoting innovation and competitiveness.[1] Finally, economic instruments may be capable of addressing diffuse pollution, an area where traditional command-and-control instruments often fail.

Economic instruments for environmental management can be classified according to the principal objectives they aim to fulfill. The following paragraphs describes the main functions of EIs, and provide a basic typology to classify EIs used in water management.

INCENTIVE FUNCTION

In cases where the primary purpose of an economic instrument is to create the necessary incentives for behavioral changes, the mechanism can be categorized as an incentive-based instrument.

Incentive taxes are levied with the intention of changing environmentally damaging behavior and without the primary intention to raise revenues. In contrast to regulations, charges, e.g. on emissions, can provide a continuous incentive for improvements in abatement technology. The incentive function can, however, only develop its potential if rates are set

[1] The argument of increased competitiveness is based on the Porter hypothesis. It is supported in part by theories of competitiveness that posit that any regulation that requires a company to re-examine its production process generates a probability of innovation in that process, which may benefit overall competitiveness and reduce or even eliminate costs of compliance (Environmental Law Institute, 1999).

sufficiently high for stimulating the source to invest in emission abatement. The success of such a tax can therefore be determined by the extent to which initial revenues from it fall as behavior changes (Speck and Ekins, 2000).

FISCAL AND FINANCIAL FUNCTION

When the primary aim of an environmental charge or tax is not to create incentives but to raise revenue, the relevant distinction lies in whether the revenue is earmarked or simply added to the general government budget. If the purpose of a tax is merely to gain money for the national budget, the economic instrument can be categorized as a fiscal environmental tax (RIZA, 1996). A charge (or tax) fulfils a financing function if the revenue is allocated for specific environmental purposes (earmarked), e.g. if the money raised from water supply charges is spent on public water management costs. While it is argued that the economic rationale for such schemes is weak, they may nevertheless play an important role in enhancing the acceptability of the taxes and charges in question in the public opinion, and in providing funds for environmental expenditures.[2] A problem with financing related public services through earmarking is that the level of finance for public services may have to adjust to changes in revenue, rather than to changes in demand and needs (see Box 1).

SOFT FUNCTIONS

Aside from the functions outlined above, economic instruments can have additional results such as, for example, capacity building and improvements in implementation ("soft functions"). Kraemer (1995c) identified several soft functions in relation with the German water abstraction tax. Some of these are:

- It provided the environment ministries in the *Länder*[3] with a source of finance that they either control directly, or have relatively strong claims on in competition with other ministries. It thus helped to build up the necessary personnel capacities for water resource management.
- It created a need for a continuous updating of information and documentation on water abstraction and consumption. This provided an opportunity to strengthen the information bases for administrative purposes.
- At the same time, it introduced many elements of control and enforcement usually associated with revenue raising. It thus helped to formalize communications between the administration and water users and to increase the frequency of feedback. This also strengthened the administrations' position in cases of conflict.

The functions of economic instruments are not mutually exclusive and, as the fourth section will show, most instruments fulfill more than one function. Charges designed to recover the costs of a service can raise the customer's awareness of its value and may prompt a more careful or economic use. On the other hand, taxes introduced primarily to provide an incentive to change behavior will also raise revenue.

A TAXONOMY OF ECONOMIC INSTRUMENTS

The application of economic instruments in the water sector can basically occur along the entire water cycle. The extent to which they are used and the experiences gained differ across countries. While water prices and sewerage charges are common instruments in all European countries, tradable permits find no application at all, and, for that reason, one must draw on experiences from OECD countries. The different instruments are presented in Figure 1 and positioned along the water cycle.

WATER ABSTRACTION TAXES

A water abstraction tax is a certain amount of money charged for the direct abstraction of water from ground or surface water (Roth, 2001). In some cases only ground water abstractions are charged to reduce the price differential between surface and ground-

[2] Source: http://www.mst.dk.
[3] Germany is a Federal Republic with 16 states, or Länder.

BOX 1

EARMARKING OF REVENUES

Earmarking can be implemented in the following ways:

- The simplest form of earmarking involves allocating resulting revenues to the group that paid for the originating taxes. Usually, different formulae are used to raise and disburse revenues. Such simple earmarking usually has little environmental effect and transaction costs can be high. However, such systems can be useful, for example, in mutual insurance schemes.
- More complex is the French model of raising "*redevance*" (see *Global Experiences with Economic Instruments* section) which is recycled *grosso modo* back to those who contributed to the revenue of the *Agence*. In fact, those who contributed have a moral claim on their contribution and can expect a subsidy when it is their turn to make pollution control investments. Such system can be useful to spread the burden of heavy investments, especially in the context of comprehensive investment programs implemented over a long period of time. Depending on the degree of solidarity among the water users within a river basin area, such schemes can either work for the basin as a whole or be segmented according to sectors or regions.
- Beyond these possibilities, earmarking can be relaxed so that money does not go back to those who paid, but is used instead to finance typical governmental functions, such as water and groundwater monitoring, modeling, research and technical development, or information disbursement. In this case, earmarking produces a double-dividend. Firstly, because of the incentive function on the revenue side, and secondly, by financing activities that are beneficial to the environment.

Earmarking has economic advantages and disadvantages and can be politically useful.

- Earmarking can, if badly designed, favor capital-intensive investments over others because of the availability of capital. Similar to the Averch-Johnson effect, it can thus lead to over-investment.
- Earmarking should not be used to subsidize activities that have significant negative externalities. Instead they should only be used to compensate for positive externalities (external benefits) that cannot be captured through the market or regulated prices or charges.
- Experience has shown that earmarking is useful to raise political acceptance for the introduction of economic instruments.
- Over time, earmarking tends to be relaxed, so that general water management functions are financed first, and later the revenue from originally earmarked charges is treated as general revenue and becomes part of general taxation.

Contrary to the principles of public finance, earmarking has proven to be a useful tool in environmental policy.

water abstraction, while in others, ground and surface water abstractions are taxed, however often at different rates.

Besides their revenue-generating function, water abstraction taxes can act as incentive measures. Effective water abstraction taxes can induce a change in user behavior resulting in lower water demand and a reduction of water leakage. If the tax is set to reflect marginal costs of water abstraction, it enhances the cost effectiveness of the service provided. In general, water abstraction policies should consider both surface and groundwater in order to limit negative effects that more efficient pricing for one water source will have on the other (European Commission, 2000a).

In many countries, revenues generated by abstraction charges are earmarked for explicit water management purposes, so that tax proceeds are indirectly returned to those liable to pay. Water abstraction taxes may be set to reflect the relative scarcity of water and may vary by regions.

WATER PRICES

The water pricing instrument has the primary goal of financing water supply infrastructure. According to the European Commission (2000b), water

FIGURE 1

ECONOMIC INSTRUMENTS FOR WATER MANAGEMENT (ADAPTED FROM KRAEMER 1995B)

prices should be set at a level that ensures the recovery of costs for each sector (agriculture, households and industry) and to allocate costs to those sectors (avoidance of cross subsidies). In principle, water prices should relate to three types of cost: direct economic costs, social costs, and environmental costs. The estimation of each type of cost involves a different set of problems (Kraemer and Buck, 1997):

- *Direct economic costs*: Full recovery of the economic costs of water services will require that water prices include (1) operation and maintenance costs of water infrastructure, (2) capital costs for the construction of this water infrastructure, and (3) the reserves for future investment in water infrastructure.
- *Social costs*: With respect to water services, the direct or indirect social benefits (for instance in the field of public health) vary largely with respect to the specific contextual settings. Calculating these costs and comparing them across cases is, therefore, not feasible, which prohibits their incorporation into a comparative study.
- *Environmental costs*: The environmental costs of a certain economic activity are generally not reflected in the prices established in the market, but appear as externalities. Conceptually, the non inclusion of negative environmental costs in price fixing mechanisms can be discussed under the heading of subsidies. In practice, though, there are great difficulties linked to the establishment of benchmarks for costs caused by environmen-

tal degradation, and to the inclusion of these costs into market-based mechanisms. Still, the principle of full cost recovery requires that these costs be taken in consideration. Given the methodological problems involved in calculating environmental externalities, the inclusion of an environmental component into water prices will be backed by political rather than economic arguments.

In addition to their financing function, water pricing policies often fulfill an incentive objective as well. Water prices which represent full costs (economic and environmental costs) provide price signals to users resulting in a more efficient water use and generate the means for ensuring a sustainable water infrastructure (Hijum, n.y.)

SEWERAGE AND EFFLUENT CHARGES (INDIRECT EMISSIONS)

Sewerage charges are tariffs paid for the discharge of used water. A sewerage charge is the amount of money paid for indirect discharges, that is domestic sewage or effluents discharged into the sewer system. Foremost, sewerage charges have the objective of providing environmental authorities with financial resources for water management activities (financial function). Furthermore, these charges may fulfill an incentive function and are in accordance with the polluter-pays principle by internalizing treatment costs into the decision process of users through adequate price signals (Kraemer and Piotrowski, 1995).

WATER POLLUTION CHARGE

A water pollution charge takes the form of a direct payment based on the measurements or estimates of the quantity and quality of a pollutant discharged to a natural body of water (not a sewer). Pollution charges are an important step towards the realization of the polluter-pays principle even if their calculation is not based on estimates of damage costs. By levying a charge on pollution, a clear signal is given that society is no longer willing to bear the costs of pollution and that at least part of the costs of the damages caused should be recovered directly from polluters (Roth, 2001). Pollution charges may set incentives in terms of pollution abatement promotion. In cases where the revenue generated by the charge is earmarked for measures to improve water quality, a pollution charge additionally fulfils a financial function for such improvement .

Designing optimal pollution taxes that minimize the total cost of pollution (damage costs plus control costs) is a difficult task, as it requires the existence of a reasonable database and information on pollution damages. The exact calculation of taxes requires information about the exact quantity and quality of the discharged wastewater (Kraemer, 1995a).

SUBSIDIES

The OECD (1996) defines subsidies as "government interventions through direct and indirect payments, price regulations and protective measures to support actions that favor environmentally-unfriendly choices over environmentally-friendly ones." This definition includes direct subsidies in the form of direct payments by the government to certain users, and indirect subsidies. Even in the absence of "explicit monetary transfers" one can speak of (indirect) water subsidies if the system of water prices in place does not adequately reflect all costs involved in delivering that service. Thus the effective implementation of the principle of "full cost recovery" in the formation of water prices in turn would eliminate water subsidies (Kraemer and Buck, 1997). This conceptual perspective highlights the close relationship between water subsidies and water pricing practices. Further indirect subsidy schemes include tax concessions or allowances, guaranteed minimum prices, preferential procurement policies and cross subsidization.

Generally, subsidies can have two main objectives: either they are instituted to compensate users for a cost they incur in response to a required action or a prohibition, or subsidies are put in place so as to set the necessary incentives for achieving a desired, but not required, action.

Subsidies can be of a fiscal nature and paid out of public funds, or take the form of parafiscal cross subsidies through redistribution between urban areas. From an environmental perspective, a subsidy consists of the value of uncompensated environmental damage arising from any flow of goods or services (Barg, 1996). As environmental damage is usually

not included in water prices, *de facto* subsidies often exist.

Subsidies are economic instruments that may lead to inefficient situations. However, they can create the necessary incentives to stimulate a change in user behavior towards environmentally friendly conduct or induce investments in environmentally friendly production techniques, thereby mitigating or eliminating negative effects. In some cases, like flood alleviation, for example, subsidies may provide a relatively cheap option for governments, especially considering the reduction in losses that may be achieved through adequate flood proofing (Otter and van der Veen, 1999). There is, however, a danger that over the longer term, resources may be channeled to solve problems that are no longer a high priority.

TRADABLE PERMITS

If disagreement exists over the allocation of water from shared resources among segments of the population, a potential instrument is the creation of transferable rights to use/pollute water and the creation of efficient markets in which the rights can be traded. The rationale behind water allocation through tradable rights is that in a perfectly competitive market, permits will flow towards their highest value use (Tietenberg, 2000). Permit holders that gain a lower benefit from using their permits (for example due to higher costs) would have an incentive to trade them to someone who would value them more. A sale will result in a situation of mutual benefit: the benefit the permit holder reaps from selling his permit will exceed the benefit he derives from using it, while the buyer gets more value out of the permit than he has to pay for it.

When discussing tradable permits systems relating to water, three fundamentally different fields of application can be discussed (Kraemer and Banholzer, 1999):

- *Tradable water abstraction rights* for quantitative water resource management. These water rights can be permanent and unlimited (property rights to the water resource) or temporary and limited (transferable rights to use water without right of abuse);
- *Tradable discharge permits*, or tradable water pollution rights, for the protection and management of (surface) water quality. Such pollution rights can relate to point or to non-point sources, and trades can even be arranged among different kinds of sources;
- *Tradable permits to use or consume water-borne resources*, such as fish or the potential energy of water at height or the kinetic energy of water flowing.

Further distinctions can then be made within each of these fields of application. In relation to tradable water rights, distinctions can be made regarding the "intensity" of trading, which can be permanent or temporary (seasonal) or even one-off. With regard to water pollution rights, further differentiations can be made in relation to the polluting substance (or class of substances) in question (Kraemer and Banholzer, 1999).

Several prerequisites must be met for the successful implementation of a tradable permit system. First of all, property rights must be well defined and specified in the unit of measurement (Kraemer, Interwies, Kampa, 2002). As a second point, water rights must be enforceable to secure the net benefits flowing from the use of the water rights for the rights holder. In an ideal case, transferable water rights should be separate from land use in order to create exposure to the opportunity to realize higher valued alternatives (Pigram, 1993). Finally, an efficient administrative system must be in place to ensure market operation (Armitage and others, 1999).

Situations in which the conditions may not be adequately met include the possibility for monopoly market power, the presence of high transaction costs and insufficient monitoring and enforcement (Tietenberg, 2000). However, even in the presence of these imperfections, tradable permit programs can be designed to mitigate their adverse consequences.

LIABILITY FOR DAMAGE TO WATERS

Environmental liability systems intend to internalize and recover the costs of environmental damage through legal action and to make polluters pay for the damage their pollution causes. To that extent environmental liability laws are a fundamental expression of the polluter-pays principle. The intention of environmental liability laws can be twofold:

first of all they aim at inducing polluters to make more careful decisions about the release of pollution according to the precautionary principle, and, second, they seek to ensure the compensation of victims of pollution. While liability systems assess and recover damages ex post, they can nevertheless provide incentives to prevent pollution, as long as the expected damage payments exceed the benefits from noncompliance.

For liability to be effective, there needs to be one or more identifiable actors (polluters); the damage needs to be concrete and quantifiable; and a causal link needs to be established between the damage and the identified polluter (European Commission, 2000c). Thus, liability is not a suitable instrument for dealing with widespread pollution, a situation in which it is impossible to link the negative environmental effects with the activities of certain individual actors.

The environmental liability instrument, therefore, conveys several advantages[4]:

- Liability rules control pollution through the decentralized decisions of polluters to act in their own interest. Polluters will control pollution up to the point where the marginal pollution damage equals the marginal cost of control, thereby minimizing their total costs for compensating victims and controlling pollution.
- The provision that polluters must pay for the damage they cause provides great incentives to avoid environmental damage. The higher the anticipated payment in case of a damage, the higher the incentive for taking preventive measures (precautionary principle).
- Environmental liability laws constitute a significant step towards the application of the polluter-pays principle.
- Environmental liability will also be reflected in prices and is thus an important contribution towards realizing the principle of "ecologically honest prices."

CLASSIFICATION

Table 1 summarizes the economic instruments discussed with respect to their main objective and classifies them according to the scheme set out in the second section of this report.

GLOBAL EXPERIENCES WITH ECONOMIC INSTRUMENTS

The following chapter complements the description of economic instruments for water management by providing examples of their application in European and other OECD countries. Case studies are presented in the boxes that follow and they exemplify interesting practices and highlight the respective functions each instrument fulfills.

WATER ABSTRACTION TAXES

In the following section, three examples of the implementation of water abstraction taxes in The Netherlands, Germany and Denmark are presented. Abstraction taxes often combine an incentive with a revenue raising function. In many cases, the tax rate is volumetric, that is based on metered abstraction, which is necessary to provide an adequate incentive to save water. As the comparison of the two examples from Germany shows, abstraction tax schemes may differ in whether the tax is levied on the actual amount of abstracted water, or whether it is linked to abstraction permits, so that the maximum amount of water for the abstraction of which a permit has been given is taxed. The incentive structure imposed by the latter system is slightly different and can cause water users to review their water needs and consider the potential for water savings and for increasing the use efficiency.

By differentiating tax rates, the relative consumption of ground water and surface water may be influenced. The abstraction of small quantities of water is often exempt from the tax, and there can be tax exemptions or reductions for farmers or industries in order to limit the impact of the tax on their competitiveness.

In Denmark and the Netherlands, the revenue of the tax is fed into the general government budget. The levy may be part of a green tax reform and compensate for a reduction in other taxes (income tax in Denmark). In the case of Germany, the taxes tend to be at least partially earmarked and the revenue is of-

[4] Source: http://www.eeb.org.

TABLE 1

CLASSIFICATION OF ECONOMIC INSTRUMENTS

Function	Economic Instrument	Advantages	Disadvantages
Incentive Functions	*Water abstraction charges*	Adjustment of price signals to reflect actual resource costs; encourage new technologies; flexibility; generation of revenue that can be used for water management activities	Low charges/prices have a minimal impact on user/polluter behavior and can lead to resource-over-utilization
	Pollution charges	Same advantages as water abstraction charges; polluter-pays principle	Same disadvantages as water abstraction charges
Fiscal Functions	*Subsidies for environmental R&D, tax differentiation*	Induce a more eco-friendly behavior at any rate; easily understandable	Rely on measurability of single components; regional aspects are difficult to consider; high monitoring costs
	Pollution taxes	Encourage the development of cleaner techniques; leave the choice to sources between paying taxes or investing in cleaner technology; fulfill an additional incentive function	Low willingness to accept by the public and the target group concerned
Financial Functions	*Water prices; sewerage charges*	In accordance with the user-pays principle; may convey an incentive function in addition to financing or cost-recovery by reflecting the true costs of a product or service	
	Financial subsidies	Popular with recipients, promote desirable activities rather than prohibiting undesirable ones	Require funding, may lead to eco nomic inefficiencies, may encourage rent-seeking behavior
	Earmarked taxes or charges	Reduce the opposition to the tax as those liable to pay benefit in turn from the revenue	Rely on the measurability of single components; regional aspects are difficult to consider
Liability Laws	*Liability legislation*	Assess and recover damages ex-post but can also act as prevention incentives; provide strong incentives	Require an advanced legal system; high control costs; burden of proof

Based on OECD, 2001a; Stavins, 2000; UNEP, 2002.

ten spent on environmental subsidies, such as compensation payments to farmers for restricted land use.

The Netherlands

In the Netherlands, the water abstraction charging scheme comprises two different taxes: one tax that is charged by the provinces and an additional national levy on groundwater abstraction.[5] In our example, the focus will be on the national charge.

The national *groundwater abstraction tax* (GAT) was introduced in 1995 as one of several "green taxes." The objective of this tax is twofold. First, it was intended to act as an incentive and to reduce

[5] The provincial tax on the commercial use of groundwater is a revenue raising tax, which generated a revenue of €20 million in 2000. The revenue is earmarked and used for groundwater research and pollution abatement (Speck, 2000).

groundwater use in favor of surface water by narrowing or eliminating the price differential between ground and surface water. Ground water is cheaper in the Netherlands due to lower treatment costs and it amounts to 70 percent of the country's water supply. Second, the tax has a revenue raising function and was partly initiated to increase the national tax yield. In 1992, a further increase of the fuel tax was suspended, in light of the adverse effects an additional increase in fuel prices would have on energy intensive industries. To compensate the general budget for resulting forgone revenues, the GAT was instituted (Mostert, 2000).

The Dutch groundwater abstraction tax is a national tax set by national law. The revenue generated by the tax goes into the general government budget. The tariff is set per cubic meter and its level is mainly determined on the basis of political considerations (Mostert, 2000). In 2000 the tariff per cubic meter was r0.16[6] for public water supply companies, and r0.12 for other users. The tax generated a total revenue of r163.4 million (Speck, 2000), and it is administered and collected by the Ministry of Finance and the Central Environmental Tax Unit in Rotterdam.

There are several exemptions to the general GAT. For example, companies abstracting less than 40,000 cubic meter per year and using pumps with a capacity of less than 10 cubic meter per hour are exempted; furthermore, the draining of building sites is exempted if less than 50,000 cubic meter per month are extracted for less than four months a year; skating rinks and draining and mining capacities at depths greater than 500 meters; and emergency extractions (for example, fire) are exempted. Finally, there exists an exemption for the use of groundwater for rinsing reusable packaging.

Besides the resulting changes in water price, the tax influenced the competitive structure of the industrial sector on two levels. It influenced competition between industries supplied by water industries as opposed to those abstracting for themselves. Also, its influence on industries varies according to the type of abstraction they use, the surface water abstraction being favored by the tax (Ecotec, 2001).

In most cases, the price differential between groundwater and surface water abstraction is not sufficiently reduced by the tax to make groundwater abstraction less profitable than surface water abstraction. The large number of exceptions also limits the scope of environmental effects related to the introduction of the tax. However, it is believed that the determination of the tax rate on the basis of metering did have an incentive effect, and that some water-saving investments have been made in response.

Box 2 summarizes information on the groundwater abstraction tax in the Netherlands as described above.

Germany

Water resource taxes on the abstraction of water from the natural environment were introduced at *Länder* level after earlier discussions at federal level in the 1950s and 1960s failed to bring about the imposition of a federal tax. Water resource taxes were introduced not as alternatives to command-and-control instruments but as their complement, and they followed the general movement of environmental policy from direct regulation by prohibition and prescription towards the use of economic instruments as a means of regulating activity (Kraemer, Strübin and Hansen, 1998).

On January 1, 1988 Baden-Württemberg became the first German Land to establish a tax on water abstraction, the so-called "Wasserpfennig." The tax was established in order to finance compensations to farmers for restrictions on fertilizer use in water catchment areas. Similar links exist between water resource taxes and environmentally motivated subsidies in other *Länder*.

The case of Baden-Württemberg is exemplified in Box 3, as it has the longest experience with abstraction taxes in Germany, and its regulatory framework has been copied by many other German *Länder.*

The case of Hamburg, which introduced a tax on water abstraction in 1989, is presented as a second example where different regulating principles are applied.

While the tax in Baden-Württemberg is levied on actual water abstraction, in Hamburg a different scheme is applied by levying the charge on the quantity of water for which an abstraction permit has been given. Accordingly, different incentive structures emerge, as the following case study will exemplify (see Box 4).

In general, two main effects can be discerned from the history of water resource taxation in Germany. First, there was horizontal policy learning:

[6] All currencies have been converted into Euro in accordance with the standard conversion tables.

BOX 2

THE WATER ABSTRACTION TAX IN THE NETHERLANDS

Objectives of the tax:

- To raise revenue (financing function) and provide incentives for water saving;
- To raise revenue for fiscal reform and to protect the scarce groundwater resources of the Netherlands, which account for 70 percent of its water supply;
- To reduce the price differential between ground and surface water.

Specific tax base:

- *Groundwater*: extraction by water works or other entities.

Tax rate (2000):

- Water companies: €0.16/m^3
- Industry/ Agriculture: €0.12/m^3
- infiltrated groundwater: €0.025/m^3

Revenue collecting authority/ administration

- Administration and collection: Ministry of Finance and the Central Environmental Tax Unit in Rotterdam.
- Monitoring of water abstraction by water companies. Self-monitoring abstractors are subject to occasional verification by water companies.

Exemptions

- Sprinkling and irrigating land (if less than 40,000m^3 per year is extracted).
- Draining of building sites (if less than 50,000m^3 per month is extracted for less than 4 month a year).
- Small pump capacity (less than 10m^3 per hour).
- Emergency extractions (e.g., fire).
- Extractions for skating rinks.
- Draining and mining (at depths greater than 500m).
- Use of groundwater to rinse reusable packaging.
- All surface water abstraction.

Effects

- Competition between:
  industries supplied by water industries as opposed to those abstracting for themselves;
  those abstracting ground water and those abstracting surface water (favors the latter);
- Price differential between groundwater and surface water is not sufficiently reduced to make groundwater abstraction less profitable;
- Limited environmental effect due to exceptions, but metering plays an incentive role and it is believed that water-saving investments have been made.

BOX 3

THE WATER ABSTRACTION TAX IN BADEN-WÜRTTEMBERG

According to the water abstraction taxing scheme of Baden-Württemberg, the abstraction of small quantities (= 2,000 cubic meter per annum) is exempt while a deduction of 50 percent is applied to abstractions between 2,000 and 3,000 cubic meter per annum.[7] Furthermore, the tax is not applied to water abstractions that do not require a license according to the federal Water Management Act or the Water Act of Baden-Württemberg, nor to cases where specific exceptions have been granted. The tariff structure (see table below) allows for a differentiation according to the origin of water (surface or ground water) and its use (public water supply, heat pumps, cooling, irrigation, and other uses).

Water Abstraction Tax Rates in Baden-Württemberg:

Use:	*Surface water* [in €/m^3]	*Ground water* [in €/m^3]
Public water supply	0.051	0.051
Heat pumps	0.005	0.005
Cooling	0.005	0.051
Irrigation	0.005	0.051
Other uses	0.020	0.051

Rebates of up to 90 percent are available for water-intensive agricultural, forestry, and industrial enterprises which might otherwise be affected in their competitive position. This rebate is conditional on taking all available measures to save water and to use surface instead of ground water. Similar rebates can be granted if they are in the interest of the public.
When the water resource tax was proposed in Baden-Württemberg, an annual revenue of about €81.8 million was projected. This level was achieved in the first three years. Since then, the revenue has fallen to €71.6 million and is now assumed to have stabilized. Part of the revenue goes to farmers as compensation for land use restrictions.

Source: Kraemer and others, 1998a

[7] Originally in the Act amending the Water Act for Baden-Württemberg of July 27, 1987; now in Article 17a to 17f, Water Act for Baden-Württemberg (*Wassergesetz für Baden-Württemberg*) as amended on July 1, 1988.

BOX 4

THE GROUNDWATER ABSTRACTION CHARGE IN HAMBURG

The German Free and Hanseatic City State of Hamburg has enforced a ground water license fee since July 1, 1989. The fee is levied on the basis of abstraction rights held by water users, namely the maximum quantity of water a user is licensed to pump per year. If that preset quantity is exceeded, the fee is set on the basis of the actual use. Exceptions are made for some abstractions that do not require a license according to the federal Water Management Act, for small quantities (< 10,000 cubic meters per annum) and for water used for heat pumps. A fee schedule is applied in the case of quantities between 10,000 and 20,000 cubic meters. Public water suppliers pay a reduced rate and, in addition, benefit from a blanket reduction of 65 percent.

TABLE 2

GROUNDWATER ABSTRACTION FEE RATES IN HAMBURG

Groundwater quality	'Good Groundwater' [in r/m3]			High chloride groundwater near the surface [in r/m3]		
	1989–90	1990–93	1994	1989–90	1990–93	1994
Public water supply	0.026	0.051	0.056	0.00	0.026	0.020
Other uses	0.051	0.077	0.087	0.026	0.051	0.051

Hamburg distinguished between public water suppliers and all other users, and between "good" groundwater (that is from deep and relatively well-protected aquifers) and water from aquifers near the surface (less than 35 meters of depth) that might be polluted or affected by the tidal river Elbe (salt intrusion). When the fee was adopted, a first increase in the rates was already included. A second increase took effect in January 1994. As of 1994, the blanket reduction for water suppliers was to be lowered to 60 percent.

The fee provided water users with a stimulus to review the water needs and their holdings of water rights, and to consider the potential for water savings and substitution. The "environmental effect" the fee was designed for was not primarily a reduction in water use but a reduction in the water rights held by users. Between 1989 and the end of 1993, more than one third of all water rights (103.8 million cubic meters) were renounced and thus made available for re-allocation for public use.

The legislation was revised on the basis of these results. The focus appears now to be shifting towards setting incentives to save water (rather than to retire water rights), both directly through rate increases, and indirectly through the decrease in the blanket reduction allowed for public water suppliers.

Source: Kraemer, Strübin and Hansen, 1998.

the *Länder*, acting in an area not regulated at the federal level, tried a variety of instruments, shared experiences and modeled their programs after others. Second, as already described, water resource taxation dramatically increased the capacity, competence and information resources of the *Länder* administrations involved overcoming one of the key weaknesses that sparked the development of such taxes in the first place (soft functions) (Kraemer, 1995c).

Denmark

In Denmark the "tap water tax" is applied to water abstraction and is fully passed on to users and added to their water bill. It was introduced in 1993 as part of a green tax reform to reduce income taxes. The tax is initially levied on the water companies, which then, in turn, collect the payments from households, so that the tax is in effect paid by the ultimate users. Water companies must pay the tax on 90 percent of

their abstracted water, independent of the actual amount of water supplied to customers. The tax thus provides an incentive for water companies to ensure a low level of leakage, in order to retrieve the costs incurred by the tax.[8] With the tax being fully passed on to households, it was further intended to act as a resource protection by limiting water demand from households.

Households pay the tax on actual metered water consumption. Since January 1, 1999 it is mandatory to have a water meter installed. Before that date, the tax for households with no metering appliance was based on an assumed water consumption of 170 cubic meters.[9] This estimated consumption level was deliberately set high in order to provide an incentive for consumers to install water meters.[10]

In 1998, the charge per cubic meter of water supplied was r0.67 (including a 25 percentVAT) and the total revenue generated amounted to r214 million. Consumers pay the tax through their water bills where it is listed separately to make it clearly identifiable. The water companies then forward the revenue to the Customs and Tax Agency. The revenue generated by the tax is not earmarked for water management activities but instead constitutes an additional source of finance for the general government budget.

Several exemptions exist, such as those for the agriculture and industry sectors, which can deduct the tax from their VAT liability. Service sector businesses, however, are not entitled to a similar tax refund.

From 1989 to 2000, the Danish water bill doubled from about €1.60 to €3.36 per cubic meter. About half of this increase can be attributed to this tax. The tax is believed to have led to an increased development of water saving appliances. Since 1994, total water consumption in Denmark has declined by 13 percent, while leakage from water works decreased by 23 percent. Box 5 summarizes information on the Danish water abstraction tax.

WATER PRICES

As outlined, water pricing policies generally address three distinct sectors, namely households, industry and agriculture. The water bill paid by users consists of several elements. For households it includes a charge for piped water supply and for sewerage collection and treatment. The following case studies will give an overview on the systems of pricing piped supply of potable water to households in Germany and France. Sewerage services will be discussed in the next section so that components of water prices can be studied in greater detail. For detailed information on the European experience with water pricing policies regarding the industrial or agricultural sector the interested reader is referred to the relevant OECD publications (OECD, 1999a, 1999c and 1999d)

Most European economies have an access rate to potable water supply of 100 percent. For the few European countries that fail to guarantee complete coverage, geographical characteristics and the presumed inefficiency of linking rural households to existing networks is generally the constraining factor (OECD, 1999d). Denmark is one of the few mature European economies that exhibit an access rate below 90 percent.

Tariff structures for domestic water provision vary significantly among OECD countries. However, the majority of countries relies on a combination of fixed and variable charges (OECD, 1999d) and in some cases on an additional connection fee. A general trend can be observed towards more economically viable pricing and the implementation of incentives for water conservation. This trend manifests itself in a decreasing application of fixed-price and decreasing block-tariff structures and a move towards volumetric pricing and increasing block-tariff structures (OECD, 1999d).[11]

France

Administration

In France, the organization of potable water supply is under the responsibility of municipalities or groups of communities, while the role of the state has been

[8] The tax is not levied on 100 percent of abstracted water as there is always a leakage, regardless of the level of maintenance.

[9] OECD, 1999b: A government declaration of 1996 imposes an obligation on water utilities to ensure that as of January 1999 all properties connected to the public water supply have a water meter installed. Furthermore, payment for water deliveries must be made via a combination of a fixed charge and a volumetric charge.

[10] Source: http://www.mst.dk.

[11] An increasing block structure implies that supplementary units of water increase in price, while a decreasing block structure stands for regressive prices with increasing consumption.

BOX 5

THE WATER ABSTRACTION TAX IN DENMARK

Objective of the tax
- To allow for a decrease of income taxes
- To reduce water demand from households (environmental resource protection function)

Specific tax base
- Piped water at delivery

Unit of measurement
- cubic meter (tax is imposed on metered water delivered to the customers; in cases where no metering is in place, a standard consumption of 170 m^3/ year is assumed)

Tax rate
- €0.67/m^3 in 1998 (including 25% VAT)

Revenue collecting authority/administration
- Customs and Tax Agency and its Regional Offices

Use of Revenue
- General government budget (revenue raised in 1998/99: €214 million)

Comments and exceptions:
- Exceptions: Farmers and industry (most enterprises can deduct the tax from their VAT liability; excludes service sector businesses)

Effects
- From 1989 to 2000: water bill doubled, from about €1.60/m^3 to €3.36/m^3. The water tax is responsible for about half this increase, while the other half is due to increased water supply tariffs, increased sewerage costs and the waste water tax
- 13 percent reduction in water consumption since 1994
- Development of water saving appliances
- Leakage from water work decreased by 23 percent

Sources: Ecotec, 2001; Speck, 2000.

limited to water law enforcement (OIEAU, 2002). Due to historical factors, there are still more than 36,000 *communes* in France nowadays with their elected municipal councils and mayors (Barraqué, 1999). There are altogether more than 15,000 undertakings for water supply, some of which are very small municipal water works serving one or two communes.

Due to the fact that local authorities, while enjoying strong political sovereignty, often have little economic power, they often choose to delegate service provision to varying extents to private operators. The delegation can either take the form of a lease, where the community makes investments and only entrusts the operation of installations to a private supplier, or of a concession, where the private company also builds installations. The duration of a concession agreement may vary from 20 to 50 years, while the "lease" type contracts last from five to 20 years (OIEAU, 2002).

Tariff Structure and Rates

There is no national tariff regulation. When the municipality is responsible for collecting a part of the price, as is the case with "lease" delegation, it has the ability to set rates on a yearly basis. In the event of the municipality being under contract with an outside operator (through a concession agreement), prices are set for the duration of the contract and not determined on a yearly basis. In both cases public participation in establishing tariffs is indirect, conducted by public officials responsible for public budgets. In addition, at a regional level, the Prefect can block price increases with public interest in mind.

Charges mostly include a component calculated on the basis of metering. Tariffs structures fall into four basic categories (Buckland and Zabel, 2002):

- Two-part tariffs with a flat rate: the consumer pays a flat rate that entitles him to consume a certain amount of water. Any excess amount is charged on a volumetric basis;
- Two-part tariffs with no flat rate: in addition to a standard fixed rate, a volumetric charge is applied to actual consumption;
- Single tariffs: the consumer is charged purely on consumption (cubic meters);
- Fixed rate tariffs: the charge for water supply is independent of consumption.

Most undertakings currently use the two-part tariff with flat rate (48 percent) (Buckland & Zabel, 2002). Since a 1992 law banned all flat rates for services, fixed rates can still apply to meter rental and reading and thus continue to be found. Tariffs also may vary according to the type of water used, for example surface or groundwater, and there is a reduced VAT rate for drinking water.

Between 1991 and 1996, public water supply prices have increased by 31 percent. In 1996, the weighted average of volumetric rates and of the average fixed charge was equal to r1.23 per cubic meter of which the fixed charge made up for 20 percent[12] (OECD, 1999d). In 1998, the average volumetric charge was r1.30 per cubic meter, no data is available on the fixed component for this year. In 2000, the average price paid by households for water supply was r151.54 per year (Schönbäck and others, 2002).

Pricing Principles

Water laws include a system based on the polluter-pays principle as well as a framework for water charges used to improve water quality and prevent deterioration (Hamada, Interwies and Kraemer, 2002). There is thus an attempt to achieve full cost recovery in water services, although there is some debate as to whether or not France achieves this target given the presence of subsidies.

[12] This figure was obtained by the addition of the average of different utilities' fixed charge elements to the average of their volumetric rates, transforming the former into a "volumetric-equivalent" by assuming a typical household consumption rate (OECD, 1999d).

Germany

Administration

According to Article 28 of the German Basic Law, municipalities are guaranteed self-governance on all local issues, including water supply, so that the provision of water services is the responsibility of municipalities. To date there are a multitude of institutional arrangements with the most common undertakings being municipal enterprises. Companies act like private companies but are in effect publicly owned by municipalities. Municipalities occasionally seek private input, capital or otherwise. The range of undertakings is as follows:

- *Regiebetriebe* and *Eigenbetriebe*: Municipal management and ownership;
- *Eigengesellschaften*: Companies subject to private law, where the municipality holds majority shares;
- Private companies;
- Inter-municipal associations: *Zweckverbände* and *Wasserverbände*;
- Water and ground associations;
- Individuals.

To date there are approximately 6,000 undertakings, of which 96 percent are community owned, 3 percent are of mixed ownership, and 1 percent is private. Drinking water quality and pricing is regulated by municipalities, often set by the local elected Town Councils. Local health authorities are responsible for the control of drinking water quality.

Tariff Structure and Rates

Charges for water services provision are predominantly based on metered water consumption and metering is extensive. Ninety-one percent of the charges are related to volume and 9 percent are standing charges (Hamada, Interwies and Kraemer, 2002). Excessive water use is discouraged by some companies through the use of progressive charges, that is through raising the charge rate as volume increases. Charges are established under the framework of the *Kommunalabgabengesetze* (Municipal Charges Laws, KAG) and are levied by the community-owned utility or mixed enterprise, but not by private operators. Private companies must set prices according to private law. In actuality, these, too, are often set according to KAG formulae. Customers have an indirect role in setting tariffs via representation on local city coun-

cils and utility boards, regardless of the private or public legal status of the utility. VAT is charged on the services and locally elected town councils usually set rates.

In 1997, the price of drinking water was equal to €1.50 of which the fixed charge constituted 9 percent[13] (OECD, 1999d).

Pricing Principles

Public drinking water services are governed by the principle of full cost recovery. Water companies must ensure that water prices cover costs of supply, that customers pay for their consumption levels (user-pays principle), that tariffs are determined by a cost structure, that there be a return on capital, and that the real value of assets should be maintained.

PRICES AND CHARGES IN (PUBLIC) SEWAGE COLLECTION AND TREATMENT

Citizens pay for the provision of sewerage services in all EU member states. Calculation of the charge is often volumetric and based on metered water consumption, although there are alternative systems (Austria). In addition to the volumetric charge, there may be a fixed component that serves as a contribution to the investment cost of the initial connection to the sewerage system (Denmark's connection fee, France). The collection of sewerage charges most often aims at recovering the costs for operating and maintaining the sewerage system. The sewerage charging systems of four representative countries (Germany, Austria, Denmark and France) are presented next and an overview is included in Table.

Germany

Administration and Organization

In 1995 in Germany, around 72.5 million inhabitants (approximately 92 percent of the population), amounting to population equivalents of 117.4 million (including small commerce), were connected to sewerage systems, producing 9.9 million cubic meters per day of sewage, which was treated in 10,390 treatment plants, 88.6 percent of it biologically (Rudolph and others, 1998). Sewerage services are a sovereign service in Germany and municipalities provide this service in order to maintain adequate living conditions for the local population (Buckland and Zabel, 2002).

As *Länder* Water Laws differ, various organizational structures for sewerage services have emerged in the country. Sewage collection and treatment has traditionally been integrated in municipal administration, or has been independent only to a limited degree. The current trend is to move away from municipal operations included in the general budget *(Regiebetrieb*) toward separate municipal entities which operate on their own clearly defined budgetary allotments *(Eigenbetrieb*). In line with this trend, cities are increasingly gravitating toward forming private-law organizations (*privatrechtliche Organisationsformen*) to run their sewerage systems, and accordingly toward shifting the infrastructure and personnel off their own budgets. This step has largely been motivated by growing financial problems and is due to the fact that revenue surpluses are not easy to produce in the sewerage sector.

Charge

In Germany, discharges of water to the sewerage system by households are subject to user charges. The charge is based on metered freshwater consumption, but in general municipalities are free to collect fixed contributions regularly (in some *Länder* even basic monthly charges) in addition to the volume-based charges (€ per cubic meter, or in the case of rainwater € per square meter) (Speck, 2000).

Four basic principles guide the setting of charges (Buckland and Zabel, 2002):

- Charges are set in proportion to the services provided (metered consumption);
- Charges reflect the benefit a user derives plus the costs incurred in providing the service (charges for new connections are borne by the property owner);
- Charges should not differentiate between users;
- Charges should be set at cost recovery rate, that is revenue should not exceed costs.

[13] This figure was obtained by the addition of the average of different utilities' fixed charge elements to the average of their volumetric rates , transforming the former into a "volumetric-equivalent" by assuming a typical household consumption rate (OECD, 1999d).

In 1997, the average sewerage charge was €2.36 per cubic meter of fresh water consumption. The collection of charges is set in the *Kommunalabgabengesetze* (Municipal Charges Laws, KAG) of the various federal *Länder* on principle of cost-recovery: the revenues collected by a particular community may not exceed the actual costs of the sewerage services, and conversely, the charges should be set at such a level that no deficit arises.

In recent years the unit prices for sewage treatment plants have been reduced due to a general downward trend in costs for construction and equipment, technological advancement, and the cost-cutting pressure of competition and rationalization. Further potential for limiting the continued increase in costs and charges for sewerage services can be found particularly in the conceptual phase of construction or expansion projects of sewerage installations.

Revenue Generation and Use

In general, municipalities are able to finance their investments in sewerage systems and operational costs through revenue from contributions and sewerage charges. A legal right to state or federal government subsidies does not exist.

Denmark

Administration and Organization

Around 90 percent of the Danish population is connected to primary and secondary treatment of sewage. Since the 1970s the Danish municipalities are responsible for designing plans for sewage disposal and for financing them through municipal taxes and charges. However, Danish sewerage services are not exclusively carried out by municipal authorities as a significant portion of the sector is dealt with privately by property owners or by neighborhood community groups. The basic principle guiding the financial arrangement of sewerage services in Denmark is the proposition of economic neutrality or self-sufficiency (*Hvile-i-sig-selv*) which is equivalent to the cost-recovery principle. Costs and revenues may be balanced over several years so that revenues and costs may be accumulated over the years. Due to a generally slow progress in water resource protection since the 1980s the Danish government has demanded both a stricter application of the cost-recovery principle for capital and operational costs and an acceleration of investment in sewerage services.

Charge

The Danish sewerage charge consists of an initial connection charge plus a charge for sewage collection and treatment. Municipalities are free to establish calculation methods for tariffs and charges but must respect the cost-recovery principle (Rudolph and others, 1998).

- *Sewerage connection fee*. For households, the charge covers the connection to a double sewerage system consisting of a system for sewage discharge and one for gutter and runoff. For enterprises, the fee is calculated based on the area of the premises.[14]
- *Annual sewerage fee*. For the annual sewerage fee actual amounts of sewage are approximated by metered water consumption, as measurement and control of water usage is much easier. For households without meters, the fee is based on an estimated water use of 170 cubic meters. However, since January 1, 1999, all households should install meters with only minor exceptions. In general, the fee should be the same for all user groups connected to the same system. A specific surcharge may however be imposed on enterprises, based on a pre-defined formula, which considers the content of certain pollutants (e.g., total amount of lead or phosphorus discharged) in the sewage.[15]

Charges can vary considerably between municipalities. The sewerage charge amounted to an average of €1.56 per cubic meter in 1997 (Speck, 2000).

Table 2 displays the development in average user fees over the 1995–1997 period. Developments prior

TABLE 2

AVERAGE USER FEES FOR SEWERAGE SERVICES, 1995–1997, IN €/M³

Type of annual fee	1995	1996	1997
Sewage fee	1.37	1.42	1.56

Source: www.mst.dk

[14] Source: http://www.mst.dk.
[15] Information is based on data from http://www.mst.dk.

to 1995 showed significant increases in the sewerage fees, attributable mainly to the implementation of the Action Plan for the Aquatic Environment. Compliance with the Plan meant that a number of sewage treatment plants undertake major investments, the costs of which were recovered through user fees.

Revenue Generation and Use

The replacement costs of the Danish collection system amount to around €27 billion in 1998 (Rudolph and others, 1998). The annual revenue generated by the sewerage charge amounts to approximately €590 million (Speck, 2000), and is earmarked for the financing of sewerage and collective treatment plants. Since 1989, sewage discharge and treatment are fully financed through user fees.

Exceptions and Comments

Since the 1980s, no direct subsidies have been provided for the Danish sewerage system. However, low interest loans are at times granted for investment in sewage collection improvement or replacement. Since 1989 the Danish sewerage services are subject to the full 25 percent VAT.

France

Administration and Organization

In France, municipalities are responsible for sewerage services but are free to choose between self-provision (direct management) and delegation to private enterprises, as mentioned earlier in this chapter. In a number of cases inter-municipal associations have been formed. The municipal authorities are required to apply the principle of cost-recovery and to make no profit. Depreciation costs should be reflected in their charges to ensure the necessary financial means for replacement and investment. There is no central regulatory authority responsible for sewerage charges, but municipalities are obliged to set tariffs themselves as well as fix delegation contracts with private providers. Private operators provide an estimated 75 percent of all customers with services, and approximately 60 percent of all municipalities have chosen delegation of water services as their operational form (Hamada, Interwies and Kraemer, 2002). There exists an oversight committee, comprising national governmental institutions, to which parties can appeal in case of contract abuse.

Charge

The consumption of fresh water forms the basis for the calculation of sewerage charges. Water meters are customary in France and the trend is moving towards measuring each household's consumption separately. In the French system, there exist sewerage charges depending on consumption (in 1998, the average charge was €1.32 per cubic meter), (Schönbäck and others, 2002), nonrecurring contributions to the initial investment cost for connection, as well as increased charges for heavy polluters and reduced charges for entities producing sewage, which is particularly inexpensive to treat (Rudolph and others, 1998). In addition, a pollution charge (*redevance*) is levied, which is used to create the assets of the *Agences de l'Eau* (River Basin Agencies) which in turn are used to finance water resource protection projects. Between 1992 and 1996 the sewerage charges rose by 90 percent, while the water price grew by only 31 percent. In 1996, the average yearly sewerage bill for a standard household (consumption of 120 cubic meters of water) amounted to €148.49 (Rudolph and others, 1998). By 2000, it increased to €166.05. The average yearly costs of sewerage disposal per person in 2000 were €69.19 (Schönbäck and others, 2002).

In examining the prices and charges for organizational dependency, one will notice that the privatized systems (or systems delegated to private enterprises) in 1996 were 16 percent more expensive (23 percent more expensive in 1991) than the systems operated by municipalities. This finding may result from the fact that privatization has generally taken place in mid-sized cities which carry higher per capita costs, and may have been at a point in time when investments became necessary or when sewerage services became too expensive for the municipality. In addition, profit seeking on the part of private enterprises is seen as a further reason for the increase in charges.

Revenue Generation and Use

In 1996, the total annual revenue generated by the sewage charge amounted to €1.5 billion. The revenue is earmarked to finance water resource protection and investments in water supply equipment.

Exceptions and Comments

Subsidies continue to remain quite important in the French system. Forty percent of the financial means of the *Fonds National pour le Developpement des Ad-*

ductions d'Eau (FNDAE) is spent on sewerage systems and 98 percent is alloted to subsidies for investments (Rudolph and others, 1998). Sewerage services are generally not subject to VAT payment; however, municipalities can pay a reduced VAT on sewerage services and at the same time reclaim VAT paid on goods and services bought in. Applied rainwater collection and treatment are also under municipal responsibility. The resulting costs must be absorved by the general municipal budgets and may not be included in the calculation of sewerage charges.

Austria

Administration and Organization

Austria has comparatively low connection rates (only 75,7 percent of the population is connected to the sewer system) and higher sewerage charges. These findings can partly be attributed to the fact that the Alps cover 60 percent of Austria's surface area, and 56.7 percent of the population lives in communities with less than 10,000 inhabitants. Due to its geography, Austria's connection rates vary quite noticeably from region to region. It is assumed that an overall connection rate of 85 percent is the maximum to be achieved within economically feasible boundaries (Rudolph and others, 1998).

In general, water management is the responsibility of the federal Ministry of Agriculture and Forestry. However, legal matters pertaining to water are under the jurisdiction of the districts, and sewerage services are under the responsibility of municipalities. The Water Law allows for the formation of local water associations *(Wassergenossenschafte*n, WG and *Wasserverbände*, WV) when these prove more effective in achieving objectives regarding water. Around one half of all municipalities are members of such an association.

Charge

The structure of sewerage charges varies greatly even within the various Austrian *Länder*: Styria alone has 29 different models. On the one hand, water meters are quite common, allowing a volumetric charging system. Yet on the other hand, there are alternative systems in Austria with charges being independent of consumption. In Lower Austria (Niederösterreich), for example, the sewerage charges are based on the size of the home, not on water consumption.[16] There are also charging schemes based on the number of toilets in a home or on population equivalents. Industrial indirect emitters generally pay the same charges as households. In general, charges are mainly based on the metered supply of water. In 2000, the charge for sewage treatment was between €0.30 and €2.88 per cubic meter of drinking water provided, €1.73 per cubic meter on average. In cases where the charge is calculated according to the size of the built-on area, rates varied between €0.58 and €10.39 per square meter (average €0.79 per square meter). In the Land of Tirol, there is also a nonrecurring fee for connection to the sewerage system of €726 (Schönbäck and others, 2002). With charges differing widely across municipalities, the average yearly costs of a fictitious household[17] for sewage disposal was €209.68 in 2000. The average yearly costs of sewerage disposal per person amounted to €83.87.

Revenue Generation and Use

There is no detailed information available on the use of the revenue generated by the Austrian sewerage charge. It is designed as a cost-covering charge, however, and thus the revenue is likely to be used in the sewerage and wastewater treatment sector.

Exceptions and Comments

Government subsidies are intended to keep the sewerage charges per household below the politically significant level of r363.36 per year. Municipalities carry the cost of rainwater collection and treatment (as far as applied).

COMPARISON OF WATER BILLS

In order to assess how different environmental economic instruments such as water taxes and charges play out when considering them as a whole, it would be interesting to compare the water bills of representative users such as households, agricultural farms or industrial firms in the different countries under

[16] Under this circumstance, for instance, owners of vacation homes who may not regularly consume water nonetheless regularly pay for the fixed costs of sewerage services.

[17] Size of flat 80m², two adults, one child, one toilet, one bathroom, yearly consumption of 150m³.

TABLE 3

SEWAGE COLLECTION AND TREATMENT IN SELECTED EUROPEAN COUNTRIES

Country	Objective of charge	Unit of measurement	Tax rate (in Euro)	Revenue collecting	Use of revenue authority/ administration	Comments (exception, etc)
Austria	Cost-covering charge	Different models exist (structure of sewerage charges varies greatly even within the various Austrian *Länder*. Styria alone has 29 different models): • m^3 of drinking water provided • sewerage charges based on the size of the home • number of toilets in a house	2000: between €0.30 and 2.88/m^3 of drinking water provided (€1.73/m^3 on average; or between €0.58 and €10.39/$m^2$of built-on area; additional fees differ between the municipalities (e.g., in Niederösterreich, dirtywater and rainwater are also leviedwith a charge)	Municipalities	Revenue is probably used to finance sewerage collection and wastewater treatment	• Sewage charges vary between municipalities; in 2000, the yearly costs of a "fictitious" household were €209.68 on average; the yearly costs per capita were €83.87 • Government subsidies are intended to keep the sewerage charges per household below the politically significant level of €363.36)
Denmark	Cost-covering charge	Charges are payable for waste water management of sewage to local authorities: charge is determined by a connection charge (fixed amount on initial connection to treatment plant) and a combined charge for sewerage and treatment services	1997: average tariff was €1.57/m^3	Municipalities; collected on an annual basis; annual revenue generated by the tax: approx. €590 million.	Revenues are used to finance sewerage and collective treatment plants	• Collective treatment plants are completely financed by charges (no government funds) • About 90% of the population is connected to primary and secondary treatment • Construction and operation of the plants is financed solely by the revenues of sewerage charges – fully user financed

(Continued on next page)

TABLE 3

SEWAGE COLLECTION AND TREATMENT IN SELECTED EUROPEAN COUNTRIES (continued)

Country	Objective of charge	Unit of measurement	Tax rate (in Euro)	Revenue collecting	Use of revenue authority/ administration	Comments (exception, etc)
France	Cost-covering charge; generation of revenue for water resource management objectives	Charges consist of a fixed amount and an amount based on water usage (metered consumption)	1998: €1.32/m^3	Municipalities with private sector involvement; revenue generated in 1996: €1.5 billion	Revenue is earmarked to finance water resource protection and water supply equipment	In 2000, the yearly costs of a standard household were €166.05 on average; the yearly costs per capita were €69.19
Germany	Cost-covering charge	Main charge is based on metered consumption of freshwater; municipalities may collect additional fixed contributions	1997: r2.36/m^3	Municipalities	Revenues are earmarked to finance collective treatment infrastructure	

Sources: Speck, 2000; Buckland and Zabel, 2002; Rudolph and others, 1998; OECD, 2002; Schönbäck and others, 2002

observation. It might be of particular interest to evaluate the affordability of water services by looking at the ratio of water prices to average disposable income, that is to assess how strongly charges affect users under the given system.

However, there are a variety of well-founded drawbacks or issues in such a comparison. The main difficulty is that the necessary data are not readily available in a comparable format, and that their compilation requires a substantial research effort and is subject to large potential errors.

The charging systems may differ in (Rudolph and others, 1999; Kraemer and others, 1998b):

- The extent of services and costs comprised in the water bills;
- Relative contributions of fixed and consumption-dependent components;
- The presence or absence of nonrecurring connection fees;
- The type of taxes/charges applied;
- The objectives of the charges applied (cost recovery, incentive);
- The role of state subsidies;
- Whether water prices are subject to VAT, and what its level is;
- The extent to which depreciation of installations is in the price.

Data quality and availability in general also vary between countries. As Rudolph and others (1999) point out, it is easier to collect comprehensive data in centralized systems, whereas in federal states like Germany, charges and bills already vary greatly between regions.

When looking at Tables 4 to 6, it is also important to note that affordability measures, which might be of particular interest to Latin American and Caribbean countries in relation to poverty issues, are based on average bills and average incomes only and thus mask regional differences and income distribution.

When comparing household bills across countries, the problem arises that the "typical" or "standard" households for which statistics are calculated differ between countries (number of persons, amount of annual water consumption/sewage disposal, size of area) (Kraemer and others, 1998b; Schönbäck and others, 2002). So it is often more convenient to refer to bills per capita.

Because of the substantial difficulties outlined above, it was not feasible within the scope of this study to newly collect and evaluate data for a comparison of water bills. Therefore, the following paragraphs will give an overview of available data. The interested reader should refer to the studies cited for more in-depth information on this subject (OECD, 1999d; Kraemer and others, 1998b; Rudolph and others, 1999; Schönbäck and others, 2002).

Sewerage Charges

A study comparing European sewerage charges conducted earlier by *Ecologic* in cooperation with the *Beratungsbüro für Wassertechnik und Management*, Wien (Rudolph and others, 1999) uses the annual bill for sewerage services per year and per capita connected to the sewage collection system. Table 4 shows the relevant data for several countries of the Euro-

TABLE 4

ANNUAL SEWERAGE CHARGES PER CAPITA IN SOME COUNTRIES OF THE EUROPEAN UNION (1996–1998)

	Germany	Denmark	France	Austria
annual charges in € per capita connected to sewerage system	109	93	68	154
GNP/inhabitant*annum (€)	20,605	21,348	17,852	19,803
annual charges in % of GNP	0.76	0.58	0.68	0.72
annual harmonized charges in € per capita connected to sewerage system	122	123	117	142

Source: Rudolph and others, 1999.

pean Unionfrom 1996 to 1998 (first row). To provide information about the level of the charges in relation to income, the same study presents the annual average sewerage bill per person as a percentage of per capita GNP (third row). In the fourth row, the annual charges are corrected for several distorting factors, such as direct or indirect subsidies, connection fees, VAT rates, and others.

From the systems reviewed, clearly Austria and Germany have the highest average sewerage bills, both in absolute figures and in percentages of GNP. There are, however, no dramatic differences in bills or in affordability.

The harmonized annual charges, which give an estimation of what the different charges would amount to under the same circumstances, differ considerably from the original data. This is an indicator of the underlying variability of charging system and thus of the challenges posed to any attempt to compare these data.

Water Supply Prices

In 1998 a report was prepared by *Ecologic* on European prices for water supply (Kraemer and others, 1998b). Table 5 shows water prices in terms of both average value and estimated maximum/minimum value for each country, as well as the average annual bill per household and per capita. This table may serve as an illustration for the aforementioned challenges to data compilation. The values are not directly comparable, since they are not available for each country for the same year. Moreover, mean values were not calculated by the same method in all cases. Because of the limited data availability, it is likely that the interval of charges within countries is actually higher than indicated here. Nevertheless, the figures should give some idea of the scale of prices and annual bills.

It is interesting to note that Germany, while having relatively high water prices per cubic meter, does not differ significantly from other countries with respect to annual bills. This suggests that water consumption in Germany is more economical than in other EU countries (Kraemer and others, 1998b).

Table 5 also shows that the variability of prices within countries is greater than the variability between countries. It appears that regional differences within or between EU countries have greater influence on the costs of water supply and water prices than legal and institutional differences between those countries.

A study published by the OECD in 1999 (OECD, 1999d) compares the average affordability of household water supply bills across countries by relating them to GDP per capita and to household income, respectively.

TABLE 5

WATER PRICES AND AVERAGE ANNUAL BILLS IN SOME COUNTRIES OF THE EUROPEAN UNION

		Water prices in r/m ^{3}		Average bill in r/annum		
Country	Year	Interval	Mean value	per household	per capita	persons per household
Denmark	1993	0.18 – 0.84	0.41	N.A.	28	—
Germany	1996	0.93 – 2.02	1.46	130	72	1.8
England and Wales	1995	0.51 – 1.43	0.87	138	59	2.3
France	1994	0.06 – 1.86	1.02	133	54	2.5
Italy	1992	0.10 – 0.67	0.36	112	38	2.9
Netherlands	1995	N.A.	1.38	174	69	2.5
Spain	1992	0.005 – 1.28	0.20	N.A.	N.A.	—

Source: Kraemer and others, 1998b.

TABLE 6

AVERAGE AFFORDABILITY OF WATER PRICES AND SEWERAGE CHARGES

	Average prices for public water supply for a family of four, relative to GDP, based on IWSA data (1996), in r	Prices for public water supply in r/m ^{3} (year)	Sum of average water prices and sewerage charges as proportion of household incomes (Y) or expenditure (E) (1997/98)
Hungary	3.62	0.28 (1997)	> 3%[18] (Y)
Portugal	2.25		
Czech Republic	2.17	0.35 (1997)	
Germany	1.32	1.50 (1997)	
Luxembourg	1.30	0.89 (1994)	1.0–1.5% (Y)
Netherlands	1.13	1.31 (1998)	1.6%
Austria	1.13	0.94 (1997)	1.0–1.3% (Y)
France	1.12	1.23 (1996)	
Belgium	1.09	1.49 (1997) (Flanders)	
England and Wales	1.05	1.23 (1998–9)	1.3% (Y)
Spain	1.02	0.59 (1994)	1.0%[19] (Y)
Finland	0.97	1.16 (1998)	
Denmark	0.68	1.00 (1995)	
Sweden	0.59	0.89 (1998)	
Norway	0.45		
Italy	0.43	0.40 (1996)	

Source: OECD, 1999d.

The first column of Table 6 relates to water supply prices only. Data are based on a 1996 household water bill survey which was conducted by the International Water Services Association (IWSA) to establish the average public water supply bill of a standard four person household in a number of cities in each of the participating IWSA members. The results exclude VAT and other consumption/sales taxes. The average bill for a household of four in each country is then divided by the GDP per capita for the same year. While the absolute magnitude of the resulting data series is not relevant, it provides an indicator of relative average affordability across the OECD.

Water prices per cubic meter are listed in the second column.

The third column presents information from the country submissions in response to enquiries made for the study. The figures in this column include both water supply prices and sewerage charges. They are presented as percentages of household incomes or expenditures.

[18] Figure exceeds 3 percent "in many regions" in the low-income categories.

[19] Barcelona only (which has relatively high charges within Spain).

The comparison of affordability and absolute water prices draws attention to the fact that low prices in international terms (Hungary, Czech Republic) can actually represent high water charges relative to per capita incomes (GDP). Similarly, water supply charges that are high in international terms (Denmark, France, the Netherlands, England and Wales, Sweden) do not necessarily reveal water charges that are the highest in relation to per capita incomes.

In terms of analyzing the effects of economic instruments, it would be revealing to disentangle the contributions each instrument makes to the total household bill, that is how taxes and charges that do not directly apply to household users, such as abstraction taxes and effluent charges, are passed on to them through their water bills. However, this would require further research and is beyond the scope of this review.

PRICES AND CHARGES IN INDUSTRIAL EFFLUENT DISPOSAL

Charges for the discharge of effluents into natural waters are collected in seven countries of the European Union.[20] Four of these systems will be reviewed here, namely the cases of Germany, France, Denmark and the Netherlands. Denmark and Germany levy charges only on direct discharges, leaving operators of sewage treatment plants to pass the cost of the charges on to their clients, the indirect emitters. France and the Netherlands follow a conceptually different approach by charging indirect emitters directly and either exempting the operators of sewage treatment plants from paying effluent charges (France) or granting generous reductions (the Netherlands). Either way, the indirect dischargers are brought into the charging system and have to pay their share.

In general, all of the four countries base their calculation of effluent charges on the amounts of certain pollution parameters discharged within a specified period of time. However, the charging systems differ considerably with regard to the exact calculation methods applied and the substances included. Furthermore, the types of effluent subject to effluent charges and the actors obliged to pay differ between the effluent charging systems.

As introduced in the fourth section, economic instruments can have different functions. This preposition is exemplified in the case of the effluent charging systems of the four countries studied which clearly differ in their main objective. The German and the Danish systems have an incentive focus, while the French and the Dutch charging systems mainly aim at revenue generation.[21]

Germany

The design of the German effluent charge seeks to provide strong incentives for pollution abatement. Industrial plants of all sizes with any quantity of discharge are subject to the effluent charging system. Sewage treatment plants are equally liable to the effluent charging scheme and no reductions or exceptions apply to them. Their costs are recovered through the sewerage charges paid by households.

The municipal authority issues permits for small discharges and the regional administration for larger discharges that is large sewage treatment plants or industry. The conditions for permits for industrial discharges are based on general emission limit values (ELV). These ELV depend on the "Best Available Technologies" (BAT). BAT-derived emission standards make considerations for the state-of-the-art technologies available for production processes and pollution abatement in the various industrial sectors. The environmental quality of receiving waters plays a complementary role.

In Germany, effluent charges are levied on direct discharges of effluents into natural waters. The definition of direct discharges includes:

- Industrial effluents;
- Agricultural discharges;
- Discharges from sewage treatment plants (STP);
- Discharges and leakage from landfills;
- Direct rainwater discharges;
- Minor effluents such as domestic sewage from decentralized treatment facilities.

No effluent charge is levied on rainwater from industrial plants not exceeding the size of three hectares. Rainwater from railway is exempted likewise.

To provide adequate incentives for being effective in directing and encouraging pollution control measures, charges must be set sufficiently high. Charging levels in Germany are set high enough for

[20] Belgium, Denmark, Germany, Spain, France, the Netherlands and the United Kingdom.

[21] Unless stated otherwise, the information presented in this section is based on Hansen and others, 2001.

acting as deterrents to water pollution and have motivated considerable investment in pollution abatement measures. The charge of €35.79 (1998) per pollution unit[22] is uniform across the entire country. Individual charges are based on the values stated in the permit and based on the following general formula:

$$EC = f(a_i; pu_i)\ 1 \leq i \leq n$$

where *EC* is the effluent charge for one year, a_i is the charge rate for a certain pollutant, pu_i stands for the number of pollution units discharged in one year and *n* is the number of pollutants entering into the calculation. Dischargers conduct self-monitoring and the permit-issuing water authority has the responsibility of inspection. The frequency of compliance monitoring by the water authority depends on the authority except for sewerage treatment plants, for which the Urban Waste Water Treatment Directive specifies the monitoring intervals. The German system allows for rate reductions in several cases:

- If effluents meet the BAT-derived ELV, the charge is reduced by 50 percent, which creates strong incentives to invest in abatement technologies;
- Charges are reduced when the monitored values are lower than stated in the permit;
- Pollutants that are subject to the effluent charge but do not exceed specified threshold values or dilution factors are not included in the calculation;
- Charges can be offset against investments in pollution abatement or expenditures for sewage treatment plants, to promote the removal of dangerous substances from industrial discharges and to support the adoption of BAT.

The total revenue generated by the effluent charge is quite high (€365 million in 1999), especially given the possibilities for offsetting the charge against investment, resulting in reduced revenues. At present, of the countries considered here, only Germany operates a system where revenues generated by the effluent charge may under certain conditions be sufficient for offsetting investment in water resource protection and management. Revenues are collected on an annual basis. As the *Länder* are the competent authorities for water management and legislation, they are the recipient authorities and in addition responsible for the distribution of revenues. Revenues from the effluent charge are earmarked for a range of water management activities, such as subsidies for the investments in water pollution control and cost coverage for other quality improvement measures. The revenue is thus used to maintain and improve water quality and also fulfils a financing function.

France

The French effluent charging system has been established to raise funds for water quality management, and for covering water pollution control by the authorities and investments into sewage treatment plants. Therefore, the design of the system aims at providing a financing function. To a lesser degree, it sets incentives to reduce water pollution by furthering the adoption of BAT and the building of sewerage treatment plants.

The French effluent charging system applies to direct discharges into surface waters and indirect discharges into the public sewer system. Indirect industrial and household discharges into the public sewerage system are thus included in the effluent charging system. Nondomestic dischargers (large industries) are charged for direct discharges, while households and small and medium sized enterprises (SME) are charged indirectly (water companies pay the charge for their clients and pass the incurred costs on to them).

The responsibility for issuing discharge permits depends on the type of discharger. The Regional Directorates for Industry and Environment (DRIRE) issue permits for industrial dischargers, while the *Préfets de Département* are responsible for sewage treatment plants. The permit conditions for industrial discharges are based on sector-specific ELV (set by a ministerial decree) and the water agencies provide incentives to introduce BAT through bonuses. Pollution fees are collected from the households by the municipalities (or concessionaires in case of delegation) via the water bill, while the water agencies collect the pollution levy from industry.

Several exemptions exist with regard to effluent charges:

- municipalities with less than 400 inhabitants are exempted from the charges;
- dischargers from sewerage treatment plants into natural waters are exempted from the charge.

[22] 1.5 pollution units approximately correspond to the 'toxicity' of the untreated waste water generated by one inhabitant per year.

French effluent charges differ across the six regional water agencies and also according to the size of the urban area (Buckland and Zabel, 2002). Charges differ between regions. For industry, charges are based on the quantity and quality of effluents discharged[23] and are calculated on the basis of actual measurement as determined by self-monitoring and compliance monitoring.

In total, the French effluent charging system generated a revenue of €1260.0 million in 1999 (OECD, 2002). The authorities receiving the revenue are those issuing the permits. The money from all effluents is collected into one "basket," so that the revenue is relatively high and used for a variety of purposes, such as the building and upgrading of public sewerage systems, water management in general, monitoring and measures to improve water quantity and quality. The earmarking is hence relatively general.

In the French system premiums for good environmental performance can be granted, which sets additional incentives for pollution abatement.

Denmark

The Danish effluent charging system seeks to provide strong incentives for pollution abatement. It is a fiscal instrument as the revenues generated by the tax are not earmarked and added to the general government budget.

The municipal authorities issue permits for small discharges and the regional administration for larger discharges, i.e. large sewage treatment plants or industry. The conditions for discharges emphasize the importance of the environmental quality of receiving waters in addition to the consideration of ELV. Like in Germany, effluent charges are only levied on direct dischargers of effluents into natural waters.

There are several exemptions to the Danish effluent charge. The discharges from mussel plants, fish farms and overflows from combined sewage collecting systems and stormwater discharges are exempt from all payments. Furthermore, rates reduced by 70 percent to 97 percent exist for entire sectors, namely the fishing, cellulose, vitamin, and pigment industries.

The Danish effluent charge is calculated according to the following equation:

$$EC = €2.67 * x\ kg\ N_{tot} + €13.35 * y\ kg\ P_{tot} + €1.47 * z\ kg\ BOD_5$$

with x, y and z being equal to the total amount of Nitrogen (N_{tot}), Phosphorus (P_{tot}) and biochemical oxygen demand (BOD_5) discharged per year. Charges are calculated on the basis of actual measurement as determined by self-monitoring and compliance monitoring; charges for small discharges are based on standard rates (estimates). Only in Denmark are charges for major discharges collected on a quarterly basis, while revenues collected for minor discharges are transferred to the regional offices of the Ministry of Taxation once a year.

By setting high charges for nitrogen and phosphorus, the Danish effluent charging system promotes the reduction of nutrient in natural waters. BOD_5 reduction is not effectively promoted, as its effluent charge is relatively low.[24]

In 1999, the effluent charge generated a revenue of €37 million. The recipient of the revenue is the Danish Ministry of Taxation rather than the authorities competent for water management and regulatory aspects. Revenues generated by the effluent charge are thus not earmarked in Denmark, but constitute a contribution to the general budget.

Netherlands

The main objective of the Dutch effluent charging system is the generation of revenue for quality management of local and state waters. The division of tasks and responsibilities for water management and regulation in the Netherlands is unique, with the type (size) of the receiving water being the determining factor. While the Water Management Authority (*Rijkswaterstaat*) is responsible for the state waters (that is, the main rivers), the management of regional waters is carried out by the water boards.

The division of the competence to issue permits for discharges mirrors the division of responsibilities for water management. Hence the Water Management Agency issues permits for discharges into state waters, while issuance of permits for discharges into regional water is under the authority of the water boards. Like in the Danish system, the conditions for discharges emphasizes the importance of the environmental quality of receiving waters in addition to

[23] For an exact equation, please refer to Buckland and Zabel, 2002.

[24] This argumentation builds on the fact that it is not possible to control for single parameters separately but only to influence the composition of effluent output of a production process.

TABLE 7

INDUSTRIAL EFFLUENT DISPOSAL IN SELECTED EUROPEAN COUNTRIES

Country	Effluent charging system	Collecting authority	Effluents / tax base	Tax rate paying	Actors	Exceptions
Denmark	Effluent tax introduced in 1997. Direct dischargers pay on the basis of volume solids discharged into all types of natural waters; calculated and collected on a quarterly basis; total revenue in 1999: €37 million; Instrumental-incentive charge.	Regional offices of *Skatteministeriet* (Danish Ministry of Taxation) collect charges from industry and STP operators. Local councils collect effluent charges from small direct dischargers	All direct discharges into all types of natural waters except rainwater discharged directly.	Charge is calculated according to formula taking pollution load of Phosphorus, Nitrogen and BOD_5 into account (see text)	All direct dischargers: sewage treatment plants, industrial dischargers and units located in sparsely build-up areas that are not connected to the sewer system.	Discharge of rainwater, stormwater discharges and discharges of groundwater or surface water. the tax is Mussel plants, fish farms, if the source of water supply and the receiver are identical.
Germany	Federal effluent charge introduced in 1976 (charge collected since 1981). Incentive charge. Federal effluent charges act last amended in 1998.	*Umweltministerien der Länder* (State Environment Ministries) they may also delegate the collection of charges to the municipalities.	All direct discharges into natural waters (including groundwater): industrial and STP discharges, rainwater, agricultural discharges, minor effluent releases and domestic sewerage.	1998: €35.79 per pollution unit (pu)	Any effluent discharger.	(§10 *AbwAG*) Water that has not been changed in character or use. Water used for mining and discharged into artificial waters. Discharge of rainwater under certain conditions.

(Continued on next page)

TABLE 7

INDUSTRIAL EFFLUENT DISPOSAL IN SELECTED EUROPEAN COUNTRIES (*continued*)

Country	Effluent charging system	Collecting authority	Effluents / tax base	Tax rate paying	Actors	Exceptions
France	Distributive charging scheme (*redevance pour pollution*) introduced in 1964. The revenue is returned to the polluter in the form of subsidies for pollution abatement.	Municipality, or in case of delegation the concessionaire collects the "*redevance*" (included in the water bill) from the households. *Agence de l'Eau* receives the *redevance*.	All discharges to surface waters and sewers are subject to the charge.	Charges are based on pollutants; differ between regions	Households (water bills), industry and agriculture. Nondomestic dischargers (large industries) are charged for direct dischargers, and households and SME are charged indirectly – water utilities pay the charge for SME and pass them on to the client.	Effluent charges from STP. Municipalities < 400 inhabitants.
Netherlands	Water Pollution Charges (pollution levy ◊ into state waters / pollution tax ◊ into local waters) apply to all direct and indirect dischargers (industry, agriculture, households). Financing quality management of local and state waters (incl. STP).	*Bureau Verontreinigings–heffing Rijkswateren* (Office for Pollution Taxes State Waters)	Industrial and STP discharges (STP operators only pay 10% of the tariff for industry), agricultural discharges, effluents and leakage from landfills, minor effluent releases and domestic sewage.	1999: €31.76/pu for discharges into state waters; €39.03/pu on average for discharges into regional waters	Discharges to surface waters and sewerage systems are liable to the charge.	No exceptions. Note: information from database1 indicates that the discharges from STP are exempt, but questionnaires sent to officials states that charges are merely reduced.

Source: Hansen and others, 1998.

the consideration of ELV. Furthermore, negotiated agreements in terms of environmental policy play an important role

The effluent charge applicable to discharges into state waters is a flat rate of €31.76 per pollution unit. The rates for discharges into regional waters differ between water boards and are higher than for state waters (€39.03 per pollution unit on average in 1999). Individual charges are calculated on the basis of actual measurement as determined by self-monitoring and compliance monitoring. For small discharges, charges are based on standard rates (estimates).

The revenue includes effluent charges from households and from indirect and direct industrial emitters. In 1999, total revenue amounted to €900 million. Effluent charges paid for discharges into state waters are administered and collected by the state water authority, while fees for discharges into local and regional waters are managed by the water boards. Like in France, the earmarking of revenues is rather broad and the charging system provides funds for a variety of tasks, such as subsidies for investment in sewerage services and water pollution control (financial function).

SUBSIDIES IN THE WATER SECTOR

Environmental subsidies constitute a vast field of study, encompassing a variety of possible schemes and measures. The following section, therefore, aims at giving an introductory overview on some subsidy schemes currently operating. The examples presented are mostly drawn from European countries (EU member states and accession countries). Box 6 additionally introduces the case of New Zealand, where all agricultural subsidies were eliminated in 1984.

Subsidies Related to Environmentally-Friendly Farming

Most countries operate financial transfer schemes that, rather than regulate, offer incentives to farmers and other landholders to achieve a desired environmental outcome. It has been questioned whether these measures can be regarded as subsidies, as they are often made in return for an environmental benefit. However, as subsidies for environmentally friendly farming are part of the overall incentive struc-

TABLE 8

SUBSIDIES RELATED TO ENVIRONMENTALLY-FRIENDLY FARMING

Country	Conditions related to payments for environmentally-friendly farming	Effects / objectives
Czech Republic	Given to farmers that experience losses due to cultivation limitations in protection zones for drinking water abstraction	
UK	Nitrate Sensitive Area scheme (NSA): payments range from €79 per hectare for restrictions on nitrogen fertilizers, to €843 for the conversion of arable land to native species grassland A total of €5.1 million was paid in 1995/96; the Ministry of Agriculture, Fishery and Food introduced farm waste grants for the installation or improvement of farm waste facilities	The NSA aims at reducing the loss of soil nutrients from agricultural practices The farm waste grant was introduced to help farmers to comply with the EU Nitrate Directive (91/676/EC)
Ireland	Rural Environmental Protection Scheme (REPS) Grants are provided to farmers who adopt nutrient management plans for the purpose of protecting water quality	
Sweden	a) 1989/1990: compensation payments for cultivation of nitrogen-fixing crops (Gotaland and Svealand) b) 1989: a temporary compensation scheme for farmers who convert all or a part of their acreage to organic production	a) In order to reduce the use of pesticides by introducing more efficient active ingredients and by lowering dose-rates

BOX 6

CASE STUDY: NEW ZEALAND – EFFECTS OF THE REMOVAL OF AGRICULTURAL SUBSIDIES

In 1984 and subsequent years, New Zealand removed virtually all direct and indirect support to agriculture, eliminating:

- output price assistance for agricultural products;
- input subsidies for fertilizer and pesticides;
- subsidies for irrigation and drainage schemes;
- land development loans and subsidized credits;
- tax concessions;
- free government services to farmers;
- subsidies for soil conservation and flood control.

While these measures were largely taken in the past for economic reasons, it was also considered necessary to remove distorting price signals, and to address environmental 'bads' before offering governmental assistance to farmers for the provision of environmental 'goods.'

The resulting decline in income caused difficulties for rural communities. Farmers reacted by cutting back on all discretionary expenditures (fertilizer use, non-essential repairs and maintenance, new land development, new equipment). They also laid off labor and did more work themselves. Credit mediation and a write-off of about 20 percent of the total farm sector debt helped to limit the number of farms being sold to about 5 percent.

The elimination of government support had a number of environmental implications:

- In some cases the financial stress of farmers led to short-term exploitation of the resource base;
- The development of marginal lands virtually ceased;
- Livestock numbers declined;
- The use of fertilizers and other agricultural chemicals decreased;
- Forestry plantings continued to increase;
- The previously constant increase in demand for irrigation water stabilized.

Overall, the New Zealand experience implies that the removal of subsidies may be a necessary, but not a sufficient, condition to redress the environmental impact of agriculture. The remaining externalities still have to be targeted through domestic environmental policies.

Source: Shepherd, 1996.

ture that influences water-relevant behavior of farmers, they are included in the analysis conducted here. As an example four different compensation schemes are presented in Table.

The **Czech Republic** operates a subsidy scheme under which financial transfers are made to farmers for losses due to cultivation limitations in protected zones where there is abstraction of drinking water.

In the **United Kingdom**, the Ministry of Agriculture, Fishery and Food operates a group of subsidy schemes that aim to protect and enhance the quality of the rural environment. Among the most important are the Nitrate Sensitive Area scheme (NSA), which aims to reduce the loss of soil nutrients from agricultural practices, and the implementation of the European Union Nitrate Directive.

The NSA compensates farmers who voluntarily change their farming practices in ways that significantly reduce the leaching of nitrates. Payments within this scheme range from €79 per hectare for restrictions on nitrogen fertilizers, to €843 for the conversion of arable land to native species grassland (1995/96). In 1995/96, a total of €5.1 million was paid to farmers.

The implementation of the European Union Nitrate Directive requires the designation of Nitrate Vulnerable Zones (NVZ), in which farmers are obliged to change their farming practices. In order to help farmers comply with the restrictions on the spreading of livestock manure in NVZ, the Ministry of Agriculture, Fishery and Food reintroduced farm waste grants for the installation or improvement of farm waste facilities (Kraemer and Buck, 1997).

The Department of Agriculture, Food and Forestry in **Ireland** operates a Rural Environment Protection Scheme (REPS), under which—among other purposes—grants are provided to farmers who adopt nutrient management plans for the purpose of protecting water quality (Egan, 1996).

From 1988 onwards, **Sweden** initiated a variety of compensation schemes for farmers in order to supplement existing regulations regarding limitations of the use of pesticides, fertilizer, and manure. In 1989 and 1990, for example, compensation payments for cultivation of nitrogen-fixing crops was granted in Gotaland and Svealand. In order to reduce the use of pesticides by introducing more efficient active ingredients and by lowering dose-rates, farmers were encouraged by this compensation to test improved field crop sprayers. Furthermore, a temporary compensation scheme was introduced in 1989 for farmers who converted all or part of their acreage to organic production (Bergvall, 1996).

New Zealand reports that there are currently no government subsidies for farmers to improve environmental performance (see Box 8). Instead, it is considered necessary to remove distorting price signals that lead to environmental 'bads' before introducing measures to assist farmers for the provision of environmental 'goods' (Shepherd, 1996).

Other Water Subsidies

While compensation payments for environmentally friendly farming constitute a common subsidization scheme, most countries grant additional subsidies to set incentives within the framework of water management.

In **Norway** and a number of other European countries, there are some subsidies for the building of new and the upgrading of existing water plants (Sjoholt, 1996). In **Denmark**, municipal and private water works generally seek to cover the full amount of capital and operational costs via water tariffs and charges. As of 1993, the average price for water was €0.414 per cubic meter. Generally, the water price per cubic meter is the same for all consumers and remains constant regardless of consumption. However, there are some examples of quantity discounts for industrial users. In regard to the tax on water abstraction that has recently been introduced as part of the "green tax reform", industrial water users can deduct this tax on water consumption on their VAT proceeds (Wallach, 1996; Andersen, 1996). Assumed that the additional costs imposed upon consumers by the tax on water consumption still do not cover all of the environmental costs involved, this tax exception, in principle, could be regarded as a subsidy. However, although methodologically consistent, the inclusion of exceptions from environmental taxation schemes in the concept of subsidy seems problematic, as the noninclusion of environmental costs into water prices is the norm in OECD member countries and full recovery of economic costs of water services is still the exception.[25]

TRADABLE PERMITS IN WATER RESOURCE PROTECTION AND MANAGEMENT

Despite the growing importance of water resource allocation issues in many countries, little emphasis has so far been placed on the economically efficient allocation of water. Only three countries have accumulated substantial experience with water-based tradable permits, namely Chile, the United States and Australia (in the United States and Australia, tradable permit schemes exist in more than one state).

While the European Union has adopted a provision to allow for water trading (Kramer and Banholzer, 1999), it has not yet been applied anywhere so that the postulated process of policy learning cannot be observed. Therefore, the following section will present two case studies on the systems operated in Chile and Australia and their experiences will be discussed. The intention of this section is to give the reader a brief introduction to the field. For a more detailed discussion and review of existing tradable permit schemes, the interested reader is referred to Kraemer, Interwies and Kampa (2002) or Kraemer and Banholzer (1999).

Chile

Chile moved to tradable water permits soon after its transition in 1973 to a market oriented society. The introduction of tradable property rights to water can be termed a "natural extension" of the initiated reforms that stressed open trade, the power of markets and economic liberalization, as it aimed at strengthening property rights, a more efficient water use and introduced market principles (Holden and Thobani, 1996).

While the Chilean water market has been in operation since 1976 following the privatization of previously state-owned land and water resources, the passing of the Chilean Water Code in 1981 made the system more effective. According to the law's provisions, the state grants existing water users property rights to both surface and ground water without charge. New or unallocated rights are then auctioned off. Water rights are completely separate from land rights and their property status is based on the property laws of the civil code and, except for a few restrictions, they can be transferred or sold to anyone for any purpose at freely negotiated prices. Accordingly, water usage and the allocation of rights are independent of pre-determined priorities and market forces alone determine the allocation of water and its use.

[25] If environmental costs are not taken into account in water prices, this constitutes de facto an indirect subsidy, as costs are incurred but not recovered.

The acquisition of water rights requires notification in a public register and the presumptive use of the acquired right either as consumptive or non-consumptive, permanent or temporary must be recorded. Different regulations apply for the different uses (Holden and Thobani, 1996):

- *Permanent consumptive use*: rights are defined in volumetric terms. In cases where the demand for water exceeds the available quantity so that not all permit holders can be fully satisfied, water is distributed proportionately.
- *Temporary consumptive rights*: these rights are only considered after all permanent consumptive rights have been met.
- *Non-consumptive rights*: are granted in cases where the water is returned to its source at a specified location and time (for example for hydropower stations).

While non-consumptive rights account for the largest water use, the number of consumptive permit holders is about twice as high.

Australia

The Australian States of New South Wales, South Australia, Victoria and Queensland have established legislative provisions for transferable water use rights. However, there is still no example in Australia of a free market for trades in water rights, and a number of restrictions are imposed by water management authorities. There are restrictions on the spatial transfer of water use, volume controls, and environmental considerations such as the preservation of river flow, control of salinity, and protection of wetlands and river ecosystems. Water authorities facilitate trades rather than participate in the water market, although they usually are empowered to veto trades if the conditions are unacceptable. Most authorities monitor trades and keep registers of buyers and sellers.

The New South Wales Environment Protection Authority (NSW EPA) has introduced a pilot system for salinity control in the Hunter Valley, and a number of Australian states are considering tradable discharge rights. Tradable rights have also been introduced for the Murray-Darling Basin, providing for salinity trades between New South Wales, Victoria and South Australia (inter-state trading). New South Wales is adopting a supplementary scheme, but this scheme is limited in scope and potential impact.

An important factor in the development and diffusion of the use of tradable permits for water resource allocation and water pollution control has been the co-operation over the river Murray and its tributaries through the River Murray Commission (later the Murray-Darling Basin Commission) established originally by the River Murray Waters Agreement.

Policy Recommendations

Kraemer, Interwies and Kampa (2002) enumerate several points to be considered for the effective initiation and operation of a tradable permit scheme.

- First of all, the definition of property rights and a transparent initial allocation mechanism are vital to the success of any trading scheme.
- Secondly, in most cases, the schemes of water tradable permits need to consider the regional physical scale for the development of a market, and bear in mind the specific framework of each region.
- Thirdly, successful trading regimes tend to be built on pre-existing institutions and are integrated into traditional regulatory regimes. This often includes the combination of tradable permits with other economic instruments (for example, taxes and charges) in order to form instrument mixes for more effective water management.
- Finally, the success and effectiveness of water trading markets depend on the frequency of trades and the number of market participants.

LIABILITY AND RISK ALLOCATION

In the absence of a set of environmental liability laws applicable to the water sector, so that damage to the aquatic environment is borne by society in general, all other efforts to effectively establish the polluter-pays-principle are undermined. Environmental liability laws, which act as a believable threat that anyone who causes environmental damage must pay for its repair, provide enormous incentives for prevention and avoidance.

The case of Sweden is described in Box 7. Its legislative framework underwent major structural changes over the last years as a reaction to a perceived lack of adequate tools for reacting to infringements of environmental laws.

BOX 7

ENVIRONMENTAL LIABILITY LAW IN SWEDEN

Swedish environmental legislation has undergone major structural changes over the last years. On January 1, 1999 the new Environmental Code (EnvC) came into force, which replaces and extends 15 former acts and implements all relevant EC legislation. The code aims to "promote sustainable development, so that present and future generations will be guaranteed a safe and healthy environment" (Swedish Environmental Protection Agency, 2000).[28]

With the EnvC, a new approach is being followed, namely to determine future actions to avoid damage and promote sustainable development on the basis of the effects an action has instead of its nature.

Along with the establishment of the new EnvC came a change in procedural rules. Five regional environmental courts have been instituted with two basic functions: First, they are entitled to grant permits for potentially harmful activities, and second they determine whether an environmental damage (property damage, personal injury and economic loss) has been caused by environmental pollution. The granting of permits must be in accordance with an Environmental Quality Standard (EQS) set by the government that outlines the highest permitted concentration of a substance in water within a fixed geographical area.

Environmental interest groups with more than 2,000 members that existed for at least three years have the right to appeal against permit or exemption decisions taken by the court.

The most important principle enacted through the EnvC is the precautionary principle, a natural extension of the polluter-pays-principle: everyone must take necessary precautions to prevent and reduce damage to human health and the environment.

Failure to comply with the requirements as set by the EnvC is subject to penalties ranging from fines to two years of imprisonment. Operators, whose actions caused disturbances to the environment and resulted in personal or financial losses, are under duty to pay compensation. Furthermore, the law requires environmental repair: Those who currently carry out an operation which causes pollution on land or water are liable for the repair of any environmental damage caused by the operation. This also applies retroactively to those who have carried out a polluting operation after 30 June 1969.[29]

Since the early 1990s, there has been extensive discussion in the European Union about a community-wide applicable environmental liability regime. In 1993, the European Council concluded the "Convention on Civil Liability for Damage Resulting from Activities Dangerous to the Environment" (Lugano Convention),[26] which aimed at making possible the adequate reparation for damage resulting from activities that are a hazard to the environment. It is based on strict liability and recognizes the role of environmental NGOs as important actors. It has, however, not entered into force so far (as of 29 August 2003[27]), as the condition (three ratifications) has not been fulfilled.

Also in 1993, the European Commission drafted a Green Paper on responsibility for environmental harm, which elicited the comments of several member states, environmental protection organizations and associations of industries. The White Paper on Environmental Liability published in February 2000 (European Commission, 2000c) examined how the polluter-pays principle, one of the key environmental principles in the EC Treaty, can best be implemented, and how a Community regime on environmental liability should be designed. It concluded that drawing up a directive would be the best way to set up a community regime for environmental liability.

As a result of the discussion following the publication of the White Paper, the European Commission produced a proposal for a Directive on Environmental Liability in January 2002 (European Commission, 2002a). The aim of the proposal is to adopt a comprehensive European regime for the prevention and mitigation of environmental damage, and to ensure that the affected areas are cleaned up, which is not always guaranteed under the differing national laws (CES, 2002). The main provisions of the proposed directive are reviewed in Box 8.

FINANCIAL ARRANGEMENTS IN WATER USER ASSOCIATIONS

The German 'Water Association Act' allows for the formation of so-called water user associations. They are self-financing institutions for the construction and

[26] Source: http://conventions.coe.int/.
[27] Source: http://conventions.coe.int/Treaty/EN CadreListeTraites.htm.
[28] Source: http://www.internat.naturvardsverket.se.
[29] Source: http://www.law500.com.

BOX 8

THE PROPOSAL FOR AN EU DIRECTIVE ON ENVIRONMENTAL LIABILITY

The proposed liability regime applies to environmental damage and to any imminent threat of such damage. The system is based on public law and thus excludes civil liability and traditional damage (such as personal injury and damage to property). The reason is that natural assets are in most cases not privately owned, and that the loss of natural assets normally affects society as a whole (European Commission, 2002b). The directive would have a limited scope of application linked to European environmental legislation. Environmental damage should be defined "by reference to the relevant provisions of Community environmental law" (European Commission, 2002a). Environmental damage thus includes damage caused to the aquatic environment (according to the Water Framework Directive), biodiversity (regulated by Community legislation on nature conservation), protected areas (under national/regional legislation) and soil contamination, which causes harm to human health. The proposed regime would not apply to diffuse or nonspecific source damages such as forest damage caused by acid rain.

The proposed regime imposes mostly strict liability (with several defenses), which implies that liability is based on causation irrespective of fault. The decisive factor is whether damage has occurred, not whether it has been caused by incorrect or negligent behavior.

The actors potentially liable under the Directive for the costs of preventing or restoring environmental damage are the operators of risky or potentially risky activities that are listed in Annex I of the proposal (e.g., chemical industry). Activities not included in the list can also be liable if they cause damage to biodiversity, but only if the operators are found to be negligent (fault-based liability).

Public authorities are charged with enforcing the regime. It is their responsibility to ensure that operators undertake or finance measures to restore or prevent environmental damage. This entails the need to conduct investigations, to assess damage or the danger of damage and to determine the most appropriate preventive or restorative measures. Competent authorities are designated by each member state. If the operator is unable to pay for all or part of the necessary measures or cannot be found ("orphan damages"), the member states have to ensure that the measures are taken, and may set up alternative financing mechanisms (such as financial guarantees, securities or collective funds).

Environmental public interest groups, alongside with legal and natural persons likely to be adversely affected by environmental damage, are entitled to require action to be taken by the public authorities or to challenge their decision before courts (access to judicial review).

Liability is prospective and not retroactive, which means that pollution that occurred within a member state prior to the adoption date of the EU-liability regime will be dealt with under the member state's legislative provisions.

Exemptions: The proposal does not cover environmental damage resulting from an armed conflict, a natural disaster, emissions allowed to the operator by permit, authorization or laws or regulation (permit-defense), or activities which were not considered harmful according to the state of scientific knowledge at the time the activity took place (European Commission, 2002d).

In the comments on a working paper preceding the proposal, some regret has been expressed by the member states that civil liability and traditional damage are not covered any longer, and there is concern about potential financial consequences to public authorities in relation to "orphan damages" that is when the polluter cannot pay for restoring the damage (European Commission, 2002a). Discussions are still going on regarding the issues of permit defense and whether financial security should be mandatory or optional.

The proposal is currently undergoing a legislative procedure at the end of which the European Parliament and the Council of Ministers will jointly adopt the new Directive. It is thus likely to enter into force within the coming two or three years.

Sources: European Commission, 2002a, b, c and d; EEB, 1998.

finance of water infrastructure. Their scope of operation includes the allocation of services among users, sewerage, the promotion of co-operation between agriculture and water management and other water management functions.

The operation of these water associations is financed purely through the members' fees. Members control the association according to democratic principles with voting rights weighed according to the economic importance of water use or water pollu-

tion. For members who do not directly abstract or discharge water, voting rights can be based on the benefits derived from the associations activities or the economic burden the association imposes on the member (Kraemer and others, 1998a). Association statutes can provide for an association committee (*Verbandsausschuss*), consisting of elected members acting on behalf of all members, to assume functions of the general assembly.

A water association can be established by the unanimous decision of all interested parties and subsequent approval by the supervisory authority, or by majority decision of interested parties and approval including the enforced participation of additional members. The approval for the construction of a water association may be denied if the proposed association's objectives are already or could better be fulfilled by another corporation. All those who benefit or can expect to benefit from the association, are involved in the establishment of an association. In cases where nonmembers benefit from the association, they can be required to make a financial contribution. Furthermore, associations have the right to use all land needed for their operations and can even expropriate property. However, anyone suffering a direct economic loss because of an association's activities is entitled to a compensation.

Water associations can themselves become members of, cooperate with, or transfer part of their responsibilities to other associations, thus creating networks of associations. Upon the fulfillment of certain circumstances, associations can be dissolved, either by decision of its members and the approval of the supervising authority, or by order from the authority (Kraemer and others, 1998a). To date, River Basin User Associations are exclusively found in the German states of Lower Saxony, Brandenburg, Saxony-Anhalt, Schleswig-Holstein, and Mecklenburg-Western Pommerania. Provisions for their establishment are made by the respective state Water Management Act, which clearly prescribes maintenance of inland waters as a public duty.

Activities of such associations, however, only include management and maintenance of second order watercourses as defined by the water acts. The first order river maintenance and management remains in the owner's hands, which in most cases is the federal state or the *Länder*.

The case of the River Basin User Association *Hunte* in Lower Saxony is presented in Box 9.

The Water Associations West German Canals (*Wasserverband Westdeutsche Kanäle - WWK*) constitutes a further example of institutional arrangements

BOX 9

RIVER BASIN USER ASSOCIATIONS IN LOWER SAXONY

One of the 115 River Basin User Associations in Lower Saxony is the *Unterhaltungsverband 'Hunte'* named after the main watercourse in the Hunte precipitation area. It was first established in 1965 based upon the Lower Saxony Water Act. Pursuant to Paragraph 100 of the amended Water Act of 1990, the association constitutes a Water Management Association in accordance with the Water Associations Act.

The River Hunte rises near the *Mittellandkanal* and is a tributary of the River Weser. From its source it runs northwards and then joins the Weser at Elsfleth north of Bremen. Responsibility for the Hunte river basin is shared between four associations, with the *'Unterhaltungsverband Hunte'* being in charge of the upper catchment area. The total length of this second order water system is 794 km draining an area of 99,330 hectares covering approximately 4 rural districts *(Landkreise)*. Competency for supervising the association's work and activity lies with the rural district authority of Diepholz.

Real-estate ownership in the catchment area is a necessary requirement for becoming a member. To date, the Hunte association has approximately 17,250 individual members. Additionally, two neighboring water management associations serving the downstream reaches of the Hunte watershed also hold a membership. This linkage provides a platform for close cooperation with regard to watercourse maintenance and management along the Hunte river basin.

The association's main duty according to its statute—and required by state law—is to properly maintain watercourses so as to support the natural drainage regime. Accordingly, keeping the functional status of all managed catchment waters is a central issue. Fieldwork activities of the association range from the mowing of slopes or river bed maintenance to river bank stabilization and clearing of drainage ditches. In addition, the association operates several dams/water retaining works, locks, and bucket elevators in the catchment area. Co-ordination of all necessary activities is achieved through a maintenance and management plan listing the material and staff required. The plan is drawn up on an annual basis. Assessment of the work of the association takes place annually in the form of an inspection tour by members of the supervising authority *(Verbandsschau)*.

Source: Kraemer and others, 1998a.

for inter-basin management (or 'inter-sub-basin management') allowing the integration and development of shipping canals, power station cooling, water supply, and ecological needs in densely populated and heavily industrialized areas (see Box 10).

CONCLUDING REMARKS ON ECONOMIC INSTRUMENTS IN WATER MANAGEMENT IN THE EU

As the presented case studies have demonstrated, the European experience with economic instruments in water management is varied and extensive. While some instruments are used in all or the majority of European countries (sewerage charges, water prices), others find no application at all (tradable permits). In most cases, economic instruments have more than one function and they are often intended to provide incentives for a more environmentally-friendly behavior. Revenues generated are often earmarked and reemployed for further water management activities, or used as an additional source of finance for the general government budget. This second option allows for a reduction in other taxes and may shift the tax burden from economic "goods" (labor) to economic "bads" (pollution).

BOX 10

THE *WASSERVERBAND WESTDEUTSCHE KANÄLE*

To maintain shipping on the Dortmund-Ems-Canal linking the industry in the Ruhr area to the port of Emden (completed in 1899), the Rhine-Herne-Canal providing a link to the Rhine (1914), and later on the Wesel-Datteln-Canal serving the northern part of the Ruhr Area (1931, see map) the Datteln-Hamm-Canal in the East (1914) was used to bring Lippe river water of good quality from Hamm into the canal system to replace the water used in the operation of locks. The availability of good water in the canals lead to an increase in demand as industrial users were attracted. In effect, Lippe water was transported through the canals to water users – power stations, mining pits and industry – but also agriculture and drinking water production (groundwater recharge). A minimum flow of 7.5 m^3 per second was left in the Lippe.

In 1968, the Federal Republic of Germany as the owner of the canals and the *Land* North Rhine-Westphalia signed an Agreement concerning the Improvement of the Lippe Flow, the Feeding of Water to the West German Shipping Canals and Water Supply. Compared to the previous arrangements, the agreement brought two important changes. One was the increase in pumping capacity at the canal locks to cover the operational water need and to pump water from the Ruhr at Duisburg (and from the Rhine if need be) for the benefit of water users along the canal system. The other change was that the minimum flow of the Lippe was increased to 10 m^3 per second and changes were made so that up to 4.5 m^3 per second of canal water can be pumped into the Lippe to increase its flow in the interest of water supply and river ecology.

The canal and Lippe water regime can now be operated in two modes. The first is the abstraction of Lippe water to feed the canals and provide water for abstraction; the second is to reverse flow and pump canal water, Ruhr water, and *in extremis* Rhine water, up into the Lippe (see map). During the extremely dry accounting period from November 1990 to October 1991, a total of 199 million m^3 was taken from the Lippe when flow was sufficient, and 33.3 million m^3 were added to the river when the flow was low (WWK, 1993). Water for industry amounted to 79.0 million m^3 and a further 83.2 million m^3 were provided for non-consumptive use (cooling).

In order to raise the capital investment required, the *Land* instigated the establishment of the Water Associations West German Canals, with the *Lippeverband*, 37 water users (abstraction only) and 7 public water suppliers being members; another 20 small users are not members. The Water Association West German Canals also operates and manages the infrastructure. The annual turnover or budget of the association is around DM 5 million. Since 1982, water quality in the canals is monitored even though this is not strictly within the remit of the association. Changes to be agreed in association's statutes over the next few years may provide a basis for measures to improve the ecological quality of the Lippe.

THE EUROPEAN WATER FRAMEWORK DIRECTIVE

The *European Water Framework Directive* (WFD)[30] is one of the first environmental policy Directives of the European Community that explicitly draws on economic instruments for achieving its objectives. Economic approaches integrated into the Directive foremost include the polluter-pays and the cost-recovery principles.

While economic principles are to play an important role, Article 1 of the Directive also makes it clear that the WFD is not intended as a one-dimensional "economization" of European water management by stating that "water is not a commercial product like any other but rather a heritage which must be protected, defended and treated as such."

The purpose of the WFD (Article 1) is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater. Its key objective is to establish "good water status" for all waters by 2015.

The main provisions of the Directive include the promotion of sustainable water use; the reduction of groundwater pollution; and the mitigation of the effects of floods and droughts.

THE WATECO GUIDANCE DOCUMENT

The European Union countries, Norway and the European Commission agreed on a common strategy approach for the implementation of the WFD. Accordingly, several European Working Groups of experts and stakeholders have been created to prepare "guidance" documents on the main issues of the Directive for ensuring concerted actions and parallel developments across Member States. One of the groups, the WATECO group (WG 2.6) dealt with the economic analysis of water uses and produced the WATECO guidance document. The paper is of a legally non-binding character but directs the efforts undertaken in the different Member States (WATECO, 2002).

[30] Directive 2000/60/EC of October 23, 2000 establishing a framework for Community action in field of water policy. The full text of the Directive can be downloaded in English, French, Spanish and Portuguese from the following webpage: http://europa.eu.int/eur-lex/en/search.

THE ECONOMIC INSTRUMENTS IN THE WFD AND THEIR RATIONALE

For a first overview, the economic requirements integrated into the WFD can be grouped into three broad categories:

- The economic analysis of water uses (regulated by Article 5 and Annex 3 of the Directive);
- The justification of exceptions and the declaration of heavily modified water bodies;
- Water pricing that ensures an adequate cost recovery for water services.

Different time horizons apply for these three categories. The *economic analysis of water uses* involves setting up of an inventory of water uses, a process that has to be completed by 2004. The *justification of exceptions and the declaration of heavily modified water bodies* have to be included in the river basin management plan for 2009, while a system of *water prices that fulfils the principle of cost-recovery* for water services has to be operational by 2010.

As indicated by the time horizons, the economic analysis is the first task to be tackled by member states of the European Union. First, the analysis must provide sufficient information to determine whether water services meet the condition of cost recovery. Second, it should enable a decision on which combination of measures allows to restore the good status most cost-efficiently. The economic analysis will be reviewed until 2013 and from then on regularly every 6 years.

According to the WATECO document (WATECO, 2002), water services include abstraction, impoundment, storage, treatment and distribution of surface water or groundwater; and waste water collection and treatment facilities, which subsequently discharge into surface water.

The definition has deliberately been constructed very broadly and makes no distinction between private and public provision.

Three different types of costs of water services have been identified by the WATECO working group, namely operating, environmental and resource costs. *Operating costs* include maintenance and capital costs as well as internalized environmental costs, for example water abstraction charges. *Environmental costs* relate to damages to the environment caused by the provision of water services. As only those costs that are associated with the provision of water services

are to be considered, the definition excludes damage caused by diffuse pollution. Finally, r*esource costs* are scarcity or opportunity costs that result from excess demand for water.

The economic analysis can answer two questions with respect to these three cost categories. First, whether the costs are met by user payments or by subsidies, and second, whether all cost types are paid by the users of a specific service or only the direct operating costs.

The condition of cost-recovery for water services is anchored in Article 9 of the WFD and constitutes the second task on the agenda for member states of the European Union. Until 2010, they have to ensure that users pay their share of the costs of the provision of water services. The information gained through the economic analysis is to form the basis for the necessary calculations.

RELEVANCE FOR LATIN AMERICAN AND CARIBBEAN COUNTRIES

The preceding chapter provides additional evidence of the advantages in using economic instruments in the water management sector. The following sections try to build a bridge between the European experiences with economic instruments and their capacity to provide a solution to the challenges posed to water management in Latin America and the Caribbean.

First, the major challenges faced by the water sector in the region will be presented and then the obstacles will be discussed that presently impede the introduction of economic instruments. The challenges that countries in the region face can broadly be grouped into five categories:

- Institutional and administrative challenges
- Human resource constraints
- Financial challenges
- Lack of data
- Social challenges.

As a next step, different approaches practiced in the region to address these challenges and to implement economic instruments will be presented. On the basis of these examples, a list of relevant factors that have proven to be important for a successful implementation will be developed.

CHALLENGES TO THE IMPLEMENTATION OF ECONOMIC INSTRUMENTS

Institutional and administrative challenges

One of the greatest impediments to the introduction of economic instruments in the Region is deficiencies in the administrative and institutional settings. The biggest challenge in this respect is that the delivery of water services is still predominantly managed through a sectoral organization which is typically ill-funded, overextended and therefore inadequate for the provision of quality services.

The creation of adequate institutional capacities including the legal framework under which water use and management take place is urgently needed. Attempts to modify water laws have been made in several Latin-American countries, but progress in this respect is generally slow. In many instances, water resource management legislation includes provisions, which may no longer be relevant and may actually constrain new management initiatives.

A second major challenge to innovations in water management is the fact that most Latin-American countries still lack effective monitoring and enforcement procedures and struggle with a confusion of roles among different administrative bodies that result in overlapping mandates among related sectoral agencies. With lines of responsibility and accountability being unclear, the prerequisites for the implementation of sophisticated charging systems are not met. In consequence, actual management (water pollution control, operation and maintenance of some waterworks) is in many cases still very poor (Dourojeanni, 2001). The lack of integrated river basin management constitutes thus a key challenge for the region.

A third factor to be considered is that although attempts have been made over the last years to increase the degree of integration between the environmental and other governmental sectors, inter-linkage remains weak both, on an inter-sectoral as well as between federal and regional levels. As Box 11 outlines, fiscal federalism may intensify the problem of impairment of objectives and coordination unless certain prerequisites are met.

Furthermore, water management is often still carried out in a top-bottom manner with little participation of locals and key stakeholders, reducing the system's transparency, the perception of problems, and their inter-linkages. With exchange being limited to a small group of actors, the optimal allocation between competing uses and the determination of a proper economic valuation is difficult to achieve.

BOX 11

FISCAL FEDERALISM

For a centralized state, it might be difficult to adapt policies to the individual needs of different regions in the country, especially if the surrounding conditions vary considerably. The local level can be better equipped for understanding regional needs and interests due to the more immediate exchange with the citizens concerned by the policy.

However, several problems often go along with fiscal federalism. In the case of Brazil, Afonso (2001) reports that tax competition among states or regions through different incentives for enterprises has contributed to the misallocation of capital. Furthermore, differing sale taxes or personal income taxes may have influenced spending patterns and the allocation of labor between states. He concludes that decentralization may in some cases be market constraining rather than market enhancing as it leads to a fragmentation of the domestic market.

Decentralization can lead to a confusion about roles and responsibilities when two or three different levels step in to pursue similar objectives. Precise and final decisions would be required on which functions and taxes are under the responsibility of the national or the sub-national level, which is in many cases not possible.

Stringent macroeconomic coordination can be difficult within a decentralized structure characterized by a high degree of autonomy, as sub-national governments might be less willing to comply with policies to sustain macroeconomic stability, but act purely in their own instead of the nation's interest. In light of this argument, it can be difficult to reconcile greater fiscal decentralization with national economic policy objectives.

Co-ordination is of vital importance for ensuring a coherent and effective interaction among all relevant actors and administrative levels. The coordination of fiscal policy in a counter-cyclical sense becomes more difficult within a decentralized structure. At times, sub-national governments may pursue expansionary fiscal policy at the time when the national government follows a contradictory policy. This argument applies in particular if local governments face soft budget constraints and can count on being bailed out by the state (Afonso, 2001).

Tanzi (2000) points to the fact that the existence of a decentralized fiscal structure has often been a major impediment to needed tax reforms. The assignment of taxes is difficult in a federal system, due to administrative considerations related for example to economies of scale in tax administration, access to information, tax competition and others. In the case of Argentina, a turnover tax is levied at the provincial level. The central government has tried to eliminate this tax which creates great distortions in the economy and to replace it with more efficient revenue sources for many years (Tanzi, 2000). However, as the tax generates substantial revenue at the provincial level, the federal structure has made it difficult to reach a consensus for reform, especially as changes affect the provinces differently.

A further challenge related to fiscal decentralization is the issue of transparency. Local governments often cannot provide good data on a timely basis, which complicates the conduct of fiscal policy and the analysis and evaluation of public sector operations.

Finally, one of the main functions of a national government is to redistribute income from richer to poorer regions. When regional disparity is high and income levels vary greatly among regions, so that one region has to subsidize another on a significant scale, it becomes difficult to pursue an effective policy of income redistribution within a federal system.

Human resource constraints

Water resource management is often hindered by a lack of adequate staffing at all levels. The sector faces a persistent difficulty of keeping qualified workers and cannot rely on expertise available in the private sector. Integrated river basin management along with stakeholder participation has the capacity to offer a remedy to this shortcoming by bringing together different experts and through the facilitation of discussions and knowledge transfers (Huber, Ruitenbreek and Seroa da Motta, 1998).

A more general problem is that public awareness on the nature of the problems and on the current situation is low so that the imperative need for improvement does not reach an adequate level of recognition.

Financial challenges

The environmental sector in the Region faces serious budgetary problems, as the necessary investments on the infrastructural and operational level are very capital intensive, especially with costs of additional

water provision being continually on the rise (World Bank, 1998). Economic instruments can help in generating the required resources for reforms and restructuring. At the moment, water is often supplied at below-cost prices, which increases the challenge for water companies to increase connection rates and finance maintenance and infrastructural upgrading. Charging for water services can provide operators with sufficient funds for carrying out their operations and maintenance activities and furthermore serve as a proper signal to water users on the opportunity cost of their water use (San Martin, 2002). However, most instruments require certain capacities before they can be put to work. For the implementation of "correct pricing" for example, accurate consumption metering and efficient and correct billing mechanisms must be in place (San Martin, 2002). Budgetary constraints can thus act as a serious constraint to the introduction of measures that in the short run require infrastructural investments and only in the medium and long run generate financial revenues.

Lack of data

Water resource management is often hindered by a lack of adequate and reliable hydrological, meteorological and water quality data as well as information on socio-economic indicators of water use efficiency (IDB, 1998a). The persistent lack of assessment and monitoring of the quantity and quality of the existing resource is a major shortcoming for its appropriate utilization and an impediment to proper management.

Due to a lack of reliable inventories, databases and information on water uses and users, major deficiencies exist with respect to supervision and pollution control, as well as with regard to the measurement of contamination. Until adequate measurement systems have been put into place, charging for pollution is not feasible (Dourojeanni, 2001).

The lack of systematic and qualified monitoring poses serious challenges to the enforcement of environmental legislation and the implementation of economic instruments.

Social challenges

Safe access to clean water and a proper disposal of waste water constitute an important contribution to public health by reducing the spread of water-borne diseases. Especially among low income groups, the rate of piped water coverage has to be increased. Extending coverage rates for water supply and sanitation will affect the living conditions of the poor in three ways: Firstly via better health and increased potential labor productivity, secondly through considerable cash savings (water from trucks is much more expensive), and thirdly through reduced time use in bringing the water to the household (San Martin, 2002).

Market-based instruments have in principle the capacity to mitigate the discrimination against low income groups in terms of access by generating financial means for extending connections to these user groups. However, in order to achieve a socially compatible outcome, possible negative consequences of water service charges for the poor must be balanced by a complementary effective redistributive scheme.

EXISTING EXPERIENCE WITH ECONOMIC INSTRUMENTS IN THE REGION

Subsidies

The economic instruments most commonly applied in LAC countries are subsidies and tax exemptions (UNEP, 1999). For example, credit and tax incentives are offered for environment-related investments e.g. in Brazil, Mexico and Colombia to cover abatement investments or clean technology adoption in the industrial sector (Huber, Ruitenbreek and Seroa da Motta, 1998). They may, however, not develop their potential in terms of environmental effects if the enforcement of standards is limited so that there is little incentive for firms to demand financial support for measures to meet these standards. Also, companies may not put the money received to its intended use if their investments are not adequately monitored. This illustrates the necessity of an adequate institutional and legal framework for the implementation of economic instruments.

Charges for water supply and sewerage

Regarding water pricing, including charges for sewage collection and treatment, the coverage of users is limited and pricing policies often do not achieve cost-recovery objectives. Therefore their environmental effectiveness may be minimal (UNEP, 1999). In order to convey economic signals about decreasing water availability through water prices and to promote a more rational use of the resources, Peru and Central American countries are making advances to assess the value of their water resources (UNEP, 1999).

In two Brazilian states, Sao Paulo and Rio de Janeiro, sewage tariffs are levied by sanitation companies on industrial users. The charges are based on the content of organic matter and suspended solids. In the greater Sao Paulo Region, considerable revenue has been raised through the charge, although only partial coverage has been achieved (only 95 big firms have been included by the sanitation company) because of monitoring difficulties. It is reported that pollution abatement measures have been induced by the pollution-based tariff system (Huber, Ruitenbreek and Seroa da Motta, 1998).

Effluent Charges

Effluent charges have been in place in Mexico and Colombia since 1991 and 1974, respectively, and are under discussion in Jamaica and Brazil (Huber, Ruitenbreek and Seroa da Motta, 1998; San Martin, 2002. See also annex one). In Mexico the pollution charges are tied to wastewater rights: an amount is paid for the right for each cubic meter of discharge, collected from those who exceed determined standards for organic matter and suspended solids. The charge level varies with both water quality and total discharges. A simplified approach based on volume alone is used for discharges below 3000 cubic meters.

The success of the charge has so far been limited. The system requires monitoring resources that are beyond the current financial capacity of the CNA (National Water Commission). The amount of revenue raised has been substantially reduced by insufficient enforcement. Thus the charges actually collected represent only a minor percentage of the potential revenue. Additionally, a lack of public participation and of proper analyses of potential impacts of the charge lead to a fierce opposition by polluters. Nevertheless, Mexico's pollution charge is one of the first instruments in the region that is based on the polluter-pays principle. It is designed to induce behavioral change through incentive setting.

The Colombian charges for effluent discharges and water use, although in place since 1974, have only been applied in few cases and have been subject to similar problems to those in Mexico. In 1993, new legislation changed the former cost-recovery design of the charge to a scheme based on criteria of full environmental costs. However, this new system will pose even greater challenges to implementation and may entail high administrative costs, so the new charges may not be implemented according to the exact terms of the law (Asad and others, 1999).

According to Huber, Ruitenbreek and Seroa da Motta (1998), pollution charges may create perverse incentives in some Latin American countries, that is, they may have a negative environmental effect despite being intended to improve the environmental situation. Pollution charges based on the concentration of substances rather than on volumes or total loads will induce polluters to dilute effluents and thus increase water consumption instead of making them reduce the pollution load. A careful design is therefore important for triggering the intended user response.

Tradable permits

Chile is the only country in the Region that has extensive experience with tradable water permits. Chile has a long tradition in water property rights, which is believed to be the basis for the political acceptance and enforceability of the system. As pointed out in that section, the assurance and acceptance of water property rights is, next to an effective administrative and legal system, seen as a prerequisite for a functioning trading system. It is suggested in the literature that other countries planning to implement a similar system take this into account and carefully review the Chilean example (Asad and others, 1999).

Legal redress and advocacy

Successful liability legislation requires adequate enforcement. Since in many Latin American and Caribbean countries courts are heavily backlogged, liability might be complemented or replaced by consumer advocacy through voluntary measures or public pressure (Huber, Ruitenbreek and Seroa da Motta, 1998).

In Trinidad and Tobago, for instance, the corporate PetroTrin established a voluntary policy of full compensation for environmental damages after a series of uncontained well blowouts in the 1980s that caused a significant public outcry as no assistance was received by the population. This voluntary policy provided the company with an incentive to improve blowout prevention devices on wells.

In Colombia, consumer action is enhanced by innovative economic instruments: Anyone pursuing environmental liability judicial action is entitled to receive a payment that amounts to 10-15 percent of the total compensation. Since its introduction in 1992, this financial incentive has been reported to have increased the number of actions taken to court significantly.

The Brazilian water management reform

As a example of recent developments in the water management sector of Latin America, the case of Brazil will be presented. The new Federal Water Resource Law that was passed in 1997 fosters the integration of economic instruments and promotes an integrated approach to the planning and management of water resources.

BOX 12

WATER MANAGEMENT IN BRAZIL

Background

Water management in Brazil has suffered from many of the problems common in Latin American countries, one of which is lack of institutional capacity. Historically the system was characterized by sectoral management with strong influence of the hydropower sector, which was kept under the control of government owned companies. During planning of projects (e.g. construction of big dams) externalities caused to the environment or the economy were not considered. After the democratization process in Brazil in 1986, discussion about institutional reorganization of the country followed in order to address problems such as the lack of integration among water sectors (irrigation, hydroelectricity, water supply), the uncontrolled urbanization processes, and the occurrence of droughts in the Northeast.

The 1997 Water Law

In January 1997 the Federal Water Resources Law was adopted, which introduced new approaches to water management. The concepts promoted by the Law include:

- planning and management of water uses at river basin scale; decentralization of the management process;
- stakeholder participation;
- controlled and coordinated issuance of water permits for intakes or for dilution of effluents;
- development of Water Resources Plans;
- status of water as an economic good that should be charged for appropriately in order to (i) achieve rational allocation (ii) create the financial resources necessary for the improvement of the river basin;
- the use of water required to meet people's basic needs shall have priority before other uses.

Institutional reform

The Law provides for the creation of River Basin Committees ("water parliaments") which are composed of members of bulk water users, government officials (of Federal, State and Municipal level) and NGOs. River Basin Committees need to be established only in the presence of actual or potential conflict over water. The establishment of these Committees should serve as a means to achieve the goal that decision-making take place at the river basin level with effective participation by stakeholders. By the representation of government, users and society, this system creates the necessary conditions for integrated water management. It is the responsibility of the River Basin Committees to

- promote discussion of water-related issues;
- coordinate the work of the entities involved;
- arbitrate conflicts;
- approve the Water Resources Plan, and monitor its execution;
- suggest the fees to be charged.

The associated executive branches of the River Basin Committees are the Water Agencies. A single Agency may serve as the executive office for one or more River Basin Committees. They are responsible for the technical work required to support the work of the River Basin Committees, such as conducting studies to evaluate water availability, assessing new projects, and ensuring adequate allocation of withdrawal rights (Porto and Porto, 2002). The Agencies are also responsible for database management. They maintain registers of water resources, as well as a roster of the users of water resources. Additionally they collect fees for water use and assess proposals for projects to be financed (Dourojeanni, 2001).

Water pricing reform

The institutional reform initiated by the new Water Law was accompanied by water pricing reforms. A system of bulk water pricing was introduced, which allows for charges to be levied on the collection of water from natural sources, or alternatively, on issuing the water permit. This levy is thus comparable to water abstraction charges in European countries (see section \n \h 0). Its goal is to balance water demand and supply by send-

(Continued on next page)

BOX 12: (*continued*)

ing an economic message to users that they might be constraining the use of others (Porto and Porto, 2002), and to provide funding to create and sustain the River Basin Committees. The 1997 Law guarantees water users the right to retain control over the revenue generated by stipulating that not more than 7.5% of financial resources collected in a basin can be transferred out of the basin.

Summary

From the examples outlined above, it becomes clear that experience with economic instruments in water management already exists in Latin American and Caribbean countries, although some of the systems are somewhat rudimentary, with little coverage or a pricing policy that neither covers the capital costs nor incorporates environmental and social externalities. Still, systems are in place that can be built upon and expanded.

RELEVANT FACTORS FOR SUCCESSFUL IMPLEMENTATION OF ECONOMIC INSTRUMENTS

From the information presented on the use of economic instruments in the Region, as well as from the reviewed literature, it is possible to extract a number of elements that have proven to be useful tools or prerequisites for the successful implementation of economic instruments in the Latin-American water management sector:

- Capacity building
- Spatial organization (river basin management)
- Decentralization and Integration
- Participation
- Full cost pricing
- Cross-subsidization
- Public education programs
- Earmarking of revenues
- Transparency

It is generally recognized that in order to address the problem of weak enforcement, institutional capacities, both in terms of human resources and financial resources, need to be strengthened, and that competencies of authorities have to be clearly defined. Institutional capacity building can be simplified by a decentralized approach that involves small institutions with limited spatial jurisdiction (Huber, Ruitenbreek and Seroa da Motta, 1998).

Decentralized entities, such as the river basin organizations proposed by Dourojeanni (2001), also enable the active involvement of all local users and stakeholders in the management process. Participation of all stakeholders, in turn, promotes an integration of the different water sectors, and thus, a coordinated management of the resource that takes all demands and needs into account and balances economic interests and environmental protection concerns.

It is a common view across the literature that users are willing to pay for their water use when they are guaranteed a safe and reliable water supply in return (Asad and others, 1999; Huber, Ruitenbreek and Seroa da Motta, 1998; Porto and Porto, 2002). A full cost recovery approach is increasingly recognized as being essential for service expansion, as well as for taking environmental costs into account. Such an approach may require the establishment of cross-subsidization schemes to assist low-income groups.

Huber, Ruitenbreek and Seroa da Motta (1998) also point out that non-regulatory mechanisms such as public education programs should be made use of, as they may improve compliance without adding to administrative costs.

In order to improve water allocation and conservation and to establish effective environmental taxes, it is necessary to have a system of monitoring and metering which allows for volume-based charges to be levied and which raises consumers' awareness (Asad and others, 1999).

It is consistently emphasized that earmarking revenues is likely to make the implementation of economic instruments such as water pricing more successful in Latin-American countries. If charges collected were transferred to the central government and incorporated into the general budget, users would feel "taxed" which could spur their rejection of the system (Porto and Porto, 2002).

Another aspect that plays a potentially important role for public acceptance of economic instruments is their transparency: It has to be clear and as easily understandable as possible what is charged for and why. With respect to bulk water pricing in Brazil, Asad and others (1999) also requests that subsidies, where they are necessary for equity

reasons, be made transparent. He suggests that users should receive water accounts that show the full cost of providing the bulk water, and the value and source of the subsidy being applied. While mitigating the impact of charges on low-income households, this measure would still create or maintain awareness of how much water resource management really costs. It would also help governments to assess the cost effectiveness of subsidy programs.

DISCUSSION ON THE RELEVANCE OF EU EXPERIENCE FOR LATIN AMERICAN AND CARIBBEAN COUNTRIES

As the discussion in this Chapter has shown, the use of economic instruments in water management is not new to the Latin-American region. The generally relevant factors, which can be derived from these cases, indicate that the Regional experience with economic instruments is likely to be of particular interest when addressing the specific problems of the Region. Furthermore, the list of relevant factors reveals a close resemblance with those issues stressed in the presentation of the European experience earlier on. Therefore, while European approaches may not be applicable to all cases and may need to be modified to meet the specific circumstances in Latin American and Caribbean countries, there are nevertheless lessons to be learned. In the following, a non-exhaustive list of issues will be presented that can provide instructive impulses:

- There is growing consensus that integrated water resources management (IWRM) is crucial in order to solve Latin America's water-related problems (IDB, 1998a and b). Integrated management is a prerequisite for successfully implementing environmental taxes, as the design of an equitable and fair system (for example of supply charges or abstraction taxes) requires that all uses be taken into account. The European experience, for instance from the implementation process of the Water Framework Directive (WFD) can serve as an instructive example for a reorganization of procedural and organizational issues towards the integrated management of water resources. Observing how the EU Member States proceed in order to fulfil the demands of the WFD can be instructive. Furthermore, the implementation process of the WFD exemplifies the promotion of public participation, increased transparency and more extensive and reliable reporting.
- Based on the Latin-American case studies, earmarking of revenues is recognized as an important factor for the successful implementation of economic instruments (see Box 1). The European experience reinforces this conclusion: Many European countries use earmarking of revenues, and it is assumed that the resistance to a charge is smaller if the responsible authorities retain control of funds collected and use them for environmental programming or investments in the water sector. The more transparent the use of revenues collected is, the easier it is to raise public support for a new scheme.
- While the EU experience in water pricing and with regard to subsidies is certainly relevant on a technical and organizational basis, differences in social settings must be considered. The social challenges water sectors in less developed Latin-American regions face require water pricing policies to be carefully blended with complementary cross-subsidization or compensation schemes.
- Sewerage charges are common in all European Member States. While the same cautions apply here as to water pricing, increasing the coverage of households connected to the sewerage system could be supported by carefully designed charging schemes that aim at recovering the costs. Charges would provide operators and administrations with the necessary funds for the required investments. Increasing the access of poorer population groups to the sewer system is furthermore desirable from the point of view of health of the population.

Finally, the European experience may be drawn upon particularly with respect to economic instruments that so far have not or only in few cases been applied within the Region (for example abstraction taxes, pollution taxes).

OPTIONS FOR INTER–REGIONAL COOPERATION

A direct exchange between European and Latin American and Caribbean actors from all relevant stakeholder groups would be even more enlighten-

ing than a general comparison of the systems. Facilitating and strengthening the cooperation between European and Regional actors and intensifying the exchange of experience and ideas would offer an opportunity for more direct case-specific support and advice by relevant actors in the field.

On a technical-scientific level, exchange is already taking place in a more or less institutionalized way through workshops, conferences or dialogues, leading to the import of expertise and a continuous exchange of information on relevant technical or scientific advances and developments.

An important area where inter-regional cooperation has so far been limited is the exchange of experiences among regulators and officials on economic, environmental and health issues. In these areas, considerable gains of cooperation can be expected through furthering the flow of information among all relevant actors.

In general, steps should be taken to promote capital investment and to encourage different forms of private sector actions to help build capacities. Private European enterprises can fulfill an advisory function, thereby importing their expertise in the field.

As indicated above, integrated river basin management should be promoted in areas with a high intensity of water use. The examples of river basin organizations for instance in the mining areas in Europe can serve as instructive cases (for example the Water User Associations in Germany).

Many of the relevant studies prepared by the OECD in the field of water management have been strongly influenced by its European members and therefore have a European focus, making them not directly transferable to the Latin-American context. Yet, Mexico as a member country may function as the linking part between the OECD and those Latin-American countries or regions within these countries that have already reached relatively high industrialization levels. Although not universally applicable, many of the OECD's recommendations for Mexico offer valuable insights and allow for a conversion to other Latin-American countries.

Finally, the existing lines of cooperation within the EU–MERCOSUR framework should be used and extended to direct cooperation with regard to environmental topics in general and water management issues in particular.

CONCLUSIONS AND RECOMMENDATIONS

Scientists and policy makers alike have increasingly acknowledged the benefits derived from instrumentalizing market forces towards supporting the achievement of environmental objectives. Economic instruments have gained particular attention in recent years as an important tool in environmental policy making, as they are capable of integrating environmental concerns in economic decision making processes.

The main conclusion of the report is that there is a rich experience with economic instruments in European and other OECD countries that can be drawn upon in order to increase the efficiency of water management in Latin America and the Caribbean. However, economic instruments require substantive administrative capacities before they can be successfully applied and administered, a capacity that in many cases will need to be put in place or strengthened before these instruments become feasible in the Region.

GLOBAL EXPERIENCE

This report illustrates how economic instruments in the water sector can occur along the entire water cycle. Examples of economic instruments given are: (i) Water abstraction taxes, (ii) water prices, (iii) prices and charges in sewerage collection and treatment, (iv) prices and charges in industrial effluent disposal, (v) subsidies, (vi) tradable permits, and (vii) Environmental liability laws. These instruments were argued to be able to fulfill one or more functions such as incentive functions, fiscal functions, financial functions and liability functions wherefore the choice and design of the economic instrument should depend on which functions the instrument is desired to address.

The German "Water Association Act" was presented as an example of a decentralized form of water management that have successfully incorporated full-cost recovery principles into its operations, primarily achieved through pricing instruments.

Furthermore, a recent political innovation in European water management, the European Water Framework Directive, was presented. This is one of the first environmental policy Directives of the European Community that explicitly draws on economic instruments for achieving its objectives.

REGIONAL EXPERIENCE

Latin American and Caribbean countries have already some experiences with the use of economic instruments in water management. The report illustrated this with examples of: (i) effluent charges from Mexico, Colombia, Jamaica and Brazil; (ii) credit and tax incentives schemes for environment-related investments in Brazil, Mexico and Colombia; (iii) Sewage tariffs in Brazil; and (iv) tradable water permits in Chile.

However, the effects of these policy innovations are often limited by problems such as inadequate enforcement and insufficient coverage of users. In many cases, impediments to the introduction of economic instruments such as major divergences from the outlined prerequisites, like severe deficiencies in the administrative and institutional setting, will have to be addressed before the implementation of economic instruments becomes feasible. At times, the instruments may also have to be designed so as to take these challenges into account and to balance possible negative effects.

The main challenges in this regard faced by Latin American and Caribbean countries are: (i) Institutional and administrative challenges; (ii) human resource constraints; (iii) financial challenges; (iv) lack of data; and (v) social challenges.

LESSONS LEARNED

While European approaches may not be applicable to all cases and may need to be modified to meet the specific circumstances in Latin-American countries, there are, nevertheless, lessons to be learned. There is a growing consensus that integrated water resources management is crucial in solving the Region's water-related problems. Integrated management is a prerequisite for a successful implementation of environmental taxes, as the design of an equitable and fair system (for example of supply charges or abstraction taxes) requires that all uses be taken into account. European experience, such as the implementation process of the Water Framework Directive, can serve as an instructive example for a reorganization of procedural and organizational issues aiming for integrated management of water resources. Observing how the EU Member States proceed in order to fulfill the demands of the Water Framework Directive can also be instructive. Furthermore, this implementation process exemplifies the promotion of public participation, increased transparency and good reporting practices.

Based on the Latin-American case studies, earmarking of revenues is recognized as an important factor for the successful implementation of economic instruments. The European experience reinforces this conclusion: Many European countries use earmarking of revenues, and it is assumed that the resistance to a charge is smaller if the responsible authorities retain control of funds collected and use them for environmental programming or investments in the water sector. The more transparent the use of revenues collected is, the easier it is to raise public support for a new scheme.

While the EU experience in water pricing and with regard to subsidies is certainly relevant on a technical and organizational basis, differences in social settings must be considered. The social challenges faced in the water sector of less developed Latin-American regions require water pricing policies to be carefully blended with complementary cross-subsidization or compensation schemes.

Sewerage charges are common in all European Member States. While the same cautions apply here as to water pricing, increasing the coverage of households connected to the sewerage system could be supported by carefully designed charging schemes that aim at recovering the costs. Charges would provide operators and administrations with the necessary funds for the required investments. Increasing the access of poorer population groups to the sewer system is further desirable from the point of view of health of the population.

Integrated river basin management should be promoted in areas with high intensity water use. The examples of river basin organizations for instance in the mining areas in Europe, can serve as instructive cases (for example the Water User Associations in Germany).

The European experience may be drawn on particularly with respect to economic instruments that so far have not or only in few cases been applied within Latin America or the Caribbean (for example abstraction taxes, pollution taxes).

Facilitating and strengthening the cooperation between European and Regional actors and intensifying the exchange of experience and ideas would offer an opportunity for more direct case-specific support and advice by relevant actors in the field. Considerable gains from cooperation can be expected through furthering the flow of information among

regulators and officials on economic, environmental and health issues.

Steps should also be taken to promote capital investment and to encourage different forms of private sector involvement to help build capacities. Private European enterprises can fulfill an advisory function, thereby importing their expertise in the field.

As the various case studies based on European and on Latin American experiences have rendered clear, important benefits may be derived from the use of economic instruments. Yet, it must be kept in mind that generalizations are always feasible only to a limited degree: A strict analysis of all relevant factors and the incorporation of all relevant actors is required to guarantee an optimal result in each specific case.

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Case Study: The Colombian Water Tax

Zulma Guzmán Castro.

This document reviews Colombia's experience in developing economic instruments for environmental management—specifically, in the area of water pollution—with a view to providing recommendations applicable throughout Latin America and in other parts of the world. The document consists of three parts. The first describes the Colombian institutional and legal context for these instruments, presenting a detailed description of the particular instrument in question (the environmental tax) and of the theoretical framework in which it was developed. The second section describes the various aspects of the instrument's functioning, implementation and results, as well as the difficulties it has encountered to date. The final section identifies the most significant positive and negative consequences of the instrument– factors that should be taken into account in considering possible implementation in other countries, as well as in any modification of the instrument in Colombia itself.

NORMATIVE, INSTITUTIONAL AND THEORETICAL FACTORS

Institutional and legal framework for economic instruments in Colombia

The economic development process in Colombia has jeopardized the country's natural wealth.[1] As a result of this situation, over a period of more than thirty years, environmental regulations have been instituted and institutions have been established to oversee environmental concerns. With the 1991 Constitution, environmental criteria came to be regarded, for the first time, as a necessary condition for economic growth, and cost-effective tools for environmental management were created.

Prior to the 1991 Constitution, the task of environmental management and monitoring was distributed among various organizations, including INDERENA, the regional autonomous corporations, the Ministry of Health and the Municipal Public Service Enterprises. This created overlapping functions and a lack of clarity regarding the scope of each institution's environmental mandate.

In 1974, the National Renewable Natural Resources and Environmental Protection Code (Executive Order 2811) created a formal framework of principles and standards that institutionalized both the right to a healthy environment and the regulations necessary to ensure it. Environmental taxes were established by the Code, but were defined as a financial instrument applicable only to profit-making users of the environment. This left large polluters, such as territorial entities, beyond the scope of the law.

Decree 1594, of 1984, partially regulated issues related to the use of water and liquid wastes, covering hundreds of pollutants and regulating the application of taxes.

The new Colombian Constitution of 1991 guarantees the right to a healthy environment for the entire population and for future generations, and assigns to the State responsibility for securing this right.[2]

[1] The primary indicator of Colombia's natural wealth is the fact that with only 0.8% of the planet's land surface, the country has 10% of the planet's biodiversity.

[2] Title II. Collective and environmental rights.

Law 99, of 1993, put the principles of the Constitution into operational form and restructured the public agencies responsible for environmental management and preservation and stewardship of renewable natural resources. To this end, it created SINA, which encompasses: the Ministry of the Environment (the highest-ranking environmental policy body); thirty-three regional autonomous resource-management corporations responsible for sustainable development for the entire country; four environmental agencies in the large urban centers,[3] responsible for environmental management; five research institutes[4] to provide technical and scientific support; a special administrative unit for the National Nature Park System;[5] and entities at the departmental, municipal[6] and district levels.

The law put in motion a strong institutional and regulatory process involving environmental instruments such as pollution taxes, or environmental taxes, clean-production agreements, environmental licenses, environmental exemptions, a sanctions regime, mechanisms for citizen participation, and environmental investment funds, which have led to the creation of new markets in the environmental sector.

Following is a description of the economic instruments provided for in Colombia's legislation with relevance for water management, although not all of them are currently included in the regulatory process.

Environmental taxes. These were established by Article 42 of Law 99, of 1993, with specific provisions for later regulation to deal with water pollution. Environmental taxes may be levied for direct and indirect use of the atmosphere, water and soil, for atmospheric emissions, for release of land pollutants, or for releases of pollutants into bodies of water as a result of human or service-related activities. The taxes apply to pollution that is within permissible limits and are currently in effect only for water pollution. Since 1997, 27 regional agencies have levied such taxes.

Compensatory taxes. These were established by Executive Order 2811, of 1974, in articles that remain in effect. In addition, these taxes are provided for in Article 42 of Law 99, of 1993. They were created to provide for the cost of maintaining renewable natural resources and rationalizing their use. To date, they have not been implemented.

Water use tax. This was established by the 1974 Natural Resources Code, Law 99, of 1993 and Law 373, of 1997. It charges users for different uses of water in order to pay for the expense of protecting and renewing the resource. It is designed to function as a financial instrument and can only be applied by certain environmental agencies.

Tax incentives for environmental investment. These incentives were introduced in the 1997 tax reform (Law 383). They are a significant variable affecting investment decisions by taxpayers, since they provide relative advantages for environmentally friendly (as opposed to environmentally harmful) investments.[7] There are exemptions for investment in clean production; there are also subsidies for the protection of ecosystems and for reforestation.

Except for the environmental tax for specific releases of substances into the environment, these taxes are considered to be financial instruments, and are intended to provide revenue for environmental agencies, not as solutions to environmental problems.[8]

Law 99, of 1993, modified the tax structure to make these taxes an economic instrument to be used by the State to charge for environmental services when the environment is used for waste disposal. The law provided that all users of renewable natural resources, whether involved in profit-making activity or not, be subject to the tax. It also established a new environmental tax system, along with a method of calculating amounts to be charged. Under this legislation, the Ministry is responsible for setting a minimum tax at the national level. The regional autonomous corpo-

[3] Environmental Management Departments are mandated for cities with over one million inhabitants. These departments are: DAMA (Bogotá), DAGMA (Cali – Cauca Valley), the Aburrá Valley Metropolitan Area (Medellín – Antioquia), and DADIMA (Barranquilla–Atlantic district).

[4] These are: the Alexander Von Humboldt Biological Resources Research Institute, the SINCHI Amazon Institute for Scientific Research, the Jose Benito Vives de Andreis Institute for Marine and Coastal Research (INVEMAR), the Hydrological, Meteorological and Environmental Studies Institute (IDEAM) and the John Von Neumann Institute for Pacific Environmental Research.

[5] This unit is a part of the Ministry of the Environment and is responsible for managing areas that are part of the park system.

[6] Both Law 99, of 1993, and the National Development Plan include the municipalities as part of the National Environmental System.

[7] Incentivos Tributarios A La Inversión Ambiental [Tax Incentives for Environmental Investment]. Ministry of the Environment, Colombia. 1997.

[8] Estrategia De Financiación Ambiental Para Colombia [Environmental Funding Strategy for Colombia], 1998–2007. Ministry of the Environment, 1998.

TABLE 1

ORGANIC WASTE BY METROPOLITAN AREA IN TONS OF BOD/DAY

Metropolitan Areas	Domestic	Industrial	% Domestic	% Industrial	Total
BOGOTA – SOACHA	259,9	82,4	28,25	8,96	342,3
MEDELLIN – VALLE ABURRA	145,9	89,2	15,86	9,69	235,1
CALI – JUMBO	64	121,0	6,96	13,15	185,0
BARRANQUILLA	38,5	20,0	4,18	2,17	58,5
MANIZALES – V/MARIA	17,4	18,3	1,89	3,08	35,7
BAHIA CARTAGENA	29,6	9,0	3,22	0,98	38,6

Source: National Planning Department. "Diagnóstico y Control de la Contaminación Industrial" [Diagnosis and Control of Industrial Pollution]. Bogotá, July 1993.

rations may adjust this figure at the regional level, following procedures and guidelines set forth in the regulatory standards.

Background for current environmental issues

For twenty-three years, Colombia has had a system for creating and implementing environmental standards, mandates and monitoring mechanisms. However, fecal coliform levels in the country's rivers are some of the highest in the world, with 97% of sewage being released, untreated, into the rivers.

Society incurs a number of costs as a result of this situation, since clean water is necessary to the society's well-being. Examples of these costs are:

- Increasing costs of purifying drinking water, due to waste and sewage discharged into the rivers.
- The reduction of fishing in the national rivers.
- The disappearance of tourists as a result of poor water quality in some locations.
- Illnesses involving diarrhea, which are a major consequence of water pollution.

Releases of household sewage into surface water have risen to 1,200 tons of BOD/day in urban and rural areas, while industry contributes 520 tons of BOD/day.

Of this total, the metropolitan areas that generate the most organic waste are Bogotá-Soacha, with 342.4 tons of BOD/day, Medellín -Valle de Aburrá, with 235.1 tons, and Cali-Yumbo with 185 tons. The following table provides a breakdown.

The agricultural sector, without sugar cane or coffee processing industries, generates the highest volume of BOD, with approximately 4,000 tons daily, followed by the livestock sector, households, and industry. Industry generates 500 tons of total suspended solids (TSS) per day.[9]

In 1997, it was ascertained that only *one* of the 6,000 sources of waste flowing into the Bogotá River —from its headwaters to Giradot—was in compliance with the standards set in 1987 by the environmental agency with authority over the region.

Clean technologies have been designed for many of the country's productive sectors, and most are low-cost technologies that, in some cases, even increase profit. However, existing standards do not create incentives for changing from polluting practices to clean ones.[10]

Design of the environmental tax: legal aspects

The concept behind the environmental tax is to generate revenue from actual or potential public services provided to taxpayers, with the revenue going only to the service areas involved.

[9] Aguas Limpias Para Colombia Al Menor Costo, Implementación de las Tasas Retributivas por Contaminación Hídrica [Clean Water for Colombia at the Lowest Cost; Implementation of Environmental Taxes for Water Pollution], Ministry of the Environment. 1998

[10] For example, PROPEL, an international NGO, developed production methods adapted to Colombian tanneries. The methods reduce pollution by as much as 70%, and significantly reduce the leather lost in processing.

Article 42 of Law 99, of 1993, establishes the environmental and compensatory taxes to be levied for direct or indirect use of resources, or as compensation for the expense of maintaining and renewing resources. This modification strengthens the tax as an economic instrument.

- "Direct or indirect use of the atmosphere, water or soil to dispose of agricultural, mining or industrial wastes or residues, sewage or waste water of any type, smoke, vapor, or harmful substances that result from human activity or from activities resulting from human activities, or economic or service activities (whether or not profit-making) shall be subject to payment of environmental taxes to compensate for the harm caused by the activities involved."[11]

Article 42 of Law 99, of 1993, also establishes a system and a method whereby the Ministry of the Environment sets the amount of the tax. The system and method is based on the following rules:

- The Ministry of the Environment shall make an annual determination of the method for calculating depreciation, taking into account the social and environmental costs of the damage, as well as the cost of returning the affected resource to its prior state. The amount levied shall take into account full depreciation of the affected resource.
- Calculation of depreciation shall take into account an economic assessment of the social[12] and environmental damage[13] caused by the activities involved.
- The amount of tax to be levied should be determined by a mathematical formula that includes quantitative variables defined to measure the damage incurred by the activity and coefficients that weights it as part of the set of factors and variables taken into consideration.
- The calculation of those coefficients shall take into account the pollutants involved, the diversity of regions, availability of resources and its capacity for assimilation, the opportunity cost of the resource, and the socioeconomic conditions of the population affected.

In Decree 901, of 1997, the Ministry of the Environment provided regulations under Article 42 to define the system and method to be used for levying the tax. The decree sets forth a system designed to levy amounts for particular releases of TSS and BOD into surface water. The amounts levied must be set for each water basin or section thereof.

It must be borne in mind that the concentrations of TSS and BOD allowed at the national level are set in Decree 1594 of 1984, which establishes that for household and industrial discharges, 80% of TSS and BOD must be removed. Hence, according to this standard, the permissible release is 20% of the total amount of these substances, and the environmental tax is applicable only to this percentage. Concentrations beyond permitted limits are not subject to the tax.

[11] Article 42, Law 99, of 1993. Ministry of the Environment, Colombia.
[12] Damage to human health, landscape, public tranquility, public and private goods, and other goods of economic value.
[13] Damage to the normal functioning of ecosystems or the renewability of resources and their components

TABLE 2

ADJUSTMENTS TO MINIMUM ENVIRONMENTAL TAXES FOR SPECIFIC RELEASES 1997–2002

Period	BOD (US$/KG.)	TSST (US$/KG.)	Adjustment
April 1, 1997 – May 5, 1998	0,017	0,007	
May 5 – December 31, 1998	0,020	0,009	17.68%
January 1 – December 31, 1999	0,024	0,010	16.70%
January 1 – December 31, 2000	0,026	0,011	9.23%
January 1 – December 31, 2001	0,028	0,012	8.75%
January 1 – December 31, 2002	0,030	0,013	7.65%

Source: Ministry of the Environment, 2002.

According to the decree, the minimum amount levied per unit of pollutant for each parameter is to be set by subsequent rulings to be issued annually, adjusting the amount of the tax in accordance with inflation. To date, the amounts set by the Ministry are as follows.

These minimum rates were based on studies by the Ministry of the Environment establishing the maximum cost of restoring the resources, based on technologies currently applicable in Colombia. Each parameter subject to taxation was considered separately, and the resultant increases were spaced over ten 6-month periods as a way of smoothing the impact of the change. The following formula was used:

$$Amount\ levied_i = minimum\ tax\ \ *regional\ multiplier_i$$

Decree 901 establishes this incremental mechanism, which is to be used for setting rates in each watershed or section thereof, through a consultative process involving all the parties involved, including those responsible within the regional community. These parties define and agree on a target for reduction of total pollution released into the watershed for the succeeding five years. Reduction is specified in terms of total kilograms of pollutants released in each six-month period.

Once the target is set for a watershed or section thereof, the regional environmental authority begins to levy the tax, based on the minimum set by the Ministry. The revenue generated goes to the regional environmental authority.

The environmental authority is responsible for identifying the parties responsible for specific releases into the water for each section of the watershed, or for the watershed as a whole as illustrated in the chart.

Parties releasing pollutants are required to report releases to the authority, which, in turn, is required to make direct, statistically significant measurements that make it possible to efficiently determine the amounts to be levied. Thus, each authority must establish a monitoring program to make semi-annual measurements of releases into the watershed and compare them with agreed reduction targets.

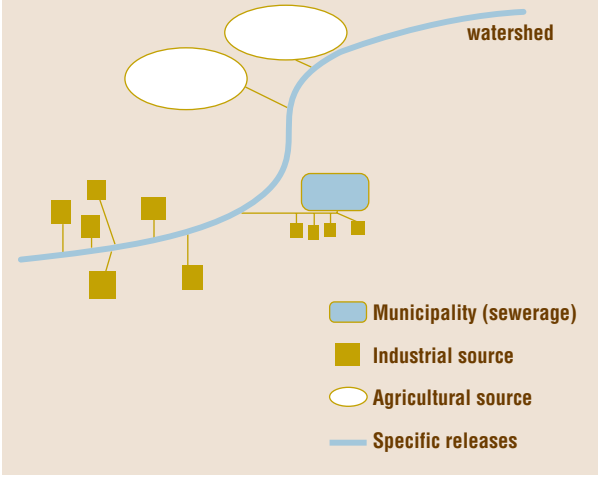
If the target is met:

$$Regional\ multiplier_i = regional\ multiplier_{i-1}$$

If the target is not met:

$$Regional\ multiplier_i = regional\ multiplier_{i-1} + 0.5$$

CHART 1



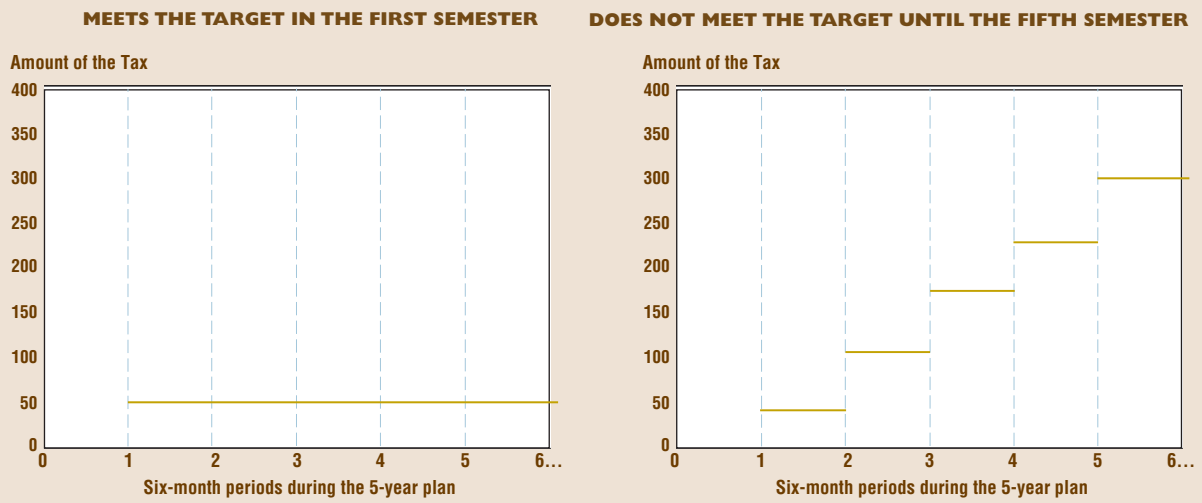
If the pollution exceeds the target, the tax is increased by a "regional multiplier" of 0.5, which will increase the tax in the following six-month period for all parties in the watershed. This multiplier was set by the decree, and its purpose is to induce polluting parties to attain the tax level that involves reducing all releases to the target level in the least costly manner, and to induce polluting parties to implement technological innovations. The gradual adjustment in the amount of the tax is an ongoing incentive to reduce pollution to the equilibrium level.

"The a priori determination of an environmental target is basic to the cost-effective functioning of any economic instrument, since it reflects the preferences of the society in relation to environmental quality. Thus, it is important for the target to be agreed on by all sectors involved with water as a resource, including both those who produce damage through pollution and those who suffer the consequences. In this way, the costs and benefits of the decision—economic, as well as environmental and social—become a part of the decision regarding the regional target. The target also sets a benchmark for measuring the effectiveness and performance of the instrument."[14]

The environmental tax functions on the principle that "the polluter pays." It was designed as a Pigovian

[14] Aguas Limpias Para Colombia Al Menor Costo, Implementación de las Tasas Retributivas por Contaminación Hídrica [Clean Water for Colombia at the Lowest Cost; Implementation of Environmental Taxes for Water Pollution], Ministry of the Environment. 1998

CHART 2



Source: Based on a presentation by OAE. Ministry of the Environment, 1998.

charge levied on the polluter, based on the pollution generated, and is an application of a concept devised and developed by William Baumol and Wallace Oates.[15] The Ministry selected this model because of its applicability to a situation in which there is little information on environmental damage and on the cost of reducing pollution.

Operational aspects of the environmental tax

The process of target setting must involve all available information, qualitative and quantitative, taking into consideration the social, economic and environmental costs of damage caused by pollution, as perceived by the society affected in each region and with respect to each resource. Thus, the agreement must take into account the abatement costs to polluters, in order to arrive at a target acceptable by the entire regional society.

The tax is to be implemented gradually over five-year periods, as follows:

- An abatement target is agreed on for the selected body of water.
- The environmental authority gathers information on progress toward the goal on a semi-annual basis.
- The environmental authority raises the tax semi-annually by applying a regionally determined multiplier if the goal is not met.
- Upon achieving the regional environmental goal, the rate remains stable for a five years period.
- At the end of the five years period, the target may be reevaluated and changed by the members of the regional watershed community who are directly involved or affected. If the target proves to have been too ambitious, and the economic costs excessive, the target should be made less restrictive. On the other hand, if the economic costs have been minimal but the environmental impact great, then the parties may agree on a more demanding target.

The system has the virtue of allowing the community that is subject to the regulations to be actively involved with the environmental authority. Furthermore, the amount of the tax is based on measured pollution rather than subjective criteria. Thus, the system produces the minimum tax rate needed to reach the agreed decontamination target in each region, with society bearing the minimum possible cost necessary to reach the level of environmental quality desired.

By determining watershed-specific targets with input from the local community, using improved information, and with economic rationalization as an

[15] William Baumol, "On Taxation and the Control of Externalities," American Economic Review; William Baumol and Wallace Oates, "The Use of Standards and Prices for Environmental Protection," The Swedish Journal of Economics; Baumol & Oates, "Efficiency Without Optimality: the Charges and Standards Approach," Chapter 11, The Theory of Environmental Policy, Cambridge Press.

integral part of the process, the environmental tax can be more efficient in meeting targets. However, economic, social and environmental conditions change over time, e.g., with respect to evolving clean technologies and changing environmental community priorities. Thus, every five years the community reevaluates perceived costs and benefits, adjusting targets as it deems appropriate.

IMPLEMENTATION OF THE INSTRUMENTS

Problems and overall issues

Following the issuance of Decree 901 in April of 1997, the Ministry of the Environment put in place various tools for support and implementation. These included an Implementation Manual written by experts in various relevant areas, and a cooperative program with environmental authorities, designed to ensure that the tax coincided with regional needs and realities.

At the end of 1997, only three of the regional environmental corporations had implemented the decree. In response to this situation, the Horizontal Cooperation Program was created, aimed at exploiting the institutional strengths of those regional authorities that had made the most progress in implementing the tax (CVC, CORNARE and CARDER) and assisting other authorities in setting reduction targets in their jurisdictions, through an assistance and support system.

During implementation, the Ministry found that the structure for channeling the revenue from the tax was a major limitation in the process. It therefore designed a tool to provide transparency in how the revenue is used. Information about the design of this supplementary tool, known as Regional Investment Funds, was released at the end of 1998. The funds are intended to clarify the allocation of revenue, as well as leveraging other funding sources in order to carry out cost-effective investments in water decontamination.

The program has moved forward slowly, and with significant problems. Of the existing 37 environmental authorities, 27 made progress in setting targets and implementing the instrument, while only 13 have billed users in their jurisdictions for the use of the resource, and only 10 have begun forming the regional funds to handle revenue from the tax. The table below shows the stage of implementation of the taxes and regional funds by the various regional authorities, as of June 2001.

Though the billing and collection process has advanced, it has been a complicated task for some of the regional authorities, since there is a complete absence of guidelines for converting the collection of the tax to a system in which households are billed for the public services involved. Moreover, most of the environmental authorities were created by Law 99, of 1993, and therefore lack credibility and political power, as well as the administrative infrastructure and experience needed to carry out the necessary activities efficiently.

This is evident from the fact that billing has not necessarily led to collection of the funds, as seen in the table below that indicates that only 33% of amounts billed have actually been collected.

The most significant delays are due to the lack of political resolve needed to implement the tax system and, in some parts of the country—where pollution problems are minimal, e.g., the eastern plains and the Amazon region—a lack of need for the system. The environmental authorities that have made the greatest progress in implementation have had positive results, reducing pollution by an average of 10% to 51%.[16]

To date, Colombia's environmental tax has proven effective in reducing pollution in the productive sector. However, it has not had the same success in respect to household pollution or pollution associated with municipalities. The technological

TABLE 3

Total number of regional environmental authorities	37
Regional environmental authorities with advanced implementation processes	27
Authorities that have invoiced	13
Authorities that have not begun implementation	10
Authorities with regional funds	10

Source: OAE. Ministry of the Environment, 2001.

[16] CORNARE has reported 31% BOD reduction and 47% TSS reduction; CDMB has found 10% BOD reduction and 69% TSS reduction; and CVC has reported more than 46% BOD reduction and 36% TSS reduction. These data were calculated by the authors based on the latest data reported to the Ministry of the Environment.

TABLE 4

Total billed by regional environmental authorities (Colombian Pesos)	Total collected by regional environmental authorities (Colombian Pesos)
$ 66,767,729,461	$ 22,518,267,884

Source: External consulting carried out for the Ministry of the Environment, 2002.

constraints involved in controlling the latter type of pollution, the high cost of implementing municipal waste water treatment systems,[17] the low number of such systems currently in existence,[18] and the lack of control that public utilities have over the use of their infrastructure have limited the effectiveness of the instrument.

The tax has been effective in promoting industrial clean-up, due to the elasticity of the pollution tax. However, because of legislative problems in transferring collections and inelasticity, the results with municipal systems have not been as positive. Municipalities that have implemented the tax are incurring growing debts to the environmental authorities, a situation that, in the long run, could create a serious budget problem for the authorities.

Municipal entities are the source of the country's largest liquid waste discharges, accounting for 70% of such discharges. In the great majority of cases, they have no clean-up or treatment systems. Failure to pay the environmental tax for their discharges – despite the fact that Decree 901 makes them subject to the tax or responsible for the discharge – is an aggravating factor in the situation.

The country's inability to solve the problem of transferring collection of the tax to household users of sewage systems is the result of certain peculiarities of Colombian politics and law.

The Asociación de Empresas de Servicios Públicos Domiciliarios y Actividades Complementarias, (ANDESCO) has been categorically opposed to implementing the instrument, especially as it applies to entities providing sewerage services, and since the initial implementation of the tax, its members have decided to refuse to pay it, in addition to initiating several lawsuits against the tax. Their primary argument is based on regulatory problems relating to public utilities. Though Law 142, of 1994, allows them to include environmental taxes in their average operating costs, and thus to transfer those costs to users, the utilities claim a lack of regulatory clarity, and hence refuse to pay the tax until such time as the Drinking Water Regulatory Commission issues a clarifying ruling.

Despite this situation, the environmental authorities have billed water and sewage utilities, though they have not collected. They have taken legal action to enforce the environmental legislation, as in the case of regional authority DADIMA, which was forced to seize the Barranquilla Water, Sewerage and Street Cleaning Company (also known as Triple A). The company then agreed to pay its approximately 2.5 billion peso debt over a period of one year, in addition to monthly payments for household sewage discharged since October 2001.

Similar cases have occurred elsewhere. Medellín Public Utilities (Empresas Públicas de Medellín) is one example. This utility only began paying for discharges as of 2000, but the underlying problem – one of gaps in the law – was not solved. Thus, the more the tax is implemented, the worse becomes the problem of collections, a situation that starts involving other sectors.

In this connection, the National Industrial Association (ANDI) has expressed concern about the inequality of implementation, since municipalities are neither reducing their discharges nor paying the tax, while the industrial sector, which is complying with regulations and investing in clean-up, is having to pay successive increases in the regional multiplier. These increases are due to a failure to reach target levels—a result, specifically, of the fact that municipalities, which are responsible for 70% of the discharges, are not undertaking any mitigation measures.

In addition, the failure to impose the tax in all of the country's regions creates inequities and competitive disadvantages for firms situated within the jurisdiction of those environmental authorities that are actually collecting the tax. These firms must either pay fees or reduce their discharges, while firms not subject to the regulations are free of these addi-

[17] Investment needed by this sector in Colombia is estimated at US$2.175 billion.

[18] Ninety-five percent of municipalities in Colombia release waste water without any treatment.

tional costs. The problem has been addressed by the Comptroller General of the Republic, which has stressed the failure of environmental authorities to enforce the law, both with respect to collecting the tax and in the sense of enforcing the absolute discharge limits imposed by Decree 1594, of 1984.

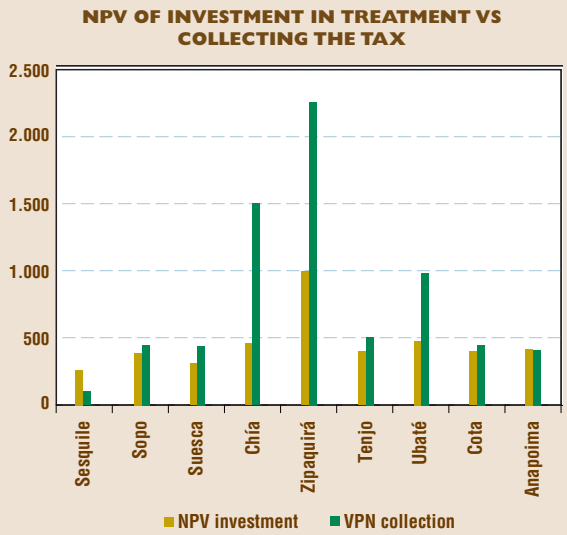
Much of the debate is focused on the lack of credibility of government institutions, which are considered corrupt, inefficient and bureaucratic. Those subject to the tax oppose channeling these revenues into the nation's general budget for subsequent allocation. They believe that such a procedure will not ensure that the funds will be used to solve specific regional environmental problems. With this in mind, some of the regional authorities, under guidance from the Ministry, have made agreements with municipalities for the management of regional investment funds to ensure the design of abatement measures that provide for cost-effective treatment systems.

The institutional process involved in handling the revenues, however, are highly complex involving the Ministry of the Environment, the Ministry of Economic Development, the Ministry of Health, the Commission for the Regulation of Drinking Water and Basic Sanitation, the National Planning Department, and the Superintendency of Household Utilities. Moreover, the taxes are seen as an additional cost which, when transferred to users, will have harmful effects on the lower socioeconomic strata, which is already in dire economic straits. This segment of the population has already suffered, over the last two years, from the economic impact caused by the withdrawal of subsidies experienced by utilities.

Before implementing Decree 901, of 1997, the Ministry of the Environment analyzed the impact of the tax on household users of sewage services. It concluded that the monthly cost borne by a family would be only 0.2% of the monthly minimum wage (approximately 600 pesos in 2002 terms). The utilities, however, predict average increases of 20% in billings for water and sewage services.[19]

The Ministry projected payments by municipalities and utilities in each region, based on population or number of users, the amount of pollution being discharged into the environment, and the reductions targeted for the respective regions. The analysis was based on two alternatives from which municipalities could choose: (a) paying an environmental tax to environmental authorities on an ongoing basis; or (b) investing in pollution-solving measures that are less costly than paying the tax.

CHART 3



Source: Office of Economic Analysis, Ministry of the Environment, April 1997.

The chart below shows the results of studies carried out by the Ministry of the Environment, indicating that, for most municipalities in Colombia, there are more cost-effective solutions than payment of the tax.[20]

Additional studies by Fedesarrollo, Universidad del Valle and Universidad Javeriana, in the cities of Cali, Bogotá and Cartagena, concluded that the system of environmental taxes did not significantly impact the utilities' economic or financial viability.

Most of the country's sectors, however, disagree, since actual implementation has been quite different from the projections. The assumptions and estimates of the Ministry have proven inaccurate, due to the fact that diverse problems have arisen, and that those assumptions did not necessarily take into account

[19] Figures by the Empresa de Acueducto y Alcantarillado de Bogotá, EAAB. 2000.

[20] Simulation of present net value of investments and operating costs for basic treatment plants in the cases of 9 municipalities in Cundinamarca, based on the tax applicable during the useful life of the project (20 years). The payment increases semi-annually by a regional multiplier of 0.5 until year five, at which time the reduction target is assumed to have been reached. From that point on, through the remaining 15 years, revenues remain constant. The amounts do not include collections from industry. Colombia's average population growth (2%) was taken into account, and a social discount rate of 12% was used. OAE, Ministry of the Environment, April 1997.

the effective existence of cost-effective technological solutions. Without going into the details of this issue, it should be pointed out that the tax, as planned, did not take into account the fact that implementing cost-effective technologies to reduce pollution discharges would require designing and building solutions, and that in most cases this takes at least two years, during which time the regional multiplier is subject to increase.

Positive aspects and successful cases

A group of experts from the Environmental Policy Division of the World Bank, made the following observations in its evaluation of the environmental tax at an event hosted by the Ministry of the Environment in Bogotá in 2000.[21]

> "*Our group has been directly involved in the design and implementation of environmental taxes with officials from China, the Philippines, Indonesia, France, Canada and Brazil during the last seven years, and we have had the opportunity to see where, in practice, there are problems related to the implementation of taxes. After having evaluated the Colombian tax, our conclusion, comparing this with the experience in other countries, is that the Colombian mechanism represents the state of the art in the design and implementation of taxes. It is a system based on cost-effectiveness and on minimizing costs. It is a mechanism notable for its simplicity and transparency, and for the fact that is objective and gradual. It also stands out for the way in which it actually incorporates the regional community in the setting of clean-up goals that reflect local preferences. It is based on a fairly practical system and method, and empirical evidence indicates that the mechanism can be implemented with existing institutional resources to reduce pollution in a very cost-effective manner.*"

This conclusion appears in the case analysis made by the CORNARE regional authority, in *Greening Industry*, a book published by the World Bank in 2000.

When the regulatory decree establishing the environmental tax was first issued, the regional environmental authority of Antioquia (CORNARE) was 15 years old. CORNARE pioneered the implementation of the tax with ongoing assistance from staff of the Ministry's Office of Economic Analysis.

Unlike most of the country's autonomous entities, CORNARE had a significant amount of information on the state and quality of the most important water resources in its jurisdiction, and knew the entities responsible for the major discharges in its watersheds. Using this information, as well as statements by the entities themselves, as provided for in the regulatory scheme, baselines were established for each of eight watersheds, based on discharges measured according to the parameters defined in the regulations. Discharge levels for the various parameters were specified for specific discharge points within the watersheds.

CORNARE had data on the location of polluters, classified by economic sector and subsector. This made the process of agreeing on regional clean-up targets clearer and the results more precise. Moreover, there had already been meaningful dialogue with unions within these subsectors, leading to agreements on cleaner production.[22] This was highly significant, since these groups represented over 90% of identified water pollution sources in the region's productive sector.

In the case of municipalities and utilities serving households, the statements received showed these entities contributing approximately 70% of the volume of BOD and TSS.

The governing board of CORNARE approved the first six months of charges, covering April 1st to September 30th, 1997, and implementation has had significant positive results in a number of the eight target watersheds. For instance, after two years of implementation in the Río Claro – Cocorná Sur watershed, TSS pollution had fallen 84.95%, and BOD5 pollution had dropped 40.42%. This watershed includes cement plants and oil industry sites. The Río Negro watershed, one of the most polluted in Colombia, showed reductions of 33.81% in TSS and of 33.56% in BOD5.[23]

The table below shows reductions, by watershed and by category.

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[21] Seminar. Colombian Ministry of The Environment and the World Bank. Bogota, Colombia, 2000

[22] Industrial entities associated with CEO (Corporación Empresarial del Oriente), flower growers (Asocolflores Antioquia), pork producers (ACP and others), agave farmers (Asdefique and others), and beekeepers (Fenavi and others).

[23] Hincapié et al. 2000.

TABLE 5

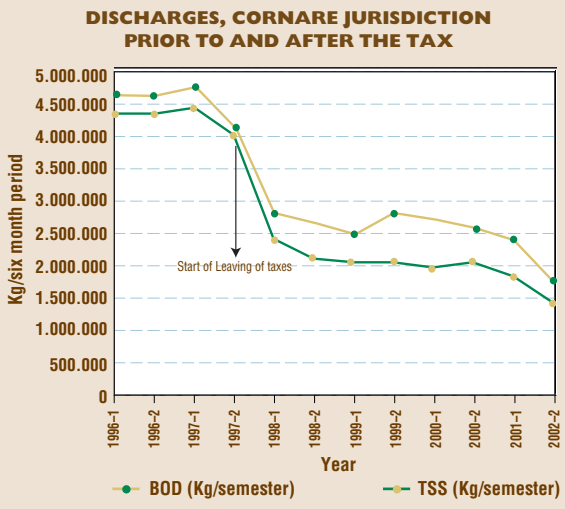
DISCHARGES BY SECTOR CORNARE JURISDICTION 1996–2001

	Domestic		Industrial		Agribusiness		Total	
Periodo	BOD Kg/semester	TSS Kg/semester	BOD Kg/semester	TSS Kg/semester	BOD Kg/semester	TSS Kg/semester	BOD Kg/semester	TSS Kg/semester
1996–1	3.207.392	3.056.154	1.305.810	1.193.659	5.231	15.929	4.518.433	4.265.743
1996–2	3.207.392	3.056.154	1.305.810	1.193.659	5.231	15.929	4.518.433	4.265.743
1997–1	3.315.668	3.159.585	1.305.810	1.193.659	5.231	15.929	4.626.710	4.369.174
1997–2	3.264.212	3.084.237	722.232	802.617	30.085	27.685	4.016.529	3.914.539
1998–1	2.055.271	1.898.749	635.668	336.456	19.988	29.899	2.710.927	2.265.104
1998–2	1.844.458	1.735.820	656.682	223.846	27.236	26.818	2.528.376	1.986.484
1999–1	1.885.275	1.741.866	511.982	181.767	17.330	21.228	2.414.587	1.944.861
1999–2	1.921.268	1.723.254	785.294	188.673	13.591	18.434	2.720.152	1.930.361
2000–1	1.909.852	1.722.465	687.526	162.805	12.760	17.924	2.610.138	1.903.195
2000–2	2.011.534	1.821.916	466.440	118.754	11.336	15.310	2.489.310	1.955.980
2001–1	1.698.055	1.610.147	582.356	97.904	9.182	13.614	2.289.594	1.721.665
2001–2	1.245.910	1.163.713	382.394	125.171	8.004	12.618	1.636.309	1.301.503

Source: Authors' figures, based on data from the Ministry of the Environment, 2002.

The following chart shows the changes in the amount of discharges over time, before and after the implementation of the water tax.

CHART 4



Source: Authors' figures, based on data from the Ministry of the Environment, 2002.

CORNARE has also been successful in the area of collections, having collected 57% of the total billed. This is far higher than in other parts of the country. Indeed, all of the industrial entities that signed cleaner-production agreements with CORNARE[24] have made their environmental tax payments in a timely fashion.

One key point in CORNARE's success is the transparency with which the collected funds have been managed. From the start, CORNARE determined that 50% of the money would be used to co-finance projects designed to deal with municipal pollution, 30% for investment in industrial reengineering and cleaner production, 10% for environmental science and technology research, environmental education, and dissemination of information about the environmental tax, and an impressively low 10% for operating expenses. A regional clean-up fund was created to handle the revenue, following guidelines provided by the Ministry of the Environment for the purpose.

[24] Members of CEO (Corporación Empresarial del Oriente Antioqueño).

TABLE 6

1992–2001	Total billings ($/semester)	Payments Outstanding	Collections	% Collected
Household collections	2.935.587.307	1.221.806.022	1.713.781.285	58%
Industrial collections	944.108.990	451.643.589	492.465.401	52%
Agribusiness collections	26.590.765	12.404.094	14.186.672	53%
Total	3.906.287.063	1.685.853.705	2.220.433.358	57%

Source: Authors' figures, based on data from the Ministry of the Environment. 2002

ECLAC[25] has also been involved in analyses of consequences of the tax, conducting an assessment of the impact of the tax on Colombia's industrial sector after four years of implementation. The study dealt with environmental effectiveness and economic efficiency in the jurisdictions of environmental authorities CVC, CORNARE and DADIMA, examining the two following scenarios:

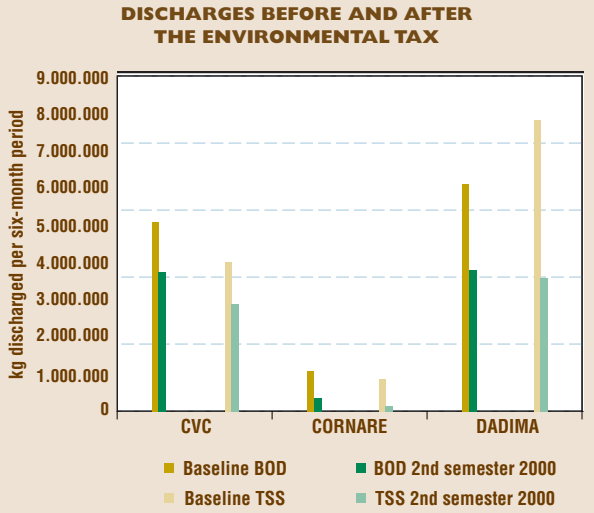
a) Regulated entities have met standards on discharges, investing in costly treatment plants, as in the cases of CVC and CORNARE;
b) Regulated entities have low levels of compliance with standards, not investing in treatment plants, as in the case of DADIMA.

The study concluded that in both cases the tax produced significant reductions, in addition to those already produced by existing treatment plants, and more rapidly than in previous years, as shown in Chart 5.

In addition, ECLAC evaluated the cost of compliance for regulated enterprises, examining two individual companies, Monómeros Colombo Venezolanos S.A. and Canteras Yarumal, as well as a third company, Cultivadores de Caña de Colombia (ASOCAÑA), in the sugarcane subsector. The results showed that in addition to a reduction in pollution compared to the previous system, companies had incentives to create cleaner production processes, thus leading, in some cases, to a rise in productivity.

Though the sugar industry already had treatment plants for its wastes, additional reductions of 24% (BOD) and 65% (TSS) followed implementation of the tax. In the cases of the individual companies studied, approximately 90% reductions were achieved within a year of implementation, even where production was increasing. Such results had not been achieved previously, despite a policy that imposed fines and even shut down companies.

CHART 5



Source: ECLAC 2001

ECLAC concludes that the tax is a more cost-effective instrument for environmental authorities than the previous system of fines and shutdowns, since although the total cost of the new system is

[25] ECLAC: Aplicación del principio contaminador-pagador en América Latina: evaluación de la efectividad ambiental y eficiencia económica de la tasa por contaminación hídrica en el sector industrial colombiano, 2001

comparable to the cost of the old regime, the administrative cost per kilogram of reduction in BOD is lower under the new system (79% lower in the case of CORNARE).

According to the ECLAC study, the tax, as a source of funds for the environmental authorities, gives these entities budget stability independent of the central government, guaranteeing that there will be money for new projects, and ensuring continuity for programs that administer, supervise and monitor water resources.

To summarize, the most significant benefits of the environmental tax system, according to the various studies and analyses of its application in Colombia, are:

- Updating of inventories of users that generate direct or indirect discharges into bodies of water.
- Developing updated information on the state of water resources, in regard to organic pollution and suspended solids.
- Identification of users and their discharges, using statement forms for users.
- Use of information that had been on file but had not been used.

In addition documents in which companies and municipalities describe the discharges they generate are now taken into consideration. This information is of value to management, and can be a factor in inducing regulatory entities to fulfill their environmental responsibilities. Other notable effects are:

- In certain regions, closer and better relations have been established between environmental authorities and those responsible for discharges.
- The obligation to pay the tax has made users more aware of environmental issues.
- In some regions of the country, industrial pollution has been reduced.

CONCLUSIONS

It is widely recognized that it is more economically efficient for society to tax "negative" activities (such as pollution) than "positive" ones (such as work or savings). Hence, there is a three-way benefit in taxing pollution: it diminishes harm to the environment, generates additional revenue for environmental management and reduces taxation on activity that is beneficial for society.

Thus, in theory, taxing pollution creates an incentive for environmentally favorable behavior, promotes proper valuation of natural resources, and promotes their efficient allocation and use. As a result, the environment is treated in a manner that ensures efficient economic allocation of resources internalizing any environmental damage derived from production.

For example, an accurate valuation of pollution implies that the marginal costs of reducing pollution (or, viewed from another perspective, the marginal benefits of polluting) are equal to the marginal costs of damage to the natural resources involved, in the optimal scenario. Environmental goods and services, however, are not tradable, and the information needed to determine the marginal cost of harm done is generally unavailable. Hence, economic instruments are used – ones that, despite a lack of important information, do permit polluters to determine the most appropriate form of reaching an established target, or of making their marginal cost for decontamination equal to the level of the tax that has been set on the amount and type of pollution in question.

The use of economic instruments in environmental policy is not new. Nevertheless, there is a large gap between the theory on which they are based and the actual implementation of the instruments. According to the OECD,[26] though these instruments are the type most commonly used, they have been problematic in practice and have not created the incentive levels needed to attain environmental goals, primarily because the level of the tax has been set too low – conceiving of them primarily as financial instruments or sources of revenue.

The situation in Colombia is different. The instrument here was designed primarily as an economic incentive to reduce releases of polluting agents into bodies of water. While this is its principal strength, it suffers from other problems. These relate primarily to implementation rather than design, except for the exponential nature of the regional multiplier.

Thus, the environmental tax is, in theory, an ideal instrument for pollution control, but in practice its applicability has been problematic. This is not necessarily the fault of the instrument itself, but rather, can be attributed to the country's institutions and to difficulties in the Colombian economy.

[26] Organization for Economic Cooperation and Development.

This situation has been aggravated by the fact that a number of variables were not taken into account in initiating the tax—variables whose importance was, in some cases, difficult to foresee. For example:

1. The time needed to design, build and implement technological solutions to mitigate the releases of pollutants;
2. The low level of municipal resources available to build the treatment plants needed in a timely fashion;
3. Delays in bringing complete sanitation services to many municipalities, making it impossible to solve the problem of waste releases into bodies of water—even with the construction of treatment plants (which would be under-utilized because of the incomplete coverage of the sewage collection system);
4. Lack, in many cities, of sewage collection systems and systems for separating rainwater, creating the same problem as indicated in the above point, in addition to the problem of paying environmental tax on discharges that can neither be controlled nor mitigated;
5. The elimination of subsidies to utilities, which entails significant economic impact, leading to social opposition to the tax;
6. The vagueness of regulations governing utilities' transferring the tax to users, which has caused resistance by sanitation companies, which believe that they may be forced to pay the charges out of their own pockets;
7. Lack of knowledge about environmental issues, especially in terms of the basic concepts of the instrument as designed. This has caused chaos when the time comes to negotiate clean-up targets, sometimes leading to targets that are entirely unrealistic;
8. The low level of experience and technical capacity of the environmental authorities, reflected in the fact that they have been unable to explain to the regulated parties the rationale for the tax, and the fact that they have not had the credibility and capacities needed to negotiate agreements;
9. Environmental authorities' lack of information on releases of pollutants into bodies of water—information necessary for billing and collection of the tax;
10. The problems that environmental authorities have had in carrying out the auditing and monitoring needed to confirm information that appears in the statements provided by entities responsible for discharges; and
11. Perhaps most important of all, the exponential increase of the regional multiplier and, consequently, of the tax, due to failure to meet targets—a situation that has led to widespread resistance to the tax.

For these reasons, experiences that have been perceived as successful are those involving environmental authorities already engaged in managing discharges by economic agents in their jurisdictions prior to the advent of the economic instrument—entities with basic information on discharges into their bodies of water. Thus, they have been free of most of the problems that have occurred in the rest of the country, and have managed to obtain compliance with the targets, thus preventing sharp increases in the regional multiplier.

The increase in the regional multiplier should be controlled so as to make it proportional to the degree to which the target has been met during the immediately preceding period, creating a real convergence between the amount of the tax and the value that makes it possible to achieve optimal clean-up.

$$\textit{Amount of the tax}_i = \textit{minimum tax}_i * \textit{regional multiplier}_i$$

If target is met:

$$\textit{Regional multiplier}_i = \textit{regional multiplier}_{i-1}$$

If target is not met:

$$\textit{Regional multiplier}_i = \textit{Regional multiplier}_{i-1} + (0.5 - (0.5 * \textit{percentage compliance with target})$$

Studies analyzing benefits of the environmental tax program have pointed to solutions to the problems of information and management essential to successful implementation, e.g., (a) updating of information on discharges and their causes; (b) closer relations between environmental authorities and regulated entities; and (c) growing awareness of natural resources among users, with reduction of industrial discharges being the only concrete result of implementation.

The intention behind the instrument was valid, and the design of the instrument was a response not only to existing legislation, but also to the principles of "equi-marginality" and economic efficiency,

attempting to reach the socially optimal equilibrium in a gradual manner. However, a number of legislative, informational and social factors were not taken into account—elements that are essential to the success of the instrument and that must be considered in future applications of future instruments of this type, such as the water use tax now being formulated.

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Synthesis of Regional Experiences: From Theoretical to Practical Issues

Ronaldo Seroa da Motta, Jose Gustavo Feres, Céline Nauges, Alban Thomas, Antonio Saade and Lilian Saade

The economic literature commonly identifies economic instruments (EIs) as a "better" way to achieve environmental goals than specified quantity and technological standards known as command-and-control mechanisms (CAC). However, the choice of an appropriate economic instrument is complex, which is recognized by the ongoing controversies regarding the efficiency of previous experiences.

Seroa da Motta, Huber and Ruitenbeek (1999) have presented a comprehensive survey of the experiences with EI in Latin America and Caribbean. This survey concludes that there is a wide range of application of EIs in the region that closely follows the OECD pattern concerning revenue-raising aims. The survey shows that water charges is the instrument with most regional applicability. It also shows persisting problems in design and implementation, such as:

i. Weak targeting and performance monitoring of environmental goals;
ii. Lack of sound pricing criteria;
iii. Poor performance on revenue collection.

The French river basin system has been used as a paradigm for Latin America experiences. This is mostly due to the fact that the French system was created by governmental decision and implemented in a reasonable time with immediate results. However, praising of this experience has obscured the identification of its main difficulties and constraints that, once recognized, could be of great value for followers.

Based on the prior diagnostic, this brief review will present the cases of water charge experiences in France, Mexico and Brazil. These country reviews are summaries based on investigations undertaken by local experts. Each country evaluation is organized along the same guidelines covering topics of relevance for the application of a policy instrument, namely:

(i) *policy analysis phase*: the policy setting in which the water EI was introduced as a mean of achieving policy goals.
(ii) *instrument design phase*: the theoretical, institutional and legal basis on which the EI was conceived .
(iii) *instrument implementation phase*: successes and failures of the EI application and its review process.

COUNTRY CASES

France

The 1964 Water Act profoundly modified the French water management system and its apparent success has been paradigmatic for water policies elsewhere, particularly in Latin America.

The French approach was based on two general principles: Decentralization and planning. First, decentralization reflected the idea that the organization of water management should correspond to the physical unity of water bodies to be managed in order to address more effectively potential sources of conflicts. In this approach the externality problems and conflicts linked to water pollution and other uses were integrated, in difference to the centralized approach

that addressed use with one set of unified performance standards. Secondly, planning was intended to provide consistent decisions at the river basin level, and to introduce a medium-term perspective on water management.

The decentralization principle was put into practice by the creation of Water Agencies and River Basin Committees in each of the six French river basins. The former were intended to perform executive functions, and the River Basin Committees would act as consultative bodies.

The application of the Water Act began with the adoption of two new instruments: five-year management plans and water charges. The implementation of water charges was gradual and it worked very well to generate revenues for water-related investments, with much of the revenue transferred back towards water charge payers. However, no major role for price incentives has been found to induce changed water use patterns at the applied water charge levels. Moreover, the special treatment to agricultural users through exemptions has led to the sacrifice of noticeable environmental gains.

Mexico

Mexico is one of the countries in Latin America that has adopted water charges in the last two decades. The water use charge applied to the use of federal water bodies has been in place since 1986 and the wastewater charge since 1991. The most recent regulation is the 1992 National Water Law that is the backbone of the federal water system.

In 1989, a central agency—the National Water Commission (Spanish initials CNA)—was created to be in charge of the use of federal water resources. The CNA is the sole authority for federal water management and is responsible for the promotion and execution of federal infrastructure and the necessary services for the preservation of water quality. The CNA is attached to the Ministry of Environment and Natural Resources (SEMARNAT). The Federal water management system encompasses 13 administrative regions defined by the CNA, following hydrographic criteria. Each region comprises one or more basins, thus basins and not states are the basis for the organization of the Mexican water management system. In total the system includes 26 Basin Councils. Following the French principles, the objective of the Councils is to promote participation in the management processes of the basins. However, the Councils have not been fully implemented and their capacities not completely developed.

A federal law that is revised every year sets the price criteria of water pollution charges in Mexico, and regulation is thereby not decentralized. The pollution charges perform the role of a non-compliance charge since polluters only pay for units above the discharge standard. However, the implementation of the water charges has not been very successful since national coverage of the country's vast water system has required monitoring resources and enforcement capability beyond the institutional capacity of the CNA. In addition, the CNA has been more concerned with infrastructure development than pursuing environmental targets. Another problem is the reduced scope for private and public participation due to lack of information made available, which has created polluters' opposition on competitiveness and distributive grounds.

As a consequence of these institutional barriers, revenue generation has been very low and no changes in water use pattern have occurred. A law reform proposal entitled *Ley de Cuencas y Aguas Nacionales* (Basin and National Water Law) and at least two other reform proposals of the current Law are being analyzed by the Congress (February, 2003). Although they are still in the discussion phase, it is worth mentioning that they all aim to give more autonomy to the river basin institutions. While the autonomy proposed might not go as far as it could, the goal of every proposal is to strengthen the institutional capacity of the decentral institutions.

Brazil

The Brazilian experience is quite different from the Mexican. Following the approval of the Federal Water Law (Law 9433 of 1997), Brazil has recently implemented a wide-ranging water sector reform, including the introduction of environmental water charges. The Brazilian legal framework for water resources management is based on the constitutional distinction between federal and state waters. Federal waters are those that flow across state boundaries or along the boundaries between two or more states or a foreign country. State waters are those situated entirely within the territory of a single state.

The new water management system also adopted the French principles of management by water basin committees and agencies, in which water charges are associated with River Basin Management Plans that identify environmental targets to be accomplished with a set of water-related investments and financed with water charge revenues. However, pricing criteria for the setting of charges have no general structure

and committees have more autonomy in this matter than in France.

The creation of river basin committees is also less centralized. The formation of a committee depends on an initiative from the users, the fulfillment of some managerial requirements and the approval from the National Water Council. This means that the river basin's national grid will be gradually extended. The National Water Council is the competent authority to deal with inter-basin and inter-state disputes and it also supervises and assists river basin committees in other issues.

The first implementation of water charges in federal rivers is due to begin in March 2003 in the Paraíba do Sul River Basin, where a single low charge will be levied on users for only a small number of pollutants. In this initial phase, the aim is to collect enough revenue to entitle the basin to compete for federal funds oriented toward water clean-up projects.

At state levels, almost all states have their own water policy based on the principles adopted in the national framework. Ceará has already water use charges and São Paulo is also near to implementing its charge system very similar to the one adopted for the Paraíba do Sul River Basin.

So far Brazil has followed revenue-raising aims as in France. But changes in water use patterns have not resulted from the price incentives developed through participatory processes institutionalized in the river basin committees.

CONCLUSIONS

Based on the reviews, our conclusions can be summarized as follows:

Policy Phase

Water charges have been introduced within a broader policy framework: The introduction of water charges has occurred within a new policy context. Charges have been considered as instruments to achieve policy goals rather than being goals themselves. All three countries analyzed have been dealing with water policy since the early 19th century. However, increasing water scarcity and environmental problems due to rapid industrialization, urbanization and irrigation have forced policy changes in water resource management. In all three cases, water charges have been introduced as instruments for this new water policy approach. This new approach, however, has been primarily concerned with (1) the need to plan and decentralize water management in order to accommodate multiple conflicting uses and the assimilative and support capacities of the country's water systems, and (2) the need to raise revenue.

The reference experience for many countries in the region is that of the 1964 French Water Act that resulted in the new legal and institutional frameworks for water management, though most come in a national variant. In Mexico, the current setup is similar to the French approach, though user charges were already in place in the eighties, however, without proper institutional and policy frameworks. It was only with the creation of the National Water Commission (CNA) in 1989 and later with the 1992 National Water Law that the implementation was enlarged to pollution matters and decentralization conceived as a tool for planning.

Water charges are introduced as a complement to CAC: Despite the fact that in theory, the primary goal of water charges has been to assign an economic value for water, in practice the examined cases has shown that charges were in place mainly to enforce CAC instruments, such as discharge permits and standards. That is, no CAC instruments were replaced to give room for a pure economic instruments approach. For example, in Mexico, emission standards were simplified and set according to grace periods in order to facilitate the application of charges.

Moreover, the new water policy frameworks created new CAC instruments such as the River Basin and National Water Management Plans where water charges would work to achieve the plan's targets. In fact, these plans ended up being the main instruments in this new policy framework since they combine a variety of considerations including water availability and priority supply, environmental targets, investment plans and distribution of water charge revenues. This point is crucial in analyzing implementation issues, since it shifts the role of water charges to revenue-raising aims from their ability to induce attainment of environmental goals through behavioral changes.

Decentralization is carried out with river basin institutions: Decentralization is planned in two ways: (i) water management goals and targets differentiated by river basins and (ii) conflicts among users dealt with through a participatory process. Institutional bases for that are the River Basin Committees that define management targets to be executed by their Water

Agencies. This is the basis of the French system in which river basin committees take managerial decisions on several water measures, particularly on charge levels.

In the case of Mexico this decentralization process is less accentuated since the federal water agency – CNA – is in charge of accommodating a basin's demands and needs, and river basin authorities have been relegated in practice to a secondary role. Brazil has gone further in decentralizing and shifting management power to basin authorities. In that country the creation of river basin authorities is not compulsory and water charges' pricing criteria are defined at basin level. Consequently, river basin committees gain more autonomy in this matter than in France and, in particular, than in Mexico.

Design Phase

Water charges are designed as a financing mechanism: Following the approach in the French system, the pricing criteria for water charges take into account assimilative and support capacities of river basins. To accommodate economic and social conflicts they also differentiate by users on sectoral and equity grounds. However, all cases confirm that water charges in practice are financing mechanisms for investment solutions for water management, including pollution control investments. This revenue-raising feature is very clear in the Brazilian case, where investment plans, as in the French system, are designed in accordance with water charge levels to achieve water management targets. In the case of Mexico, the goals are clearly delineated since there is an emphasis on using the water charges (for discharges above the levels set by standards) and exemptions to enforce CAC instruments and targets.

Revenue transfer and exemptions play a major instrumental role: Apart from administrative costs, the major share of water charge revenues goes to infrastructure investments and direct transfers for users to finance their pollution abatement actions. Such transfers are thought of as the cornerstone for political acceptance and users' commitment to the charge system. Charge exemptions and rebates are also widely used to protect economic activities or are justified on equity grounds. All this has been pointed out in the French case, as revenue transfer has, in fact, increased over time, and the attempts of the federal government to use fund revenues in the general budget have failed. In Brazil the first experience in the Paraíba do Sul River Basin has set charge levels according to the financing needs required to leverage federal funds for river clean-up programs. In Mexico, the CNA has recently explicitly committed to use revenue funds for water-related investments. In all cases, agriculture is either exempted or paying very low charges.

Implementation Phase

Unsolved sectoral conflicts reduce system efficacy since they are the main barriers for the full application of charges. In France, the charge system was gradually implemented by increasing the set of pollutants and sectors included over time. The French system started by charging for pollutants that are more easily monitored (industrial and residential organic matters and suspended solids, for example) and from sectors with less political resistance and higher ability to pay (industrial and residential users). It must be noted that ability to pay is used here in the sense of water intensity costs in total operational costs, so the agriculture sector in France was only recently subjected to user charge, and is still free of pollution charges.

Mexico, in turn, has failed to fully implement its charge system mostly due to political resistance that was not solved prior to the implementation phase. CNA was not able to attract enough federal budgetary resources to improve its monitoring and enforcement capacities to collect payments from state-owned sanitation companies and also from several industrial sectors that received waiver schemes during recession periods. All this contributes to undermine the system and reduce revenue allocation to improve institutional capacity. Mexico, in fact, has been trapped in this vicious circle despite several modifications in the water charge regulation. This can be partly explained by the fact that regulation enforcement in developing countries generally is often poor. But it is also reasonable to assert that a greater autonomy of river basin authorities could have mitigated the weak monitoring and enforcement capabilities by accommodating conflicts. The recent movement to a more river basin oriented approach in this country may change this pattern.

Brazil, has adopted a more cautious approach of gradual implementation, recognizing that the country's territorial and hydrological dimensions would not allow for the immediate creation of an al encompassing complex structure of river basin management. The new water policy shifts the initiative to create a river basin committee to the stakeholders and

thereby also the application of water charges. This will most likely lead to a slow implementation initially, but it is expected that successful experiences will create incentives for the supply of qualified human resources and the transference of institutional capability that will eventually speed up the whole process of mounting river basin committees over the country. Nevertheless, the present lack of a national grid of river basin committees, poses serious problems related to inter-basin externalities when connected basins are not all organized in river basin committees, as already apparent from the first major experience of the Paraíba do Sul River Basin Committee.

Participatory process may preclude price incentives: The need for a participatory process to accommodate users' conflicts and to increase acceptance does not in itself make available the potential benefits of a water charge system. The French case has shown that agricultural users can use sectoral subsidies to compensate for the increasing burden of water charges, thereby reducing their incentives for changes in water use patterns. It is also known that low charge levels can create incentives for operation of abatement facilities once they are in place, but it does induce abatement investments that are highly dependent on charge transfer. That is, participation may solve revenue-related conflicts but it does not necessarily create a charge system that will significantly change water use patterns. In the Brazilian experience of the Paraíba do Sul River Basin the charge level setting was initially calibrated to have the minimum economic impact level on users' costs with no attention to environmental consequences and water use levels.

Environmental and water management frameworks have to work together: Although monitoring of water use is usually under the responsibility of water agencies and so within the water management framework, water pollution control is exercised by environmental regulators. As said before, in France and in Mexico, where water charge systems are already in place, efforts have been made to conciliate the water pollution's CAC instruments with the water charge systems. However, in both cases joint work in terms of monitoring and information sharing needs to be improved. It is also known that the lack of a continuous evaluation process to analyze the effects of the charge system on use levels and on environment quality has delayed improvements in the system and in the allocation of the water charge revenues.

RECOMMENDATIONS

Based on the analysis presented above, we make the following recommendations:

- A policy framework must be in place before charges are designed, and charges must be in accordance with policy goals. If revenue-raising goals are the only politically viable options, that should be explicitly acknowledged and the reinforcement of CAC instruments for achieving environmental goals has to be planned.
- Autonomy of river basin authorities must be tailored according to the dimension and complexity of the hydrological system to maximize institutional capacity by facilitating political acceptance, reducing information gaps and administrative costs.
- River basin committees are important to launch the system but they can promote favor seeking and do not solve the economic and environmental conflicts that prevent charges from being implemented to support environmental targets.
- Water management framework must be integrated to other policy frameworks to increase monitoring and enforcement capacities. This is the case for environmental agencies as well as sectoral agencies in order to accommodate policy aims. Since this integration requires federal level negotiations this is a task for a federal water agency and cannot be delegated to river basin authorities.
- Even with emphasis on revenue generation, environmental consequences of charge application should be explicitly discussed to allow for gradual incorporation of environmental criteria in the charge system. Continuous environmental evaluation of the river basin should be undertaken incorporating economic models that identify water use changes related to charge impacts.
- An explicit criterion for desirable charge levels should be elaborated based on economic and equity factors, and all users should be covered by the charge system from the beginning to strengthen commitment and enforcement.
- Cost-benefit analytical tools should be developed for projects to be financed with charge revenues to maximize the social value of the investment actions.
- Public opinion should be brought into the debate by putting public attention on water management issues with data release and tech-

nical arguments to consolidate river basin management and the role of water charges.

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Discussion Note on Economic Instruments for Water Management in Latin America and the Caribbean

Clifford Russell

The application of economic instruments in water and solid waste management has been informed by descriptions and analyses of a variety of approaches, including the prior examples from a number of European countries (Kraemer, *et al.*), a longer study of the French water management system (Feres, *et al.*), and two Latin American country case studies, Brazil (Seroa da Motta and Feres) and Mexico (Saade Hazin and Saade Hazin). Each study provides a wealth of detail, set against a background of instrument typologies and commentary on instruments based on the extensive economic literature examining their advantages and disadvantages.

To put this material in perspective, the following observations may be helpful:

> There is something of a disconnection between the focus of the environmental economics literature on instrument design, and the reality of instrument application reviewed by these studies. The attention given in that literature to the ability, or lack thereof, of an instrument to deliver the least-resource-cost solution to the problem of meeting regional or national ambient environmental quality standards is not reflected in the choice and design of the real instruments. Other parts of the literature hint at why this might be, telling us how difficult it is in practice to design least cost solutions to achieving ambient environmental targets using price or regulatory instruments, and how such solutions would have to change in a world that is not even remotely static. But that literature also tells us there are other important characteristics on which to judge the systems described, when thinking of them as candidates for adoption in other countries represented in this dialog.

The actual economic instruments described can be cataloged under 5 headings:

1) One set has a general incentive purpose—as in water abstraction charges aimed at encouraging reductions in total volumes extracted and waste disposal charges aimed at encouraging reductions in total discharges. These instruments, if set high enough to have effects on behavior, can in principle deliver specified reductions in aggregate extraction or discharge at lower cost than command and control approaches. (In practice the costs of monitoring and enforcement for various strategies must also be considered.) As the above paragraph notes, these charges have <u>not</u> been designed for least cost achievement of ambient targets.
2) A second set is designed to raise revenue, which in turn is used either to subsidize water users or waste dischargers in their pursuit of more efficient water use or to pay for collective facilities with the same goal.

3) A third set attempts to have it both ways and get some incentive effect while producing revenue for similar uses to those in (2).
4) In several situations, such as the provision of water to households and the sewering and treatment of domestic wastewater, there are well-defined investment and operating costs that are supposed to be recovered from the charge levied on the units provided.
5) Finally, one example (Mexico's pollution charge scheme) is provided in which the economic incentive is, in effect, a fine for exceeding a discharge standard, going to zero when the standard is met.

In table 1 a summary is provided of the types of instruments described in the dialog studies, using the above categories.

It is worth emphasizing how, by confining the instruments used to these types, the choice of actual per-unit charges is simplified. Any charge level high enough to get the attention of the decision makers in firms, municipalities and households can provide a generalized incentive. Its effectiveness in changing behavior will depend on its relationship to the marginal costs for different decision makers of changing behavior, which in most cases are either quite well known or discoverable through engineering studies. The same kind of information would be needed if authorities wanted to raise a certain amount of total revenue with the least overall economic burden. But there is not the same need for detailed knowledge of every party's cost structure as there would be if economic efficiency (the full balancing of social marginal costs and benefits of achieving different ambient environmental conditions) were being pursued. In practice a revenue raising charge can be structured simply by estimating revenue needed and parceling that need out over chargeable parties, perhaps evenly, more likely not given political considerations.

The approach to economic instruments that stresses revenue collection and use of that revenue for compensatory subsidies or the provision of collective public works may be seen to have a political advantage over the incentive charging schemes. Under the latter, each party facing the charge must commit resources to making an adjustment to the charge (as by reducing priced waste discharges to the level at which the price equals the marginal cost of further reductions) and must pay the charge on each remaining unit of discharges. By assuming that revenue is recycled through a subsidy or public works scheme with roughly the same environmental goal, the sources will be paying only the resource costs of

TABLE 1

CATALOGING ECONOMIC INSTRUMENTS FOR WATER MANAGEMENT IDENTIFIED IN THE DIALOGUE STUDIES[a]

	Applications Water Country	Water Abstraction	Sewage Collection Delivery & Treatment	Direct Discharge (esp. industry)
Austria			(4)	
Denmark	(1)		(4)	(1)
France		(4)	(4)	(2)
Germany	(3)	(4)	(4)	(1)
Netherlands	(3)			(2)
Brazil	(3)/(4)b			(3)
Mexico	(1)			(5)

Notes: The numerals refer to the catalog of types identified in the text: (1) Incentive, (2) Revenue raising, (3) Attempt to combine (1) and (2), (4) Cost recovery as for water works or sewers and sewage treatment plants, (5) "Fine" for exceeding a standard.

[a] Not every element of the table could be filled in on the basis of the dialog studies. Blanks do not necessarily mean that there is no economic instrument applying to that use in that country.

[b] The Brazilian case is very complex because of the autonomy enjoyed by the states in designing their own systems.

achieving the goal plus a sort of markup reflecting the administrative costs of the agency through which the revenue flows.

There is, however, a broader implication for society at large, of emphasizing revenue collection and redistribution (or, for that matter, the charge-equivalent-to-a-fine approach). These choices take away some part of the incentive to innovate that is present in incentive charge schemes. Not all the incentive is lost, for the presence of a standard to be met or even a modest charge to be paid implies that there will be some reward to lowering the costs of responding through innovation. But that incentive will be lower than the one produced by pricing *every* unit of discharge.

In the long run, economic instruments aimed at revenue generation may create other problems. A closed system of charges, the revenue from which supports an agency and its planning, construction, operation and subsidization activities, creates an incentive to perpetuate all those activities even if the need for them declines over time (indeed, even if they become socially damaging rather than beneficial).[27]

Table 2 presents a summary of the advantages and disadvantages of the several actual choices of economic instruments relative to each other and to the alternative most often presented in the economic literature. Seven dimensions, found in the literature as bases on which to judge instruments are applied, and brief characterizations of the 5 instruments identified in the dialog studies are provided for each dimension. For contrast, a charge system seeking least-cost attainment of an ambient target is similarly characterized.

A reasonably close look at the table helps one to see why generalized incentive and revenue-raising charging schemes are popular with policy designers. They tend to have modest information requirements, and the sacrifice of static efficiency in the pursuit of ambient targets is an ephemeral loss in the ever-changing real world. Otherwise they have somewhat weaker versions of all the virtues ascribed to such a charge system.[28] It is important for real-world decision makers that economists and other policy analysts give proper attention to instrument characteristics that are important in situations where major changes are occurring in the types and quantities of pollution sources, information is scarce, technical progress matters, and compliance with whatever instrument is put in place is hardly something that can be assumed.

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[27] Something very like this has arguably happened to highway construction in the U.S. because of the earmarking of gasoline tax revenues for this purpose.

[28] Note that there is no *actual* efficiency-seeking charging scheme in existence so far as I know. Several regions have been modeled and charges necessary to attain static efficiency derived from the optimization process, so we know it *can* be done, but it is a daunting task even for highly developed agencies.

TABLE 2

BRIEF SUMMARY OF POSITIVE AND NEGATIVE ASPECTS OF VARIOUS ECONOMIC INSTRUMENTS WITH CONTRAST TO AN EFFICIENCY-SEEKING CHARGING SCHEME

	Instruments					
Dimensions	(1) General Incentive	(2) Revenue Production	(3) (1) & (2) Combined	(4) Cost Recovery	(5) "Fine" for exceeding standard	(6) Ambient-based charge system
1. Achieving Static Cost-effectiveness in Ambient Environmental Performance	Only by luck (though policy can achieve total reduction in extraction or loading at lower cost)	Not applicable	Not applicable	Not applicable[a]	Not applicable	The goal
2. Information Needs	Modest and general about charged parties' costs	Cost of plans and subsidies	Combination depending on mix of goals	Well known costs of facilities/ operations[a]	Something about cost of meeting standard and probability of discovery	Detailed and specific knowledge of marginal cost functions and regional environmental conditions.
3. Flexibility in Face of Change	Since goal is general, this is not meaningful	Charges adjustable easily and annually.	Again, depends on mix of goals.	Not applicable	Not applicable, except as inflation erodes incentive	Has to be updated as set of sources changes etc. Recalculation is required.

(Continued on next page)

TABLE 2

BRIEF SUMMARY OF POSITIVE AND NEGATIVE ASPECTS OF VARIOUS ECONOMIC INSTRUMENTS WITH CONTRAST TO AN EFFICIENCY-SEEKING CHARGING SCHEME (continued)

	Instruments					
Dimensions	(1) General Incentive	(2) Revenue Production	(3) (1) & (2) Combined	(4) Cost Recovery	(5) "Fine" for exceeding standard	(6) Ambient-based charge system
4. Revenue Production	Secondary consideration	The whole point	Part of the point	The whole point	Not important	Secondary consideration
5. Incentives for Technical Change	Greater than an equivalent standard would be	Some but less than incentive charge	Some	Some	Some, but due to standard itself	Conceptually equivalent to Column (1)
6. Monitorability	For all alternatives it is necessary to be able to measure actual discharges per unit time with enough frequency and precision that payment of proper charge or meeting of standard can be assured.					
7. Political Feasibility without obvious return makes it unpopular with sources		Likely easiest harder than (2)		Familiar and easy to since charge can be avoided by meeting standard.		Similar to Column (1)

Notes: a It is possible, though difficult, to implement long-run marginal cost pricing which has some efficiency properties but also much greater information requirements than rough average cost pricing. LRMC pricing may also lead to fluctuating charges and either too much or too little revenue.