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Environmental Impacts of Trade Liberalization and Policies for the Sustainable Management of Natural Resources

A Case Study on Romania's Water Sector

National Institution leading the Study:

Center for Environmentally Sustainable Economic Policy
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NOTE

The views and interpretation reflected in this document are those of the author(s) and do not necessarily reflect an expression of opinion on the part of the United Nations Environment Programme.

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PREFACE

With the recent acceleration of global trade, countries throughout the world have benefited from more investment, industrial development, employment and income growth. Recognising that the benefits of trade can strongly contribute to the improvement of basic living standards, many of the world›s developing countries and countries with economies in transition, have sought to actively participate in the global trading regime. For most of these countries, efficient and effective participation in the global economy has required substantial economic restructuring at home. Thus, in recent years, national governments have implemented structural adjustment programmes to stabilise and reorient their economies in order to face the challenges of development. This included in the first instance the restructuring of economies to increase foreign exchange earnings through enhanced trade and trade liberalisation as embodied in the set of agreements of the World Trade Organisation (WTO).

National experiences with structural adjustment programmes have been mixed. Nevertheless, trade liberalisation elements of restructuring programmes have facilitated the rapid growth of targeted export markets, and succeeded in attracting much needed foreign investment to fuel continued economic growth. Recently, however, many undesirable effects of rapid increases in trade have emerged. Affected countries find that inadequately managed economic activities, supporting, or supported by, growing trade, often result in serious environmental degradation. Air, water and soil pollution, and unrestrained natural resource exploitation, grow to levels that jeopardise the viability of the economic activities they support. Trade thereby becomes unsustainable.

The United Nations Environment Programme (UNEP) believes that the potential for negative impacts of trade on the environment can be minimised, if not avoided entirely, by integrating environmental considerations—that complement rather than inhibit trade—into development planning. Over the past two years, UNEP has worked closely with six countries—Bangladesh, Chile, India, Philippines, Romania and Uganda—on comprehensive projects to identify the impacts of trade liberalisation on national environmental resources and the use of economic instruments to sustainably manage these impacts.

These projects have encompassed new action-oriented research on unique trade-related environmental problems and their social and economic implications in diverse sectors and varied country settings. Importantly, projects have involved multi-stakeholder participation in numerous consultations to accurately identify the dynamics of environmental degradation, and to develop innovative and widely acceptable national response strategies. Each study concludes by recommending a set of practical measures—comprising ready-to-apply command and control measures and economic instruments designed to meet national conditions—that promise to effectively halt trade-related environmental degradation, and in turn, ensure that the country›s trade remains robust yet sustainable over the long-term. But the projects do not end with published studies, the final component of each country project involves a pilot implementation of proposed measures undertaken by national authorities in collaboration with each project›s national team and UNEP.

This report on the Romanian water sector, is one in a series of UNEP publications presenting country studies implemented under a first phase of “Capacity Building for Integrating Environmental Considerations into Development Planning and Decision-making” projects funded by the Ministry of Foreign Affairs of the Government of the Netherlands and the European

Commission. Other projects in the first round examine the shrimp farming industry in Bangladesh, the Chilean mining sector, the automotive industry in India, the Philippines'forestry sector, and the Ugandan fisheries sector.

As we approach the WTO's Third Ministerial Meeting in Seattle, which may mark the launch of the next round of trade negotiations, this report provides a valuable source of information and knowledge on Romania's experience with the environmental impacts of trade liberalisation and the development of measures to address these impacts and promote sustainable trade and environmental policies.

The complex trade-environment dynamics and innovative strategies to manage emerging environmental problems of the Romanian water sector are presented and discussed in detail in this report. The insights that this, and other reports in the series provide, make the series an extremely valuable resource for policy-makers and sectoral practitioners aiming to effectively address the emerging environmental impacts of trade in their own countries.

ACKNOWLEDGEMENTS

The preparation of this country report on the Romanian water sector has been made possible by the cooperation and commitment of many individuals and organisations.

The Romanian national team—the author of this report—is to be commended for taking the lead in project execution. Led by Mihaela Popovici of the Center for Environmentally Sustainable Economic Policy in Bucharest, the team—with members coming from an array of research institutions, non-governmental organisations and national agencies—worked tirelessly to organise national workshops, gather field data, analyse economic and environmental trends, develop policy recommendations, and report on their activities and research results. Additionally, a National Steering Committee was established to ensure the project remained relevant and on-track, and local citizens' groups helped identify emerging environmental problems, elucidate their causes, and elaborate policy responses.

The work of a varied set of national team members, supplemented with inputs from a wide group of national constituents that participated in consultations, was essential in ensuring that diverse cultural and social perspectives were integrated into the project. Indeed, all of these national actors are to be thanked for their genuine interest and commitment in the project, and for the valuable contributions they made to the project's success. In addition, national authorities are to be thanked for their steadfast support of the project's objectives.

The Economics and Trade Unit (ETU), Division of Technology, Industry and Economics (DTIE) of the United Nations Environment Programme (UNEP), was responsible for the overall coordination and management of all six country projects. Through a joint UNEP-UNCTAD (United Nations Conference on Trade and Development) collaboration, René Vossenaar and Veena Jha provided technical guidance and assistance to the national teams on various aspects of their research. International expert meetings further provided a forum for project implementation review by national teams and representatives of relevant international and United Nations organisations. Additionally, critical reviews of draft reports were provided by Theodore Panayotou of the Harvard Institute of International Development and Konrad von Moltke of the Institute of Environmental Studies of Vrije University.

Once the national team had completed their final report, Eugenia Nuñez, Desiree Leon and Rahila Mughal of UNEP worked closely with an external editor, Robert Hamwey, to process the report for publication.

Finally, it must be recognised that like so many international environmental research projects, funding from interested sponsor governments is the key to their existence. UNEP is indebted to the Ministry of Foreign Affairs of the Government of the Netherlands who generously provided the financing that made this project possible.

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Chapter I: Introduction

1.1 Rationale and Overall Objectives of the Project

UNEP's Unit for Economics and Trade (ETU) aims to promote the integration of environmental considerations into macroeconomic policies, including trade policies, in developing countries and countries with transition economies. The project "Capacity Building for Integrating Environmental Considerations in Development Planning and Decision—with Particular Reference to the Water Sector in Romania" is an activity of the ETU. The project focuses on environmental and distributional implications of both (i) Structural Adjustment Programmes (SAPs), primarily trade liberalisation, and (ii) economic instruments for the water sector. Romania thus benefits from project assistance to enhance its institutional and human capacities for integrating environmental considerations into development planning and decision-making and for designing sustainable development policy packages.

The project's first component addresses the short- and long-term impacts on the water sector resulting from the 1997 removal of quantitative restrictions on export and identifies policy options required to mitigate the negative impacts of such policies. Adverse impacts can be alleviated by designing policies to mitigate them. SAP impacts were identified through analyses of social and environmental costs and benefits of different SAP reform measures. Methodologies were developed to assess these costs and benefits, as well as to assess technological impacts of trade liberalisation and strategic management responses in the private sector.

The underlying problem causing unsustainable water use practices in the sector is that current water prices are not determined on the basis of full-cost-recovery, but rather they are dictated solely on the basis of demand-side allocations. Current prices are spatially uniform and sectorally differentiated in a fashion opposed to efficiency. Furthermore, water rates do not cover the long-term marginal cost of water supply.

The project's second component thus aimed to develop economic instruments to address these current pricing mechanism shortcomings. It includes a review of existing economic instruments in the sector and their impacts on the economy and environment. A focus was made to examine current water use practices and the development of new economic instruments. The impact of higher water pricing on the international competitiveness of economic enterprises—and on their export volumes—was also examined. In the absence of any similar national study, a review of international literature was made to provide guidance for Romania where higher water costs are likely to have an important impact on competitiveness. The review provided insights into appropriate methods to address this question for Romania's industrial sectors where water use is substantial. Based on national data on input demands and related price elasticities for 50 surveyed industrial enterprises, additional analyses were made to infer what management strategies might develop as industry is faced with higher water prices.

This project has attracted renewed national interest to the use of economic instruments that permit the market mechanism to improve economic efficiency and enhance environmental sustainability in the water sector. During the various workshops and consultations organised under this project, government ministries recognised the simplicity and practicality of economic instruments.

Other stakeholders—not traditionally involved in pricing policies—furthered their understanding of the historical factors responsible for underpricing of water resources.

Discussions showed that key ministry officials are as much concerned with fundamental questions of institutional reform of the entire water sector in Romania, as they are with what are essentially accounting questions of cost allocations and cost recovery. Of ultimate concern to the Ministry of Water, Forests and Environmental Protection and the Water Authorities are questions of how to devolve increased decision-making authority and financial autonomy to lower levels of administration in the sector, including the creation of River Basin Committees (RBC) which was considered in the present study as an option to capacity-building. The purpose of the River Basin Committees would be to serve as a forum for coordinating integrated management policies of basin water resources with responsibilities for establishing priorities in the establishment of the water management investments; ensuring public participation in decision making; and, encouraging new developments aimed at increasing water use sustainability.

The project's first two meetings were organised by the Center for Environmentally Sustainable Economic Policy and the Ministry of Water, Forests and Environmental Protection to discuss the motivation for undertaking the research and adopt research methods. The first national workshop (8 May 1998) served to introduce the water sector, recent literature and to discuss research methodologies. It brought together representatives of international organisations (UNEP, USAID, EU, Dutch Embassy, UNDP, Resources for Future, HIID), government ministries, Romanian Parliament, Chamber of Deputies, Chamber of Industry and Trade, Competition Council, water research institutes, water authorities, environmental protection agencies, universities. The following consultation meeting was a round-table (29 June 1998) with participation of relevant national organisations for discussions and recommendations on the criteria for enterprise siting and the content of the questionnaire for data collection at the enterprise level.

Following the completion of field studies, two consultations were held to survey results and analyses of data according to the selected methodologies. A final national workshop (23 March 1999), with international and national participation, was organised for the acceptance of the project's results, recommendations and policy options. Participants were fully agreed on the need to look into the trade implications of full-cost water pricing policies and to propose the design and implementation of policy instruments able to mitigate negative impacts on the economic competitiveness of industry. A consensus was reached on the need to set water charges to cover the cost of supply, treatment and transmission, including any administrative and transactions costs. However, equity concerns were raised over charge setting, although principles to ensure equitable charge setting were not clearly articulated.

The participation and support of the Ministry of Water, Forests and Environmental Protection, the Ministry of Industry and Trade and the National Company Apele Romane in the development of a research plan facilitated the success of the project. The National Company Apele Romane provided useful data and information (water intake quantity, raw water price, actual payments for water charges) and wastewater discharges (water discharge quantity, main pollutants, tariff and/or penalty rate, actual pollution payments), while the Ministry of Industry and Trade facilitated the project survey of 50 industrial enterprises. The surveys were undertaken to establish some baseline information on what "signals" are being perceived by consumers about the value of water. The results of these surveys have interesting economic implications for the relationship between water pricing and the competitiveness of economic enterprises. An investigation as to whether water prices are effective in terms of cost recovery has also been made in this study.

Analysis of this study was applied in two stages. In stage 1 it was applied at the sector level using rough estimates of elasticity and actual data on water costs as a share of revenues. This analysis identified which industries are especially vulnerable to price increases for raw water. In stage 2 it was applied at the industrial level examining 50 enterprises of various types that are especially vulnerable to raw water price increases. The data set of the selected enterprises comprise the following industries: food manufacturing, beverage manufacturing, textile and fiber mills; petroleum and chemical manufacturing; non-metallic mineral product manufacturing: cement manufacturing; glass manufacturing; fabricated metal products; machinery except electrical; and pulp and paper. The industrial enterprises considered water use for several purposes: cooling intermediate inputs, sanitation and as a direct input (e.g., beer production). Water use is assumed to be distinct from other inputs.

The results of the analysis provided several insights into the structure and role of water use by Romanian enterprises. The results indicated that industrial companies are sensitive to the costs of water. At the same time, data gathered for this project shows that Romanian water prices are very low. Low prices mean that cost recovery is not achieved and little or no account is taken of economic factors in forecasting water demands. This has resulted in forecasts that are biased upward with the consequent overbuilding of systems.

The study identifies international competitiveness as one of several issues to be addressed if economically sound sustainable growth policies are to be successful in Romania. Until recently, command-and-control mechanisms, based primarily on legislative and regulatory provisions implemented through directives from central regulatory authorities, were almost the only instruments used. Wherever economic instruments have been used in Romania, supporting policies that allow for adaptive choice and decentralised decision-making have also been applied. Economic instruments rely more on decentralised decision-making and market mechanisms than do direct regulations. By creating markets for natural resources and the environment, the instruments can signal true resource scarcity to users, creating economic incentives for wiser management.

The Romanian Government can influence resource use patterns by controlling the quantities/ qualities of natural or environmental resources that are traded, or by controlling their prices, either directly, where there is a mandate to set prices, or indirectly, through charges, taxes, subsidies and other economic instruments.

The proposed legislative actions required to support the implementation of the selected economic instrument (full-cost pricing) include:

a. Drafting a water pricing methodology, based on the strategy developed in this project, by the Center for Environmentally Sustainable Economic Policy in collaboration with the General Directorate of the Ministry of Water, Forests and Environmental Protection and National Company Apele Romane. Deadline 30 June 1999

b. Applying the methodology on a pilot basis during a six month trial period.

1.2 Framework of the project

The present study has been based on both primary and secondary data. The approach has allowed reflection on national considerations concerning water pricing, the formulation of objectives and targets for the water sector, and the identification of measures to mitigate the negative impacts of water pricing on various users. Several international and national publications served as background information for the research. The team members included government officials, international and national experts, entrepreneurs and stakeholders.

The team undertook case studies that involved a selected river basin and various industrial activities. The methodology, the final structure of the questionnaire and practical improvements in the design and implementation of the field studies were agreed upon during consultation meetings.

After benefiting from stakeholder input obtained through consultations, the recommendations and the conclusions of the research were drafted and forwarded to the main beneficiary of this study: the Ministry of Water, Forests and Environmental Protection.

This document consists of nine chapters. Chapter I sets the objectives of the project's research, while Chapter II focuses on the impacts of economic reform in Romania, analysing the state of transition and both existing and new economic instruments for the water sector. Chapter III presents an overview of the water sector in Romania with the aim to facilitate an understanding of the main challenges it faces. Next, Chapter IV explores user-specific problems resulting from rising costs in a new pricing and tariff system. The existing raw water pricing policy at the National Company Apele Romane is analysed in the Chapter V, and its exemplification is given using a case study in a specific river basin in Romania where problems are most pronounced. In Chapter VI, the results of the raw water pricing policy implemented by Apele Romane are compared with those of for drinking water services tariffs in the municipality of Satu-Mare. Chapter VII presents a synthesis of the "trade and environment" literature, which was used to develop a model on the impacts of higher water pricing on the competitiveness of industrial enterprises in Romania in Chapter VIII. Concluding remarks are presented in Chapter IX.

Chapter II: Economic Reform Impacts in Romania

2.1 State of the transition economy in Romania

2.1.1 Socio-economic aspects

At the end of the 1980's Romania had an excessively centralised government, a non-competitive economy, no experience in economic reform, and insufficient regulations and institutions needed to support a market economy. Democratic practices were completely absent, and the population's standard of living was considered to be the lowest in Europe.

The socio-economic starting point for the Romanian reform process towards a democratic society and a market economy was particularly weak when compared with situations in other Eastern European countries. This situation was characterised by increased resistance to the process of change leading to substantial economic and social losses. The entire transition process started when the central government began promulgating several legal and institutional reforms. *First*, private property was recognised and the consumer was allowed to have sovereignty on issues of residential location. *Second*, decentralisation laws gave local governments the authority to manage their own problems. *Third*, local finance laws officially shifted the burden of financing most local services onto local governments. *Finally*, democratic reforms have meant that contested elections make local officials more accountable to voters, and thus, more sensitive to their preferences for improvements in the municipal or rural services. Inevitably, new elements of inequality and social fragmentation have marked this period. Since 1990, when the free market formally replaced the centrally planned economic system, specific elements required to restructure the whole economy begun to materialise, especially those related to state-run economic enterprises. As a result, these enterprises were transformed into independent commercial companies, except in certain strategic sectors, where they were retained as state-run monopolies. Moreover, in agriculture, private ownership was restored for most of the country's arable land. However, the destruction of centralised planned economy equilibria led to a rapid decline in industrial and agricultural output.

Positive changes over the last two years have contributed to the cessation of the economic decline:

- The transfer of state planning and resource allocation decisions to the newly independent commercial companies;
- Recently developed legislation covering such fields as privatisation, environment, water resources and forestry management. The restructuring of different economic sectors including industry, agriculture, financial services and banking;
- Newly established free market relations between commercial companies.

2.1.2 Price liberalisation and subsidy removal

The Government of Romania reoriented its policies towards a more market oriented approach, launching, at the end of 1990, a step-by-step programme including: price liberalisation; the introduction of a value added tax system (VAT) (1993); the liberalisation of trade margins (June 1993); and, fuel price increases (November 1993). These reforms represented major changes from the pre-1990 *modus-operandi*, where prices were determined by negotiation between economic agents under the supervision of the Ministry of Finance.

The largest part of consumer subsidies were removed in 1993; a year in which the number of goods with prices controlled by the state was strongly reduced to about 30 categories of goods. In 1994, aside from subsidies allocated to environmental investments, only extractive industries remained subsidised, largely for social and economic reasons. At the end of 1995, the state was controlling prices for only 3 per cent of consumption goods and public services and 7 per cent of industrial products, but almost 30 per cent of raw materials.

At the beginning of 1997, the new government decided to liberalise prices further, reducing the number of goods with prices controlled to less then 20 items (mainly public services and energy). Since 1996 it adopted a series of stabilisation and structural adjustment measures, such as devaluation, price liberalisation and relaxation of market controls. The process was aided by recent changes in the political leadership of the country. Further political liberalisation took place in 1997 and 1998, with the liberalisation of raw material imports. Subsidies are expected to be totally eliminated by the year 2000. The prices of a number of essential agricultural products were liberalised in March 1997. However, the price of timber to the wood processing industry remains highly subsidised discouraging the efficient use of the timber. The controlled price of timber is about one twelfth of prevailing European prices. The introduction of stumpage auctions did not lead to a major improvement as the Ministry of Finance mistakenly set auction starting prices below fair market values, thus reducing the effect of stumpage prices on buyers.

The Romanian government has recently decided, within the context of the structural adjustment package supported by the international financial organisations, to rapidly implement several reform actions of relevance for the forestry sector:

- Liberalisation of stumpage auctions;
- Liberalisation of sawed timber exports;
- Privatisation of forests.

There are expectations that the liberalisation of sawed timber exports will lead to a significant surge of timber prices, which in turn will encourage an increase in the presently manageable level of illegal cutting. The future private owners are expected to skirt regulations and cut trees to make fast profits. Presently, the policy action envisaged to respond to this threat is to increase the size of the Forests ranger force by financing it from the higher revenues that will result from higher timber prices.

The existence of subsidies in the transition period has also had its effects on government strategies to manage the services sectors. Previously, these strategies did not recognise consumer sovereignty while administrative policy set the level of service based on the consumption norms. All infrastructure, including housing stock, was financed and owned by the state. Capital and other input costs were subsidised. Reforms, based on new strategies, now recognise consumer sovereignty and a move towards recovering capital, operation and maintenance costs, through full-cost pricing.

2.1.3 Privatisation

Privatisation represents one of the main economic adjustment strategies imposed by the last elected reformist government through its IMF FESAL agreement. The development of the private sector was remarkably slow before 1996. In 1996 the private sector realised a 52 per cent share of GNP. Privatisation has made an important progress concerning small companies, but the most advanced privatisation took place in agriculture where ownership rights were restored to more than 80 per cent of the cultivatable lands. Such progress is less obvious in industry, particularly for large enterprises. In the energy and telecommunications branches privatisation started in 1997. In 1996 the share of private sector ownership in industrial production was less than 25 per cent.

As in other transition economies, the slow rate of privatisation and a lack of investment capital represent the main barriers to private sector development. At the end of May 1997, from among 3,257 middle and big enterprises proposed for privatisation in 1991, only 840 were privatised. In 1998 the country underwent massive privatisation. The rapid increase of private sector activity in 1996 and 1997 resulted from property transfer from the state to the private sector and the establishment of completely new private enterprises. In total, over the last five years, the establishment of 750,000 new private firms has been recorded. This trend continues to the present time.

The government issued an Emergency Ordinance 88/1997 referring to the “Law on direct sales privatisation and asset sales” with an incorporated environmental liability procedure that promotes investor interest while increasing prices Romania receives for its sold assets. The Government Decision 55/1998 established the “Methodological norms on privatisation” with an integrated environmental procedure for setting minimum acceptable environmental goals in privatisation contracts.

2.1.4 Financial situation

The budget deficit, money supply and inflation remain to be brought under control. The proper design of economic instruments is viewed by the Ministry of Water, Forests and Environmental Protection as critical to generating more enterprise investment in environmental protection in order to avoid further environmental degradation. The favoured instrument of the government has been an improved permit system with co-financing for environmental abatement investments in order to stimulate pollution sources to meet permit requirements. In 1994 the national treasury provided the majority of financing, yet in 1997 its share of investment financing fell to 45 per cent.

Despite the progress that has been achieved, Romania still needs a more complete legal and regulatory framework to protect the environment and, at the same time, needs to facilitate sustained economic growth. It has only been recently acknowledged (in conjunction with the creation of the new Environmental Fund) that there are limits to the effectiveness of command-and-control measures in terms of enforcement and that a reliance solely on these instruments to finance environmental and hydraulic structures is ineffective. Accordingly, the question of choice, design and implementation of economic instruments for environmental management and financing has become a growing part of economic policy development in Romania. At the moment, the advantages and disadvantages of the economic instruments over the command-and-control tradition, employing uniform emissions and environmental quality standards, needs to be analysed by government economists in order to identify arguments in favour of employing economic instruments as a means of achieving environmental policy objectives.

Responsibility for proposing a series of new economic instruments and procedures to assist with the management of both water and air has been delegated to environmental authorities. Such instruments are consistent with provisions of new legislation that are based on the “polluter-pays” and “beneficiary-pays” principles. There is a renewed interest on the correct application of economic instruments to assist the market mechanism improve economic efficiency in the water sector and the environmental sustainability of the resources.

The historical use in transition economies of command-and-control approaches to environmental protection has been shown to be costly. Great attention has focused, therefore, on the choice and design of economic instruments with the aim of “getting the prices right” so as to generate a more efficient allocation of environmental goods and services and to reduce agents’ costs for environmental compliance.

Specific environmental investment financing is provided from: central and local government budgets for public utility works; water users' own funds; development funds of the state-run autonomous agencies (Apele Romane, Romsilva); and, funds deriving from loans. As an example, pollution abatement technologies for public utilities agents include water treatment units, waste disposal sites, filtering stations, etc. These agents use state budgets, credits, or their own funds to acquire or modernise clean technologies. Despite dedicated efforts by the government and by donors to provide investment financing, the reduced allocation of funds is obstructing the creation of environmentally sound development in Romania. Moreover, the cost of the environmental regulatory system is too high for both the government (elaborating regulations, standards, and guidelines) and the economic agents (complying with the legal requirements of the regulations) and this might affect the country's international competitiveness. The Ministry of Water, Forests and Environmental Protection has recently developed a proposal with a prioritised, low-cost strategy on how to achieve the sustainable development of the country by the year 2000.

2.2 Existing economic instruments

Economic and social impacts of transition-restructuring and modernisation, budgetary deficits, high inflation rates, and new private sector management responsibilities, coupled with increased environmental pollution, has lead policy makers to define and implement new economic instruments to stimulate an optimal level of investment in environmental protection. A principal challenge in Romania is the choice and design of economic instruments with the aim of "getting the prices right" so as to generate a more efficient allocation of environmental goods and services, stimulate investments and to reduce compliance costs. Traditionally, environmental policy in Romania has consisted of command-and-control instruments employing uniform emission and environmental quality standards. These instruments have required related licensing and monitoring mechanisms. The command-and-control regulations have been shown not only to be costly, but also ineffective in the presence of weak monitoring and enforcement capacity. These policies presuppose that, once set, higher internalised prices will be paid. However, in a transition economy, not even existing low prices for environmental goods and services are paid, casting doubt that even higher internalised prices generated by economic instruments will be paid. Moreover, as the country is undergoing intensive privatisation, leading to a greater agent sensitivity to price effects, privatised enterprise may take advantage of weak enforcement and the level of environmental qual-ity could be further diminished.

Since 1990, Romania has embarked on an ambitious adjustment programme to transform its economy from a centrally planned to a market economy. Financing from the International Monetary Fund and the World Bank supports the adjustment programme. The Romanian government aims at linking the scope and timing of environmental policy measures with the pace of this adjustment programme.

Favourable impacts on the environment come from the introduction of policies that force producers to compete in open markets, from price liberalisation and removal of subsidies, privatisation, competitive markets, reform of taxation, and market governed interest and exchange rates. However, the use and effectiveness of economic instruments to address environmental problems remains limited in Romania. This is the result of several factors including:

- A perception that economic instruments are not yet affordable for agents;
- A poor understanding of the link between policy instruments, environmental priorities and environmental investments;
- Limited institutional capacity to design programmes of implementing economic instruments;

- Difficulties in determining the economic levels of charges, policy directions and environmental goals;
- The poor relation between the charge rates (which are almost exclusively based on the toxicity of the pollutants) and the economic measures of the damages;
- Poor monitoring capacity;
- The dominance of revenue raising considerations in the design of the existing economic instruments;
- Controversies regarding the use of revenues;
- Limited institutional capacity to design economic instruments, to assess the options available, and to identify the constraints to their implementation;
- The lack of enforcement capacity and political will to impose sanctions.

Previous limited use of economic instruments in Romania provides some information on their effectiveness as incentive tools. Even though most of the charging and taxation measures were initially designed to raise revenues, analysis of costs and benefits related to economic instruments in Romania has shown that the response of polluters to environmental regulation varies according to output product price. Features of the fee mechanism in Romania limit efficiency. Many of the fee rates are based on the toxicity of pollutants, but are not necessarily correlated with economic measures of damage. Furthermore, the collection and distribution of fees is not properly managed.

Water use in Romania is estimated at about 36 billion of cubic meters annually, which represents about 27 per cent of the total available annual water supply. Inner rivers and lakes provide 13 billion cubic meters annually (36 per cent), the Danube River, 20 billion cubic meters annually (56 per cent) and groundwater 3 billion cubic meters annually (8 per cent). Per capita water demand is relatively low, being about 890 cubic meters per capita annually. In the medium run, water demand is expected to decline with major reductions in demand from industry and the energy sector. With the recovery of the economy, water demand is expected to increase again. With the introduction of incentives for more efficient water use—economic pricing of water for industrial, agricultural and municipal consumption—there is great potential for reducing water consumption in the future.

The raw water supply authority, Apele Romane, faces severe budgetary problems. Legislation limits raw water prices to levels necessary for the recovery of operating and maintenance costs. Capital costs must be financed through government appropriations. Almost no new investments are being undertaken. Apele Romane needs a mechanism to obtain needed O&M funds for flood prevention activities. There are several important questions about how VAT is imposed on Apele Romane, especially given the fact that about one-half of its invoices are not paid. Furthermore, its charge levels for water delivery are very modest. Since Apele Romane receives part of its funding from collected discharge fees, perverse incentives for the agency to encourage wastewater discharges exist. The Water Department and Apele Romane can take enforcement measures against non-complying facilities by levying fines and other sanctions, including facility closure when violations are severe.

The existing economic instruments in the water sector are:

a) **Water charges**

Being introduced at the start of 1991, “water charges” do exist in Romania, for direct consumption or use (i.e., paying a “price” for water as a “good”) as well as for discharges according to their quantity and quality through tariff-charges for discharging wastes into water bodies (i.e., paying for water as a “service”). Raw water is supplied by the entity Apele Romane, which charges for raw water delivery to farms, municipalities and industry as well as for water taken directly from surface and groundwater sources by users. Their aim is to encourage sustainable resource use and to generate adequate revenues to finance water supply and sewage disposal and treatment. Water charges are revised quarterly for inflation. There is a single, national price for each category and use of raw water. Industry pays more than agriculture, that pays more than households. There is a separate price for water used for thermal power stations (heating and hot water). Likewise, there are separate national raw prices based on the type of water body: water from the Danube, groundwater and inner rivers, and lakes each have different prices (groundwater sources are the most expensive, about 20 per cent more costly than domestic surface waters, while water taken from the Danube is about one-eighth as expensive as surface water). According to legislation, related regulations and the ongoing reorganisation of the Romanian water sector, implementation of full-cost pricing by river basins is set to become a reality.

While discharges are governed by the permitting system, charges are levied on twenty substances according to Government Decision 1001/1991 and revised annually.

Water users pay for the quantity of water specified in their contracts (except when water is rationed during drought periods and users pay for actual use); Apele Romane imposes substantially higher charges for amounts taken in excess of contracted amounts.

The Water Department is currently involved in designing full-cost pricing of raw water through its river basins policy. Water prices determined based on opportunity cost should be dictated by considerations of cost-recovery, not demand allocation. Such costs include:

- long run marginal cost;
- user cost;
- external cost.

The price for water taken from domestic surface supplies is low. Farmers currently pay 718 lei ($ 0.09) per 1000 cubic meters that is very low relative to international norms and to the value of water as an agricultural input. In contrast, industrial users pay 54,186 lei per 1000 cubic meters ($7) and municipal supply systems 19,186 lei per 1000 cubic meters ($2.50). Finished water is supplied by municipal water supply systems. Municipalities buy raw water from Apele Romane, treat it, mark its price up to 10 to 100 fold, and supply it to households or other users. Because households typically are not metered, charges to residential users are based on the number of inhabitants in each unit. Finished water prices are very low: rates per thousand cubic meters in 1996 for industrial users were 23,755 lei (US$4) from rivers, 2,851 lei (US$0.47) from the Danube, and 29,240 (US$5) from - ground sources

The drinking water price at the end of 1997 was for most (80 per cent) of the country, between 1,300-1,500 lei/m^3. The extreme values in the country were between 300-8,000 lei/m^3 and it was 1,400 lei/m^3 in Bucharest. In 1994, drinking water prices were between 100-250 lei/m^3. The extreme values in 1994 were between 25 and 800 lei/m^3 and it was 186 lei/m^3 in Bucharest. The extent of metering is limited and varies from locality to locality. Generally, in each locality, the degree of metering is between 30 per cent to 50 per cent and includes economic agents and blockhouses. Usually, water delivered to each household is not metered. Taking into account the recent changes in water policy, rigorous metering activity becomes a priority. At present, revenues cover costs for maintenance and operation of drinking water systems and a very small part of development costs. The autonomy of different water industry units can be observed in price variations. These variations depend on the raw water source, the technology used, the complexity and state of the water system.

1997 Sector Data

1. *Water abstracted from inland rivers*

• For industry and livestock	58,336 lei/1000 m^3
• For irrigation and fisheries	773 lei/1000 m^3
• For municipalities	21,390 lei/1000 m^3
• Others	58,336 lei/1000 m^3

2. *Water abstracted from Danube*

• For industry and livestock	6,998 lei/1000 m^3
• For irrigation and fishery	159 lei/1000 m^3
• For municipalities	4,113 lei/1000 m^3
• Other	6,998 lei/1000 m^3

3. *Water abstracted from underground*

• For industry	71,806 lei/1000 m^3
• For irrigation and fishery	2,825 lei/1000 m^3
• For municipalities	16,379 lei/1000 m^3
• For livestock	21,745 lei/1000 m^3
• Others	71,806 lei/1000 m^3

In 1996, for example, "tariffs for discharging wastewater" were levied on only two contaminants: a 7,850 lei/tonne charge for suspended solids and a 31,750 lei/tonne (US$5.30) charge for BODs.

For the year 1997 the discharge fee situation was as follows:

Discharges to surface water resources within limits established by water management permits:

- For suspended solids and substances in solutions: 19,278 lei/tonne
- For oxygen consumer substances: 77,970 lei/tonne

b) **Sewage charges**

Romania is in a process of seeking to meet European legislation. One of the most important EU directives to meet relates to municipal wastewater treatment. Since last year, the Ministry of Water, Forests and Environmental Protection has finalised two norms to implement this directive. These two norms (NTPA 001 and NTPA 002) will imply new efforts from water users in order to build, upgrade or modernise wastewater treatment plants that will have to meet the new requirements. It is obvious that to accomplish this financing through new instruments will be necessary.

The variation of sewage charges is very high because of different conditions existing throughout the country. Mainly, the value of the charge depends on whether the locality has a wastewater treatment plant. It also depends on discharge conditions in the receiving water body and the complexity and state of the sewerage network.

In 1997, the average charge for domestic wastewater discharged into sewerage systems has been between 500 and 700 lei/m^3 in the country and 350 lei/m^3 in Bucharest. Extreme values were between 200 and 3,000 lei/m^3. In 1994, this figure was considerably lower: between 10 and 20 lei/m^3 in the country and 17 lei/m^3 in Bucharest. These sewage charges can cover, partially, the costs of wastewater collection and treatment.

c) **Effluent discharge permits for point sources (approx. 3,000)**.

d) **Tariffs for discharging substances within permitted amounts and tariffs and fines for exceeding permitted amounts** are applied to point sources. For discharges within permitted amounts, tariffs are levied on two classes of substances: those that consume oxygen (i.e., BOD—biological oxygen demand) and all other dissolved and suspended substances. Charge are 72,423 lei and 17,906 lei (approximately $9 and $2.40) respectively per tonne. Approximately 15 different classes of substances are charged at different levels based on reports of exceedances filed monthly by sources.

e) **Penalties for violations by point sources during random inspections** may also be levied by Apele Romane, local environmental protection agencies, and the State Water Inspectorate of the Ministry. Last year about 6,000 inspections were made. When an inspection reveals a violation, sources may be fined 2 to 6 million lei (individuals potentially are subject to fines of up to 5 million lei and imprisonment). For the nine months through September 1997, approximately 1 billion lei in penalties had been levied for routine exceedances as reported by sources and 200 million lei in fines imposed for violations detected during random inspections. Amounts collected as penalties revert to the Water Fund; while collected fines become state revenue. The penalty depends on both the volume of wastewater emitted and the difference between actual and permitted concentrations. For the ith pollutant, the formula used is $P_i = (C_i—C_i^*)\ V\ R_i$ where P_i is the total penalty assessed on the ith pollutant, C_i and C_i^* are respectively the actual and permitted concentrations of *i*th pollutant, V is the annual volume of wastewater discharged, and R_i is the rate for discharging the ith pollutant. For repeat offenders, penalties are doubled each year until concentration standards are met.

The government is undertaking measures to strengthen deterrent values of penalties as the present level of fines for violating different Environmental Acts are very low when compared to the cost of compliance. The polluters prefer to pay the penalty than to comply with regulations.

f) The **Water Fund** is used to subsidise pollution control investments undertaken by point sources as well as for other purposes.

g) Sources may be **liable for damage** to natural resources, for restoration of the environment, and for third-party losses. According to provisions of the Water Law and the Law on Environmental Protection, parties responsible for accidents generally must clean up accidental releases of pollutants into waters.

h) **Reporting information** filed by point sources and by Apele Romane must be done in a uniform manner specified by the Water Law.

Excessive abstraction of water causes environmental problems by lowering underground and surface water levels. This increases contaminant concentrations and exposes flora and fauna to additional hazards.

2.3 New economic instruments

2.3.1 Full-cost recovery water prices

There a number of possible instruments whose revenue raising proceeds could be placed in a river basin water fund. The decision on which instruments will be selected and how they will be implemented depends on the structure of reorganisation for the water sector. The new proposed structure of the Ministry will provide for full self-financing and integrated media (air, water and soil) management fully harmonised with the upcoming EU IPPC directive.

This proposal places environmental management at the level of six “super basins” designed to fully internalise physical effects within, and flows between, basin boundaries. Each basin contains a basin environmental protection agency that carries out permit issuance, inspection and monitoring functions for air, water and soil according to principles of integrated control and prevention. Thus, these new bodies include all regulatory functions previously held by Apele Romane for water, the Environmental Protection Agency (EPA) for air, soil, and water, and the National Forests Administration for nature conservation and biodiversity. Moreover, the new structure will contain a river basin committee with water goods and services to be provided by a basin-level raw water supplier (previously Apele Romane). This supplier will be incorporated with its shares to held by the government and oversight of its contract and or concession being the responsibility of the river basin committees. The above institutional structure is completely self-financing. All permitting functions of the Environmental Protection Agency—including those related to inspection and monitoring—will be financed from permitting fees. Tariffs, set to cover the operating and capital cost of services, will also pay for other EPA functions such as those required for privatisation. The proposal also provides financing for operating and capital costs of water supply and flood control incurred by the Water Company. These tariffs are levied through water abstraction prices, flood control fees paid by public and private beneficiaries, and water discharge tariffs. The money collected to cover the capital costs of water infrastructure will be held in separate basin-level accounts or “funds” that are utilised only with approval of the relevant river basin committee.

The recent organisation of the Ministry of Water, Forests and Environmental Protection and Apele Romane considered only partially the original proposal (as described in para 5.3.2.). There are hopes that the second phase of reorganisation will completely take into account the proposal.

2.3.2 Pollution discharge tariffs

Based on toxicity to health and the environment, tariffs may be increased within permitted levels and differentiated among various types of suspended and dissolved substances. All receipts from effluent tariffs will go the Water Fund and allocated to assist point sources in reducing effluent discharges.

BOD discharges within permitted amounts cost approximately $6 per tonne and discharges of other non-BOD dissolved and suspended substances about $1.50 per tonne. These charges are very modest, relative to both the cost of control and to likely damage. Under this proposal, heavy metals and other toxic substances would be charged at much higher rates than salts of magnesium, calcium, and sodium.

Chapter III: Overview of the Water Sector in Romania

3.1 Introduction

Water resources, part of the national wealth and a natural resource together with the land fund, the forestry fund, useful mineral reserves, terrestrial and aquatic fauna and flora, represent a vital factor of socio-economic development. Different from other natural resources, which become scarce in time, water is a renewable resource, being subjected to a continuous replenishment process, following a natural cycle that ensures its continuity.

Through a growth of water demand and of human intervention in hydrological processes, water becomes “a good of economic and social value”, thus water management in the real sense becomes necessary; meeting these demands is conditioned on the basis of rational water use and conservation, economic efficiency, and social equity criteria. The integrated development of water resources and water sector infrastructure improvements should further take into consideration other principles included in the EEC/UNO documents, such as those concerning the organisation on the river basins and the necessity of sustainable water resource development.

Under conditions of an accentuated energy crisis, water management problems should be solved by adopting optimum solutions at the level of entire basins, because the application of strictly “local” economic management can often lead to significant losses in other geographical areas and in other sectors.

3.2 Natural conditions

3.2.1 Geography

Romania is located in the south-eastern part of Central Europe (see figure 3.1), between the 43/20’ and 48/20’ parallels, northern latitude and, between the 20/20’ and 29/50’ meridians. There are three important structures that define the geographical position of Romania in Europe: (i) the Danube River, (ii) the Black Sea and (iii) the Carpathian Circle. Romania covers an area of 237,500 km^2. The territory is divided into three main regions: mountainous (31 per cent), hills and plateau (36 per cent) and plains (33 per cent). The surface of the country is drained by a hydrological network (figure 3.2) with a permanent flow of about 76,000 km total length belonging to the Danube River basin and on its lower course also accompanying the Black Sea basin. Out of the total boundary length of 3,190 km, the river boundary is 1,865 km—the terrestrial boundary 1,036 km and the sea boundary 288 km. The Danube River defines 1,075 km of the Romanian border, discharging into the Black Sea through three arms: Chilia, Sulina and Sfîntul Gheorghe, which together form the Danube Delta, an important marshland area, declared as biosphere reservation for its large diversity of unique flora and fauna.

Romania has a transitional type of continental temperate climate influenced by the Mediterranean from the south-west with strong continental characteristics in the east and south-east. Annual mean rainfall is 640 mm. In the mountainous region, the average value of annual rainfall is between 1,200 mm to 1,400 mm, whereas along the Black Sea Coast this value is below 400 mm.

Figure 3.1 Location of Romania in Europe

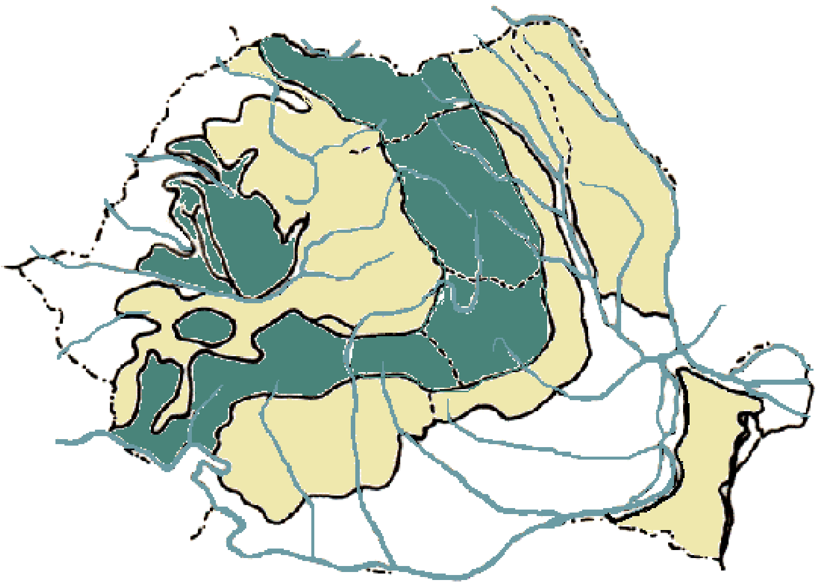


Figure 3.2 Map of Romanian rivers and morphological areas

3.2.2 Population

Romania is the cradle of an ancient population and civilisation of Geto-Dacic and Roman origin, little influenced by migrations from Northeast, East and South.

Romania has a population of 22.8 million inhabitants, of which 56 per cent are living in urban areas and 44 per cent in rural areas. The average population density is 95.8 inhabitants/km^2, with a variation of 1291.7 inhabitants/km^2 in Bucharest to 32.1 inhabitants/km^2 in the county of Tulcea.

Romania comprises 42 counties (judet), including Bucharest. The average surface area of a county is 1,600 km^2, with a population of 500,000 inhabitants (average value). Differences in the surface areas of counties (8,678 km^2 county Timis to 3,705 km^2 county Covasna) are determined by geographical conditions, traffic routes and by traditional relations between localities.

3.3 Water resources of Romania

3.3.1 Water resources and their allocation

Romania's water resources are relatively poor and unequally distributed in time and space, deriving from surface waters—inland rivers, lakes and reservoirs, the Danube River—and from groundwater reservoirs.

Black Sea water resources, although very important, cannot be exploited for the time being because of technical and economic difficulties in seawater desalination.

Water resources of inland rivers and lakes are estimated at about 40 billion m^3/year (with an average multi-annual flow of 1,300 m^3/s), of which, in the natural flow regime, only 5 billion m^3/year are utilisable, and, in the actual river training regime, 13 billion m^3/year. Taking into account only inland rivers, the specific resource is about 1,700 m^3/inhabitant/year, a value relatively low compared to endowment levels in other European countries.

Out of the Danube's theoretical resources, Romania consumes 85 billion m^3/year, but the possibilities of its use in the natural regime are limited because of the river's navigable character. Thus, technically, only 30 billion m^3/year contribute to the water stock that can be used for consumption.

Although in Romania there are about 3,450 natural lakes with a water capacity of 2 billion m^3, these are only of local importance in water management because only 400 million m^3 are fresh water. Because only 12 per cent of the potential resource can be used in the natural flow regime, many reservoirs had to be developed for water volume redistribution in time. Inter-basin diversions for a territorial reallocation of water resources according to local demands had to be developed as well. In 1996, existing reservoirs were storing a total volume of 13 billion m^3 of which 5.5 billion m^3 was useful volume. Taking into account existing and future reservoirs, inland rivers can provide about 25 billion m^3 in a drought year, which represents a maximum limit that cannot be increased through reuse of purified wastewater or by intensifying industrial wastewater recycling and improved production technological processes.

Groundwaters, generally of better quality than surface waters, are estimated at an available annual amount of 9 billion m^3, of which about 3 billion m^3 can be accessed under existing technico-economic conditions.

The possibility of enriching surface water resources through artificial rains, and groundwater resources through reservoirs, is not yet economically feasible and is not taken into consideration here.

Technically utilisable resources can not be used without the establishment of certain significant investments in complex development works in the hydrological basins and in treatment installations because:

- the most important water resource, the Danube river, can not be used but to a small extent, due to its eccentric position, at the southern limit of the country;
- inland rivers are unequally distributed over the country, presenting significant areas with insufficient resources and important flow variations in time and space;
- pollution of certain inland rivers exceeds admissible limits, which makes their use difficult and sometimes even prohibitive.

3.3.2 Water resources quality

3.3.2.1 Romania monitoring system for water resources quality.

Water quality monitoring in Romania was initiated in 1954, but it started to be systematically performed beginning in the mid 70's when methodologies specific to this domain were first elaborated. These were defined by two fundamental elements:

- spatial and temporal structure, which refers to the network of control sectors and stations where representative water samples are drawn in order to analyse qualitative characteristics;
- logistical means, consisting of methodologies, procedures, programmes etc.

Within national monitoring, fresh water natural resources are grouped in three subsystems, differentiated by the nature of the component hydrological formations: flowing surface waters (rivers), lakes (natural and artificial) and groundwater aquifers.

With respect to surface water, the monitoring system was organised for the surveillance of 20,000 km rivers, with the daily sampling for 60 control sections, upstream of big polluters and with periodical sampling in another 240 control sections. For groundwater, in view of providing groundwater quality protection, a national system of groundwater quality monitoring was set up in 1984 that has ever since been undergoing a full organisation and development process. This system is structured on two subsystems:

- a groundwater background monitoring system which includes more then 3,000 wells;
- a groundwater impact monitoring system with over 10,000 wells.

Each aquifer observation well within the background subsystem makes evident the natural hydrogeological regime of the layer in relation to major sources contributing to aquifer supply. These wells are located both in the supplying areas of the layers and in the draining and discharging areas of the aquifers. The wells within the impact monitoring system are located in the area of the main groundwater polluting sources. These wells aim to indicate the intensity and type of pollution in view of eliminating disturbing effects and of taking protection measures. Apele Romane had the responsibility to maintain water quality monitoring operations.

3.3.2.2 Water resources quality in present

The quality of surface water natural resources is influenced by their present patterns of use. Discharges into natural receivers, especially those of large industrial sources, of non-treated or insufficiently treated wastewaters, renders the effected downstream length of degraded water courses unusable for other purposes without high-cost treatment. This is mandated by the provision of STAS 4706/1988 for water of 2nd and 3rd quality, which can not be used as a source of drinking water.

With respect to the Danube River, very high water flow ensures a sufficient dilution of received wastewaters to render the global quality of water in the 1st and 2nd quality limits. Even under these conditions the water supply for riparian towns (Tr.Severin, Oltenita, Calarasi, Cernavoda, etc.) is affected, with the treated water exceeding admissible limits for potability due to high concentrations of certain parameters (ammonia, heavy metals, organic matter, etc.)

Comparative analyses of groundwater quality has pointed out an accentuated depreciation of resource quality from the point of view of the growing spatial extension of the affected areas and of increasing pollution intensity in the main polluting areas. Consequently, these resources can not be used as drinking water unless first receiving adequate treatment.

The main causes of global water resource quality deterioration may be synthesised as it follows:

- the growth and development of polluting industries;
- the retention of highly polluting production technologies which in developed countries had already been abandoned (i.e., pulp production through the sulphite process at the Dej and Zarnesti Pulp and Papers Works, soda production through the Solve process at Ocna Mures and Govora);
- rapid growth of the non-point source pollution, especially that arising from the irrational use of fertilisers and pesticides in agriculture;
- sewerage facilities and treatment plants whose capacities have fallen behind increased industrial production and urban development;
- inadequate operation of existing treatment plants (low reliability constructions and installations, insufficient reagents, reduced energy shares, insufficient and untrained operational personnel);
- lack of an organised collecting, storage and management system, especially for mining, industrial and domestic wastes and for sludge resulting from wastewater treatment, including recovery of useful substances.

3.4 Current and projected water demand in Romania

Sustained water use of the river basins in Romania is based on a multifunctional approach in water resource management. Domestic demand is characterised by specific water-quality requirements, including criteria, objectives, targets. There is a close relationship between water quality and water quantity in river basins of Romania. Water quantity variables influence water quality and the interpretation of the water resource characteristics depends on combined data for both water quality and water quantity aspects. The changes in the water levels, flow characteristics, water supply, water uses, and the occurrences of sedimentation or erosion problems, all affect water demand in Romania.

At the end of 1996, about 2,740 localities had centralised drinking water systems (in comparison with the previous year when there were only 2,653 such localities) out of which 262 were municipalities and towns. The total capacity of drinking water production was 10,234.8 thousand cubic meters per day and the total length of the supply network exceeded 34.4 thousand km. The values indicated in Table 8.1 represent the raw water demand, including all losses (up to 50 per cent) with allowances for public uses.

The share of the population connected to centralised water supply systems is about 13.8 million. About 10.5 million people in urban areas and 3.3 million people in rural areas are connected to centralised drinking water supply systems.

In rural areas, a number of villages and communes (2,391) have water supply systems (representing 17.76 per cent of their total number). Only 346 rural localities are equipped with sewerage systems and generally, effluents are discharged into municipal wastewater treatment plants. The total abstracted volume, for both urban and rural areas is 116.3 m^3/s, out of which 70.3 m^3/s are abstracted from surface waters and 46 m^3/s from groundwaters.

The total amount of water delivered by the water supply system is about 2,588 million m^3/ year, of which, 47.5 per cent represents domestic use, 11.3 per cent public use, 19.6 per cent use for economic activities and 21.6 represent the network distribution losses.

Table 3.1: Total domestic demand for raw water (million m^3)

River Basin	*1994*	*1995*	*1996*
Tisa	4.633	4.661	6.360
Somes	132.264	142.123	139.760
Crisuri	55.895	57.592	57.718
Mures	143.201	151.315	159.113
Bega-Timis-Caras-Birzava	147.991	141.746	142.360
Cerna	3.813	3.463	3.772
Nera	0.660	1.128	0.544
Jiu	61.138	64.736	71.395
Olt	154.606	190.600	168.344
Arges	507.108	488.624	466.292
Vedea	10.344	11.782	12.897
Calmatui-Olt	0.245	0.295	0.213
Mostistea	0.213	0.231	0.235
Calmatui-Buzau	0.672	0.401	0.354
Siret	237.264	272.249	271.163
Ialomita	178.173	108.426	112.456
Prut	49.975	51.912	60.359
Littoral	89.947	89.779	90.278
Danube	272.220	278.418	298.729
Total Romania	2,050.362	2,059.481	2,062.341

The average per capita specific water consumption in urban areas, at the country level, is about 513 l/inhabitant/day out of which:

- Domestic use – 294 l/inhabitant per day;
- Public use – 70 l/inhabitant per day;
- Industrial – 122 l/inhabitant per day;
- Network losses – 134 l/inhabitant per day;

In the *rural area*, the specific consumption is 172 l/inhabitant and day.

Summarises the evolution of the water demand from 1970-1996 Table 3.2

Table 3.2: Water demand evolution in Romania

Billion cubic meters

	1970	*1975*	*1980*	*1985*	*1990*	*1993*	*1994*	*1995*	*1996*
Total	9.6	14.	18.8	20.5	20.4	19.9	18.0	16.0	15.0
Industry	4.7	6.6	9.8	9.3	9.0	8.7	8.1	8.0	6.1
Agriculture	3.4	5.7	6.7	8.4	9.1	8.9	7.7	5.9	4.6
Domestic	1.4	2.0	2.2	2.6	2.2	2.2	2.0	2.0	2.0

The industrial water demand includes water for industries supplied by their own facilities. The water demand for agriculture includes water for irrigation and livestock breeding.

The domestic water demand includes water for households, public utilities and local industry supplied through the public network.

The evolution of the domestic wastewater production is shown in the Table 3.3

Table 3.3: Domestic wastewater production

Million m^3

Basin	*1994*	*1995*	*1996*
Tisa	4.241	4.161	4.620
Somes	105.812	114.783	113.200
Crisuri	29.197	35.684	40.911
Mures	124.079	122.870	126.238
Bega-Timis-Caras-Birzava	141.130	133.769	143.396
Cerna[1]	1.482	1.082	1.091
Nera	0.376	0.455	0.235
Jiu	47.758	52.107	57.517
Olt	115.350	137.883	132.660
Arges	247.762	391.479	335.786
Vedea	7.163	7.075	10.317
Calmatui-Olt	0.003	0.002	-
Mostistea	0.130	0.018	0.811*
Calmatui-Buzau	0.493	0.214	0.240
Siret[2]	129.591	165.691	171.944
Ialomita[3]	100.884	88.689	83.676
Prut[4]	74.213	83.584	165.440
Littoral[5]	67.762	54.299	72.200
Danube[6]	121.839	133.276	141.017
Total Romania	1,317.713	1,527.121	1,621.344

Notes:

1) The volumes discharged directly into Danube are not included;

2) The discharged volumes corresponding to the volumes abstracted directly from the Danube are included;

3) The discharged volumes corresponding to the volumes abstracted from the Arges River and Danube are also included;

4) The discharged volumes corresponding to the volumes abstracted from the Siret River are also included;

5) The volumes discharged into the Black Sea are included;

6) The discharged volumes corresponding to the volumes abstracted directly from the Cerna and Siret rivers are also included. The discharged volumes corresponding to the volumes abstracted by the economic units are also included.

Because there is no accurate record of wastewater discharges in the existing documents or reports of the water authorities, it is quite difficult to obtain a complete picture of wastewater dynamics in Romania.

Table 3.4: Demographic projections

Year	*Total population Thousands*	*Active population Thousands*
1997	22,600	11,215
1998	22,635	11,230
1999	22,605	11,235
2000	22,570	11,240
2001	22,540	11,220
2002	22,500	11,200
2003	22,450	11,175
2004	22,400	11,145
2005	22,350	11,120
2010	21,970	10,915
2015	21,430	10,635
2020	20,785	10,300

If the birth rate increases after 1999, according to the projection given by National Commission for Statistics, then the figures shall be those presented in Table 3.5 where an average growth rate of 0.04 per cent has been assumed.

Table 3.5: Population by 2020, by urban and rural area

Population of Romania

	2000	*2010*	*2020*
TOTAL	22,643,793	22,734,368	22,825,305
URBAN	12,431,032	12,480,756	12,530,679
RURAL	10,212,761	10,253,612	10,294,626

The distribution of the population by river basin was also estimated by taking into consideration the rate of existing natality, the area of each river basin and the existing population of the river basins, considering that the increase will be the same for the each area. The values are given in Table 8.6.

Table 3.6: Future Population by river basin

RIVER BASIN	*2000*		*2010*		*2020*	
	Total	*Urban* *Rural*	*Total*	*Urban* *Rural*	*Total*	*Urban* *Rural*
SOMES -TISA	2,439,000	1,293,000 1,146,000	2,449,000	1,298,000 1,151,000	2,459,000	1,303,000 1,156,000
CRISURI	938,000	381,000 557,000	942,000	383,000 552,000	946,000	385,000 561,000
MURES	2,225,000	1,188,000 1,037,000	2,234,000	1,193,000 1,041,000	2,243,000	1,198,000 1,045,000
BEGA-TIMIS	1,101,000	669,000 432,000	1,106,000	672,000 434,000	1,110,000	675,000 435,000
JIU-CERNA	1,652,000	859,000 793,000	1,659,000	863,000 796,000	1,666,000	866,000 799,000
OLT	2,617,000	1,366,000 1,251,000	2,627,000	1,371,000 1,256,000	2,638,000	1,377,000 1,261,000
ARGES-VEDEA	4,245,000	3,226,000 1,019,000	4,262,000	3,239,000 1,023,000	4,279,000	3,252,000 1,027,000
IALOMITA-BUZAU	1,522,000	554,000 968,000	1,528,000	556,000 972,000	1,534,000	558,000 976,000
SIRET	2,343,000	726,000 1,617,000	2,353,000	730,000 1,623,000	2,362,000	732,000 1,630,000
PRUT-BIRLAD	2,023,000	971,000 1,052,000	2,031,000	975,000 1,056,000	2,039,000	979,000 1,060,000
DUNARE-LITORAL	1,606,000	919,000 687,000	1,613,000	922,000 691,000	1,619,000	926,000 693,000

Domestic Water Demand

An evaluation of domestic water demand has been made according to the Romanian standard 1343/1-91. Thus, the specific water consumption values assumed, taking into account losses and portions for both public and industrial uses, were the following:

- for the urban area, between 335 l /inhabitant per day (level 2000) and 366 l /inhabitant per day (level 2020);

and

- for the rural area, between 126 l /inhabitant per day (level 2000) and 259 l /inhabitant per day (level 2020).

Assumptions taken into consideration for the evaluation of water demand from 2000 to 2020 include two scenarios:

1. considering that losses will remain at constant values;
2. considering a reduction of the losses over the period 1996-2020.

Table 3.7: The projection of the domestic water demand

Million m³

River Basin	*2000*		*2010*		*2020*	
	With losses	*With losses reduction*	*With losses*	*With losses reduction*	*With losses*	*With losses reduction*
Tisa	6.678	6.544	7,679	7.141	10.750	9.030
Somes	146.748	143.813	168.760	156.946	236.264	198.461
Crisuri	60.603	59.39	69.693	64.814	97.570	81.958
Mures	167.068	163.726	192.128	178.679	268.980	225.943
Bega-Timis-Caras-Birzava	149.478	146.488	171.900	159.867	240.660	202.154
Cerna	3.960	3.880	4.564	4.244	6.390	5.367
Nera	0.571	0.559	0.656	0.610	0.918	0.771
Jiu	74.964	73.464	86.208	80.173	120.691	101.380
Olt	176.761	173.225	203.275	189.045	284.585	239.051
Arges	489.606	479.633	563.046	523.632	788.264	662.141
Vedea	13.540	13.269	15.571	14.481	21.800	18.312
Calmatui-Olt	0.223	0.218	0.256	0.238	0.358	0.300
Mostistea	0.246	0.241	0.282	0.262	0.394	0.330
Calmatui-Buzau	0.371	0.363	0.426	0.396	0.596	0.500
Siret	284.721	279.026	327.429	304.508	458.400	385.056
Ialomita	118.078	115.716	135.789	126.283	190.104	159.687
Prut	63.376	62.108	72.882	67.780	102.034	85.708
Litoral	94.791	92.895	109.010	101.379	152.614	128.195
Danube	313.665	307.391	360.714	335.464	505.000	424.200
Total Romania	2165.458	2122.148	2490.276	2315.956	3486.38	2928.564

3.5 Institutional and legal framework of water sector

3.5.1 The institutional framework

The structure of water management activity in Romania, at all levels (decision making, research, design, execution, operation) was developed to take into account two water dimensions: quantity and quality, yet at same time water is a natural and environmental resource. Institutional structures should provide a framework for coherent development of water management and other socio-economic activities and create a capacity to effectively implement integrated water resources management.

The problems related to water resources knowledge, and to the design and establishment of river training works, have existed since the end of the 14th century. Thus, until 1924, in Transilvania, Banat and Bucovina, local water offices have been in operation and in the ancient kingdom water concerns were addressed by the Ministry of Agriculture.

On the 1st of January 1925, after approval of the Law regarding the water regime, the Water General Department within the Public Works Ministry was organised and operated until 1956. This department had subordinated branches for territorial water, which were responsible for the design and development of river training works and for the control of water utilities and observance of water permits.

In 1956, the National Water Committee was organised, and in 1974, it was transformed into the National Water Council.

Between 1974 and 1989, the National Water Council became the central national authority responsible for the development of the qualitative and quantitative water management activity, and for organising and conducting meteorological and hydrological activities. Subordinated to it, were the Research and Design Institute for Water Resources Management and the Meteorology and Hydrology Institute.

The National Water Council performed its functions through water departments organised in 9 hydrological basins (Mures, Olt, Jiu, Arges-Vedea, Ialomita-Buzau, Siret, Prut, Somes and Crisuri); 40 water management offices organised in each county; and the Water Management Office in Bucharest. It must be mentioned that, during the same period, the National Council for Environmental Protection, reporting to the Council of Ministers, was organised.

The structural changes in Romania after December 1989 have also been reflected in the field of environmental protection, and particularly so in the field of water management. In 1990, the National Water Council, the National Council for Environmental Protection, the Ministry of Silviculture were put together forming the Ministry of Water, Forests and Environment, with its Water Department with singular responsibility for water management. Between l991 and l997, this ministry was reorganised, under Government Decision No.568/1997, to form the Ministry of Water, Forests and Environmental Protection. In the field of water management, its Water Department has the main task of validating and promoting measures for water resources protection, conservation and management. Its specific functions include:

- strategic planning, including water management schemes for each river basin and coordination regarding all aspects of water management including consolidation of individual river basin plans into national programmes;
- allocation and management of national budgetary resources for water management;
- preparation and management of policy initiatives and administrative processes for the regulated use of water resources through a system of permits;
- preparation of legislation and policy regarding determination of the magnitude and structure of fees and fines;
- provision of guides and technical assistance to other institutions;
- control and monitoring of compliance with national standards, policies and regulation concerning water management;
- coordination of international cooperation and mechanisms at international or regional levels to facilitate integrated water resources development and management of transboundary water resources;
- up-dating legislation in the field of water to meet standards set by the European Union Directives.

Under Law No.15/1991 concerning the organisation of national authorities and companies, in April 1991, Apele Romane was created. Apele Romane is the operational agent of The Water Department and reports to the State Secretary of Water. It is charged with the implementation of the national water management strategy. In this capacity, Apele Romane administers the country’s water resources, promotes their rational use, protects them against pollution, prevents their overuse and exhaustion, and controls the destructive effects of the waters themselves by promoting economic efficiency and social protection in the use of water. Apele Romane is also responsible for the coordination of reservoir operation and the development of new water management works. It has basinal territorial branches (11) responsible for national water management. The specific responsibilities of the basinal territorial branches include:

- the preparation of the river basin management and investment plans in accordance with the policies issued by the Ministry;
- the administration of an investment fund supported by fees collected and used to provide financial incentives under the action plans;

- operation and maintenance of water management facilities;
- operation and maintenance of a monitoring network for water quality and a monitoring network for meteorological and hydrological information;
- the elaboration of the water management permits and licenses.

The drinking water supply, wastewater collection and treatment, the central heating network, state real estate, housing and street maintenance, solid waste collection and disposal are the responsibility of municipal enterprises. These are autonomous organisations providing public services. The latter are local enterprises which, before December 1989, were organised at the county (judet) level, and called County Enterprises for Public Works and Housing at that time under the authority of the County Popular Council. Now they are under the County Council.

The new Government Decision (December, 1998, published in March 1999) took into consideration the EU IPPC Directive and a new water management structure was created which implements full self-financing and facilitates integrated media management by the environmental protection agencies. The pollution control functions of the river basin authority (RAAR) were reorganised, separated from the other functions to be handled by the environmental protection agency (EPA), and vested in the National Company Apele Romane. In addition, the government accepted to remove regulatory responsibility for water management from basin authorities (which were transferred to the EPA) so that they retain only non-water consumer activities, like power generation plants or the construction of bridges across rivers.

3.5.2 The legislative framework

With regard to the legislative framework, the first provision regarding water protection was specified in the Law for festering in 1891, and later in 1927, was promulgated the Law of Water Regime.

After 1950, the concerns for creating a legislative frameworks have materialised by promulgating in 1953, Decree 143 regarding rational water use, development and protection, and in 1974, the Water Law (Law No. 8), a specific law derived from Law No. 9/1973 concerning environmental protection. In 1976, Law No. 1 was enacted, through which a national programme for future development of the river basins in Romania was approved. The programme was based on frameworks, schemes and development plans of the river basins drawn up by the National Water Counsel. Law No. 8/1974 has been completed with Law No. 5/1989 concerning rational water management, water quality protection and control.

Since the early 1960s, Romania issued several national standards for water quality, water management and water works. The most relevant standards are: STAS 1342 for drinking water quality, STAS 1343 for standard water needs, STAS 1846 determination of wastewater discharges, STAS 4706 for surface water, quality categories and conditions, STAS 9450 for irrigation water and water used in agriculture, and STAS 12574 for air pollution. In addition, a considerable number of standards for design, construction, building materials, laboratory tests etc. are in force. The standards are reviewed every 5-7 years and progressively revised in order to meet the standards of Western Europe. In 1979, Decree No. 414 was promoted which establishes admissible limits for main polluting substances in wastewaters before their discharge into the natural receivers and in 1983, the ordnance No. 90 was promoted which establishes admissible limits for the main polluting substances in wastewaters before their discharge into sewerage systems. At the same time, for the developments achieved in waters or related to them, an operations permit has been introduced.

With respect to the legislative framework, in order to adjust the water outlook to the new socio-economic conditions, the activity in the field of water management is now based on the new Water Law No. 107/1996. Starting from Constitution provisions and from the provision of the Law for environmental protection (No. 137/1995), this law establishes conservation and protection of water resources by maintaining an ecological balance, and legislating the application of key economic factors in water system management and participatory decision-making for all stakeholders. For the first time in Romania, a legal system has been established that allows the public to review and comment on environmental assessment, permits, applications or policy and legislation.

At the same time, the Ministry of Water, Forests and Environmental Protection updated a series of regulations establishing water quality parameters, the criteria for water categories classification, as well as water standards for different end-uses in a similar way as is done in the EU Directives. In 1997 Degree No. 414/174 and Order No. 90/1983 were enacted. They concern the establishment of admissible limits for polluting substances in wastewaters before their discharge into the natural receivers and sewerage systems.

3.5.3 The financing mechanism

In the past, before 1989, tariffs were applied only on drinking water, industrial water and for sewerage system use.

Based upon Government Decision No. 1001/1990 of 1 January 1991, an integrated system of payments for products and services of water management was created. It manages the protection of water against pollution and overuse, the establishment of water intakes, protection against flooding and the implementation of market-based instruments to improve efficiency of water management and protect water quality. This act has two parts: first—general orders regarding national water management; and second, policies to set prices, tariffs and penalties in water management fields.

In the Government Decision No. 196/1991, Apele Romane is set up as the only entrusted institution in charge of collecting fees for the use of surface and groundwaters.

This system of payments for water management was introduced starting in 1991. In principle, Apele Romane calculates total expenses of water management at the national level (National System of Water Management) to be recovered by payments of users or beneficiaries. Payments consist of two elements: prices and tariffs:

- *Prices*—are the same throughout Romania but differ in accordance with the source of water (e.g., inner rivers, the Danube, or groundwater) and the category of users (industries, households, power plants, farms, fisheries, etc.).
- *Tariffs*—are levied on water pollution to reduce suspended and oxygen depleting substances in river flows using limits set by the law. If the limits are exceeded, fines or penalties are levied.

There is an extra tariff for extracting sand and gravel from the rivers. This tariff covers the cost of managing the extraction of sand from the rivers, which are owned by the state. Finally, extra tariffs exist for other provisions, applied at the local level e.g., for the transportation, treatment and pumping of water. This tariff must also cover expenses.

The penalties for non-compliance with the permits or contracts, for water intake and discharge of used waters, represent an instrument for reducing environmentally harmful impacts of certain activities and to oblige users to respect limits inherent in their permits.

The penalty revenues provide a source of funding for the “Water Fund” created in 1991 and administered by Apele Romane. The Water Fund was created to finance some improvements in water quality, in river bed stabilisation, flood control, efficient water use and to cover water management units’ expenses in critical periods (droughts and floods). This fund equals 5 per cent of prices and tariffs of all water management units in addition to the revenue from the penalties mentioned. The Ministry of Waters, Forests and Environmental Protection allocates the distribution of this fund.

In the beginning of the transition period prices have been very much lower than costs for the activity of Apele Romane. However, Apele Romane supervises the functioning of the system, including making necessary changes in prices according to inflation and exchange rates. In general, the cost approach followed by Apele Romane is that costs should include all operation and maintenance costs, including repair, but not costs for future investments in water supply.

At the present, after the new Water Law No. 107/1996 entered into force, the Water Fund, together with other sources, is used to support:

a) the National System for Quantitative and Qualitative Water Resources Surveillance;

b) the endowment of laboratories, information networks related to the National System for Quantitative and Qualitative Water Resources Surveillance;

c) the realisation and modernisation of the water treatment plants and installations in order to improve the quality of the water resources;

d) public works of local interest with a significant social effect for which local authorities do not have sufficient financial resources;

e) the prevention and control of floods, works of intervention, and the control of natural calamities;

f) the provision of a hydrological information operational decision-making system in the water management field;

g) the elimination, destruction or improved safety of hydraulic structures of national or local interest, such as dams, embankments, etc.;

h) protection works of river basins against clogging;

i) studies to identify the evolution and administration of water resources;

j) grants to projects for protection against the depletion and degradation of water resources;

k) Basin Committee activities.

Financing for water management works, structures or installations shall be secured, totally or partially, as appropriate, from:

a) the state budget or local budgets, for works declared of public utility, pursuant to the law;

b) the water users' funds;

c) the development fund of Apele Romane;

d) funds obtained through credits or issue of bonds, guaranteed by the government or through local public authorities, for the works of public utility or for partnership associations wishing to carry out such works;

e) the Water Fund.

Private sources, including enterprise resources and capital markets, will play a much greater role in meeting water financial needs.

The 12 district branches of Apele Romane or their subdivisions are responsible for the collection of fees, tariffs and penalties.

Apele Romane expects that in the near future there will be a decrease in water consumption because of a general economic downturn and the introduction of new technologies with lower levels of water use, including technologies for recycling of water. Thus, immediate new investments in water supply should be limited. However, investments in sewage water treatment by industry and municipalities should be increased.

The municipalities are, of course, also important polluters of water bodies, but it feels that the greatest problem here is a high degree of leakage from the water supply network.

The main and dominant problem at present is the inability of industry, agriculture and municipalities to pay for the costs of water management. So the system cannot yet be evaluated as environmentally effective and cost-efficient. Enforcement and collection of the payments must be given high priority. In the medium and longer term, consumers should be able to pay for their water services.

It is clear that, especially in water pollution, the policy of the Polluter Pays Principle is recognised as the guiding principle for the environmental protection.

On a large stage—once economic stabilisation has been achieved and experience running the system has been gained—detailed consideration should be given to the potential introduction of further pollution charges or further increases in tariffs or penalties that will contribute to the clean-up costs of old polluted sites which constitute an environmental danger to the water supply and to water quality in Romania.

Furthermore, in the long run, possibilities for introducing different prices for raw water supply in each river basin area should be evaluated and introduced.

The use of economic instruments in Romania relies on a combination of command-and-control (CAC) and market-based instruments.

The role of the economic instruments is likely to increase over time for a number of reasons:

a) transition to a market economy and a general trend toward less government intervention;

b) cost-efficient response of enterprises and households to economic instruments,

c) limited state budget and the need to create new revenue raising mechanisms for environmental protection in the transition economy.

In general, due to the limited resources of the Water Fund, the financing strategy should be concentrated on priority recipients that are likely to survive over the long term.

Another important principle is that Water Fund money only provide capital costs of projects and not operational costs.

It must also be taken into account that state financing of operational costs may decrease incentives for enterprises to economise on operations and maintenance costs.

Many projects have been designed without adequate concern of the operational costs. For example, some municipalities designed large wastewater and water treatment plants and later found it difficult to finance their operational costs.

The Water Fund yearly spending programmes or budget is the key tool for translating financial strategy and into specific country priorities.

3.6 Water resources management policy of the past

3.6.1 Achievements

- The interdependence between different kinds of water use, authority and protection, as well as that between different activity domains interested in good management, renders rational water management a complex activity that must meet all of the requirements of socio-economic development.

- The unified approach to hydraulic works development and its complex development plans drawn up between 1959-1963 and later continued within the river basins framework schemes drawn up between 1971-1975.
- The long term National Programme for river basins development in Romania approved under Law No. 1/1976, provided the necessary framework for relating water management to navigable ways development, water quality protection, defence against floods through attenuation lakes, water courses training, calibration, and embankment and soil erosion control, and the growth of forests.
- Between 1950-1990, about 260 reservoirs were developed totalling a volume of 11 billion cubic meters, diversions and feedpipe systems of 471 km, riverbeds embankments and training on about 11 per cent of the rivers' length. As a result of these works, 2.3 million hectares and more than 2,000 localities no longer lie in flood zones.
- The draining works for excess humidity removal represent about 30 per cent of the arable surface of the country, including the draining carried out for irrigation application without influencing groundwater levels.
- The works for soil erosion control have been carried out on about 24 per cent of the arable surface of the country. In relation to these, torrents in forestry fund have been extinguished on 63,000 hectares and, afforestation for the deteriorated areas protection on 20 000 hectares had been achieved. At the same time, navigable ways on 91 km and pisciculture developments on 15,800 hectares.
- In order to protect the water quality, about 4,800 wastewater treatment plants and installations have been built.
- For the irrigation of the lands with a lack of water, development works have been carried out on 3.25 million hectares, of which, 2.4 million hectares is situated in the south of the country, where the Danube River is the water source.
- Through the development of 34 per cent of the technical river potential, an average output of 16.4 kWh/year of electricity is generated, which is, in an average year, about 21 per cent of the national total energy output.

3.6.2 Water demand evolution

3.6.2.1 Water demand for population

In comparison to the limited water resources, water demand has continuously increased, from 1.4 billion cubic meters in 1950 to about 20.4 billion cubic meters in 1989, of which 11 per cent is for drinking water and the domestic use, 44 per cent for industry (for units included within localities and on industrial platforms) and 45 per cent for irrigation, animal husbandry and pisciculture.

Within the water utilities, human settlement water supply represents about 10 per cent of total water demand. From the statistical data, in 1989, more than 20 per cent of the country's population was connected to centralised water supply systems (about 2.200 localities supplied in 1989). The total volume of drinking water distributed in 1989 was 2.530 million cubic meters, of which 43 per cent was for domestic use, 19 per cent for public needs and 38 per cent for industrial utilities connected to the drinking water networks.

The total share of industrial utilities, at the county level, connected to the drinking water networks is variable between large limits, that is, between 18 per cent and 62 per cent. Among the counties with a low share, under 30 per cent, are Bacau, Brasov, Calarasi, Mehedinti, Vaslui and, among those above 60 per cent, are Botosani and Gorj.

3.6.2.2 Water demand for industry

Water demand by industry, including cooling water for thermal power stations, is 8.6 million cubic meters/year.

The degree of water recycling achieved in certain technological processes is very low: only 11 to 16 per cent rather than an optimal 78 to 87 per cent (taking into account the capacity of the equipment). This is mainly because recycling facilities do not operate all the time at their full capacity.

3.6.2.3 Water demand for irrigation

The water demand for irrigation is about 9 billion cubic meters. In most cases, inefficient irrigation technologies are being used, so that a large quantity of the distributed water percolates into the soil thus adding to water lost through seepage from the feeding canals.

3.6.3 Discharge of wastewater

The increase in water demand has been accompanied by an increase of discharged wastewater, without being related to the increase of capacities within the treatment installations, particularly in the industrial and animal production units. Thus, in 1989, of the total wastewater discharges of about 10 billion cubic meters, about 5 billion m^3 required treatment, of which only 25 per cent was adequately treated, about 50 per cent was insufficiently treated, and about 28 per cent was discharged into natural receivers without treatment.

3.6.4 Critical aspects

Water demand increases partly reflects socio-economic development, but more so it reflects the maintenance of irrational water use behaviour by consumers. This is caused by the use of high water consumption production technologies in the industry, as compared to those used in other countries, and by the use of exaggerated water norms for crop irrigation, by water wastage and water losses within water users' installations, as well as within municipal installations, by the inadequate endowment with measurement systems for drawn and discharged water, and by the lack of a key economic factors management system.

Thus, communal services and consumers register significant losses that can reach, in certain localities, up to 20-30 per cent of total treated water and sometimes, such being the case of Bucharest, up to 40 per cent . Pipe networks, made of steel, cement and plastics, have a very low reliability, daily damages occur—up to 150 in Bucharest.

In the case of water use for agriculture, inefficient irrigation technologies and inadequate watering regimes are noted. A large quantity of the distributed water percolates into the soil being added to the water lost through seepage from the feeding canals. The immediate effect is a decrease of hydraulic output within the irrigation systems (about 50 per cent), an increase in groundwater levels in certain areas, and the occurrence of some soil saltines with negative effects on agricultural production and the environment.

3.7 Recent water resources management policies

Through a growth of water demand and of human intervention in hydrological processes, water becomes "a good of economic and social value", thus water management in the real sense becomes necessary; meeting these demands is conditioned on the basis of rational water use and conservation, economic efficiency, and social equity criteria. The integrated development of water resources and water sector infrastructure improvements should further take into consideration principles included in EEC/UNO documents, such as those concerning the organisation of the river basins and the necessity of sustainable water resource development.

Under conditions of an accentuated energy crisis, water management problems should be solved by adopting optimum solutions at the level of entire basins, because the application of strictly "local" economic management can often lead to significant losses in other geographical areas and in other sectors.

An efficient elaboration and implementation of a national policy for the rational use of water resources to benefit present and future generations, should be a priority taking into account the following aspects:

- the reduction of water consumption growth at the level of all national economic branches;
- rational use and savings in intensive water use within the utilities, in order to reduce water demand, drinking water demand from the source, and non-recoverable water consumption;
- protection against shortage and pollution;
- the efficient operation and exploitation of the existing facilities;
- legislation and management;
- public participation.

3.7.1 Water demand development prognoses

Starting from a study of socio-economic consumption in Romania under the existing status of water management practices, a socio-economic development prognoses for utilities requiring priority water management works has been made.

It is estimated that in the near future the problem of a meeting a significant increase in water demand can no longer be accomplished. Special attention will be given to new technologies and to the modernisation of the water supply systems, as well as to avoiding water wastage. In other respects, high water consumption and wastage occur because no water payment system was promoted, a measure that was taken only in 1990, with water consumption reduction and more rational resource use being its immediate effects.

3.7.1.1 Drinking water demand

With respect to drinking water demand, considering social and legislative changes during recent years, a growth of the urban population was estimated due to the elimination of residence restrictions and to the development of the private sector, counterbalanced to a smaller extent, by the population return to rural areas, as the Land Fund Law came into effect.

In order to have stable or increasing rural demographic growth, a minimum domestic comfort is planned to be ensured by connecting a minimum of 75 per cent households to local water supply networks.

In order to improve the situation existing in certain areas lacking drinking water, firm measures must be taken for reducing water losses within urban distribution networks, while simultaneously providing drinking water from groundwater sources (but not for industrial water consumers that do not necessarily require a special water quality for their production processes).

3.7.1.2 Industrial water demand

With respect to industrial water demand under new market economy conditions, a reduction of activity in some high water consumption industries should be possible. For future industry development, water demand can be met through the availability of new and modern technologies. Thus, demand can be kept at the present level or will even diminish, for many industries.

3.7.1.3 Water for irrigation and pisciculture

With respect to the water for irrigation and pisciculture, under the Land Fund Law lower development of irrigation and pisciculture works is expected, especially for small systems using water provided by local sources. The following could compensate possible additional demands for irrigation:

- a reduction of operational capacity of existing irrigation systems;
- reducing losses in irrigation systems by waterproofing water transport and distribution networks, under the conditions of an increasing water cost;
- reconsidering existing irrigation norms, and adjusting them to specific areas and for annual climatic and hydrological variations.

In order to satisfy water demands of an ever growing population, measures will be continuously taken for pisciculture works and fish breeding development in inland waters, including reservoirs, simultaneously with works for pisciculture developments in the Danube and the establishment of ponds.

3.7.2 Water management structures development prognoses

The large diversity of water management problems, their tight interdependence with energy and environmental protection problems implies solutions adjusted to each situation depending on local conditions. Water management represents an activity that requires important long-term investments, possesses technical difficulties, and should be developed in an integrated manner for whole river basins.

For financial reasons, after 1990, evolution in this field was very limited.

The Ministry for Waters, Forests and Environmental Protection revised river basins development works schemes, on short and medium terms.

Starting with investment objectives for on-going water management, from the water demand prognoses, and taking into account the national economic situation, the Ministry of Water, Forests and Environmental Protection, proposes that new capacities should be adopted. These capacities will provide water supply to the population, industry and farms in the Buzau, Baia-Mare areas on about 100,223 hectares and provide protection against floods for about 100,000 hectares of agricultural land and 267 localities.

It is foreseen that the water shortage objectives can be met with enhanced reservoirs, catchments, derivations, etc. Besides water shortage compensation (by providing a total volume of 10 cubic meters/second) catchment installations will increase operational safety and protect certain localities and agricultural lands against high floods. Special attention should be given to Bucharest, as well as to the areas of Petrosani, Sighisoara, Copsa Mica, Comanesti, Onesti, and Valea Prahovei (Azuga).

In addition, certain objectives should be set for protection against high floods on about 46,650 hectares of agricultural land in areas affected by the high floods of 1991and 1999 (Buzau, Neamt, Suceava, Bacau, Vrancea counties), as well as protection of 6,600 hectares of agricultural land and localities in Arad county. Enhanced embankments, river training, consolidations and temporary accumulations will be needed to achieve these.

Hydro-powers reservoirs should be completed and new micro-hydropower stations should be constructed to improve water resources use and extend the use of renewable energy sources.

Taking into account the special character of the Danube Delta Reservation, ecological reconstruction works including developments within Govora-Uzlina, Somova-Parches, Sontea-Fortuna, are planned.

With respect to water quality protection till the end of 2000, the completion of Bucharest municipal treatment plant and extension works at certain plants now exceeding their capacity (in Botosani, Craiova, Resita) are planned.

A promotion of water management development works will be made following the framework development schemes of the river basins. At the same time, special attention should be given to improving existing financial mechanisms in the field of water, which should ensure that fees and penalties established by authorities should be reinvested in water pollution control measures and in activities that increase water resource use efficiency.

Methods to ensure active participation of financial supporters, users and local authorities in establishing priorities in the field of water management must be achieved. Modalities for covering river basin expenses should be also established. Cost benefit analyses should also be improved in order to estimate priorities in water management activity planning at the level of each river basin.

3.7.3 Water management priority objectives

Starting from relatively poor water resources in Romania, water significance as a socio-economic development factor should be reconsidered. It is also necessary to re-estimate the valuable functions of rivers and lakes and to ensure a harmony between nature and human activity in future national development. Short, medium and long term strategies in the field of water management should be adopted, taking into account that Romania is in a period of transition to a market economy. The general objectives of the water management strategy should include the rational use of water resources and their protection against shortage and pollution.

The Ministry of Water, Forests and Environmental Protection has elaborated such a national strategy for water management in concordance with socio-economic development. Among the priority objectives of this strategy, the following may be mentioned:

- periodical elaboration of short- and medium-term national programmes for water resources and aquatic ecosystems conservation and protection, taking care that these are adequately carried out;
- rational water resource use and protection against shortage;
- drinking water supply and sewage treatment having in view viable town-planning;
- water resources and aquatic ecosystem quality conservation;
- water management having in view food production and rural sustainable development;
- Danube River and Black Sea rational use and quality protection;
- prevention and control of water damage effects;
- water management development works operation and maintenance;
- use of rivers' hydro-energy potential;
- improvement of the price, tariff and penalty system;
- development of scientific research in the field of hydrology, meteorology and water management;
- permanent completion and adjustment of institutional and legislative framework in the field of water management, consistent with new priorities of the market economy in Romania;
- strengthening of international collaboration and cooperation;

- development of a balanced educational system that communicates water issues to the populace and gives access to information and training in the fields of hydrology, meteorology and water management.

Taking into account more than 40 years experience in the field of water management, activities for strategy application will be based on the river basins framework schemes and the complex development works programmes, elaborated in accordance with socio-economic changes of Romanian society. Requiring approvals and permits for works carried out on waters and the application of economic stimuli, will be main factors ensuring that the objectives of the water strategy are met.

3.8 Danube river basin

In 1989, the use of Danube water represented about 65 m^3/s water drawn for water supply (to the population, industry and animal production) and for the irrigation of 2.2 million hectares of agricultural land. To meet future (2025—2035) water demand for these same uses, a water demand of 100 m^3/s will be required. Compared to the total Danube resource at the entrance into the country, there are no problems in ensuring necessary water quantity from the Danube despite certain navigation restrictions during periods of low waters.

Taking into account Romania's position within the whole Danube basin and the fact that the river is the main collector and emissary of all discharges from the riparian countries towards the Black Sea, the problem of water quality management for the Danube has become a great concern.

Chemical analyses have shown an improving trend in quality over the past 20 years. Yet although quality remains within acceptable limits, the increase of nutrient salts (Nitrogen and Phosphorus) and organic matter discharges, continue to cause significant phytoplankton growth both in the area of Portile de Fier reservoir and in the Danube Delta.

The increase of navigation traffic and harbour activities, as well as the use of pesticides of high persistence on agricultural lands, have led to unfavourable effects on species evolution and in ichthyofauna quality in the Danube Delta and in the Black Sea coast.

On the Black Sea coastline, accentuated beach erosion is noted, simultaneously with an alarming increase of the sea water blooming phenomena as a result of the Danube river contamination by discharges of biogenic substances.

The Danube Delta is the largest delta in Europe, covering a total area of some 550,000 ha, over 400,000 ha of which lie in Romania and the remainder in Ukraine.

With respect to protection, conservation and recovery of the ecological balance of the Danube Delta, Romania created in September 1990 the Danube Delta Biosphere Reservation, within which any human activity and intervention that could generate ecological damage is forbidden. In May 1991, the Delta was declared a Ramsar site and over fifty per cent of its area was placed on the World Heritage List in December 1991. As a Biosphere Reserve, the basic objectives for management of the delta are to balance goals of conservation, research and sustainable resource management to meet socio-economic needs of the local population.

Overall, the protected area covers 679,000 ha and includes parts of the flood plain and marine area. The protected area is home to the majority of the world population of red-breasted geese, a threatened species.

Romanian integration in water use and protection activity at regional and global levels will require bilateral and/or multilateral cooperation as well as new activity priority programmes. International cooperation is also an essential condition for improving industrial and agricultural development in order to re-establish the dynamics of ecological balance.

International cooperation typically gives special attention to problems related to the Danube River, Danube Delta and the Black Sea protection. Most activities require international financial support that cannot be provided by either the state or potential beneficiaries. The existing state of water resources management was a starting point for the elaboration of priority programmes. To date these programmes have focused on water resources exploitation optimisation within the river basins of Arges river, Prahova-Teleajen, Trotus and Birlad, which are the main water supply sources for the towns of Bucharest, Ploiesti, Vaslui, Birlad, etc.

For Danube water quality protection, Romania considers that the Helsinki Convention is very important as well as the Convention on Cooperation for Protection and Sustainable Use of Danube River. The latter is a regional convention of permanent character promoting a progressive recovery of Danube water quality through programmes and action plans coordinated between interested countries.

Chapter IV: Water User Specific Problems in Applying the Price and Tariff System

4.1 Introduction

Government Decision 1001/1990, establishing a uniform payment system for water management products and services was approved in 1990, aiming to increase the role of economic instruments in the rational management of water resources and ensure the protection of water quality. The system sets water prices and tariffs based on economic considerations.

With a view to stimulate users to reduce water demand and improve water quality, this decision sets forward prices and tariffs for water products and services and penalties for violations of legal statutes on water use.

Prices and tariffs were designed to cover the full-costs of operation, maintenance and repairs of the National Water Management System and part of the depreciation of hydro-technical works administration (flood control works are exempted from depreciation by law).

The implementation of the new price system was not well accepted, as users had difficulty in accepting that water is a good with a value. In the old system, only users that received water from reservoirs had to pay for it, a different price for each reservoir.

The new system introduces:

- prices for abstracted water;
- tariffs for discharge of contaminants in water streams;
- penalties for failure to comply with regulations and contracts.

4.2 The goals of the pricing system

The goals in introducing a price system were largely attained, namely:

- to integrate water management activities with other national social and economic activities;
- to recover operation and maintenance costs in this sector, without financing infrastructure, by appropriately charging beneficiaries;
- to change user behaviour about water conservation and protection;
- to apply economic and environmental standards to all activities involving waters.

After the uniform pricing system was introduced, users reduced their water demand. As economic changes occurred at the same time, it is not clear how much of the demand reduction was the direct effect of increased water pricing.

4.3 The effect on users

The impact on users was felt in the following aspects:

Positive

- better proportioning of water demand, although demand is typically greater than actual abstraction;
- reduced loss within water systems in production processes and internal re-circulation of water;
- increased interest in installing flow-meters, to avoid paying for more water than was actually abstracted;
- improved water quality in some very polluted areas;

In turn, the effects of reduced abstraction included:

- reduced costs for abstraction and for wastewater treatment—reduced product price;
- reduced discharge, therefore reduced impact on receiving water;
- reduced circulated water volumes;
- by the internal re-circulation of water, total water costs are reduced;
- reduced total product price;
- increased production to water input cost ratio.

Negative

- since development goals sought to achieve increased production, investment went primarily into production technologies, while wastewater plant and internal water circulation systems are only upgraded once improved profits are obtained;
- company expenses on water, although a small percentage of total costs (1-2 per cent) are paid to the water management companies with great delays. Bills are paid with priority to suppliers of electricity, gas, raw materials, etc., and only later for water.

4.4 Problems with users when prices are raised or when payments are introduced

This study has noted the following problems:

- delayed revenue for water products and services reduces the volume of maintenance and repair work that can be conducted, while the value of delayed payments decreases due to inflation.
- resorting to loans means additional costs due to high interest rates and hence increases in the real price of water.
- reduced volumes of abstracted water due to reduced production or the shut-down of industrial facilities leads to an increase of water prices.
- insolvent users are sued and made to bear financial penalties, which leads to increases in product prices or reductions of profits.
- in cases where price is established by river basin authorities with many users, when one or more of the largest industrial users shut-down or reduce their production, accounts receivable decrease, revenue goes down, and the possibility to maintain the river basin system at its nominal operational level disappears.

- Local administrations are one of the customers that pose problems by delayed payments. They distribute water to an important number of small and medium enterprises that produce goods for export.

The price of water needs to be raised to its real value. This will have a negative effect on users, especially now, in a difficult economic environment.

Agriculture has been traditionally privileged with lower prices than for industry. If a correct price of water for irrigation were introduced, its impact on farmers would be substantial.

Price updates to account for inflation and reduced water abstraction for users yield revenues that do not fully cover expenses incurred in the system.

Penalties to be disbursed into the Water Fund have not been updated since 1993, so that they are no longer effective pollution control instruments. Moreover, penalised users fail to pay penalties in disregard of the law.

When water prices are raised, so that they may cover increased operation and capital expenses, users' ability or willingness to pay will also be lower. In this case, bills will go up, but so will debts.

If prices are to be differentiated by river basin, in some basins the price for the user may grow seven fold compared to the present. Under such conditions water costs will be greater in some river basins and much lower in others, compared to the current situation of uniform prices.

4.5 Identification of Expenses to Provide Water

Under exclusive NCAR administration	Administered by NCAR or units of other ministries and central authorities	Administered by users	Administered by users or third parties
Hydrological and water management works **National Hydrological and Water Management System** **Surface and ground-water sources**	**Water Treatment abstractions** **Transport Piping**	**Storage Distribution** **Restitution** **Water use** **Sewer**	**Treatment** **Discharges**
Area of water price source formation (expenses for information systems, maintenance of water sources operation and maintenance of hydro-technical and water management works	Expenses that are added to the source price of water, or, as applicable to the price of abstracted, transported, treated or distributed water.	Internal expenses of users.	Expenses to be added case by case, to users' nternal expenses or to be expressed as third party tariffs.

4.6 Average costs of bulk water nation-wide and as broken down by river basin (1998)

Specification/ Subsidiary	*U.M.*	*Cluj*	*Oradea*	*Mures*	*Timis*	*Craiova*	*Valcea*	*Pitesti*	*Buzau*	*Bacau*	*Iasi*	*Constanta*	*Stanca*	*Total Regie*
0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*
Total expenses	*mill. lei*	*27.5*	*14*	*35.6*	*18.2*	*21.15*	*38.78*	*47*	*39.4*	*32.8*	*28.5*	*16.9*	*3.9*	*32 3.73*
BVC expenses (year 1+2)	*mill lei*	*22.90*	*13*	*28.1*	*17.6*	*18.6*	*27.3*	*40.5*	*22.3*	*22*	*23.5*	*16.9*	*3.1*	*255.80*
Supplied volume 1998	*mill. m^3*	*407*	*221*	*1045*	*245*	*1582*	*500*	*1102*	*583*	*601*	*124*	*1999*	*114*	*8523*
Average BVC cost (year 1+2)	*lei/m^3*	*56.27*	*58.82*	*26.89*	*71.84*	*11.76*	*54.6*	*36.75*	*38.25*	*36.6*	*189.52*	*8.45*	*27.19*	*30.02*
Total expenses cf. Norms	*mill. lei*	*51.15*	*33*	*84.09*	*33.7*	*31.5*	*55.06*	*76*	*82.3*	*72.58*	*53.01*	*25.35*	*7.08*	*604.82*
Normal expenses (year 1+2)	*mill. lei*	*42.9*	*28.88*	*70.07*	*32.5*	*25.38*	*37.89*	*68.29*	*61.23*	*50.06*	*47.45*	*25.35*	*5.98*	*495.98*
Nominal average cost (year 1+2)	*lei/m^3*	*105.4*	*130.68*	*67.05*	*132.65*	*16.04*	*75.78*	*61.97*	*105.03*	*83.29*	*382.66*	*12.68*	*52.46*	*58.18*

4.7 Comparison between the price increase index of consumption goods and of water management products and services

Reference base 1990

Year	*Cost index Consumption price*	*Index Water management price*
1991	2.702	2.370
1992	3.104	2.010
1993	3.561	2.606
1994	2.367	2.632
1995	1.323	1.280
1996	1.388	1.460
1997	2.548	2.350
1.09.1998	1.686	1.393

Reference base 1990

Year	*Cost index Consumption price*	*Index Water management price*
1991	2.702	2.370
1992	8.388	4.757
1994	70.719	32.633
1995	93.534	41.770
1996	129.825	60.984
1997	330.794	143.313
1.09.1998	557.855	199.635

4.8 Tariffs for water management services provided by water management units established with the Office of Competition

Water Management service	*U.M.*	*Tariff lei/U.M.)*
1. *Receiving into surface waters substances discharged within regulated limits*		
For suspensions and substances in solution (all the indicators the permit)	Tonne	27,487
For oxygen demanding substances	Tonne	111,163
2. *Concentration of electricity potential in the Regie dams*		
For average head provided by the dams	m	498,056
power stations under 4 MW installed	head/year	669,478
power	m	825,249
power stations between 4 MW and 8	head/year	
MW	m	
power stations over 8 MW	head/year	
For volume of water used		
power stations under 4 MW installed	10,000 m3	1,014
power	10,000 m3	1,386
power stations between 4 MW and 8 MW	10,000 m3	2,240
power stations over 8 MW		

Tariffs do not include VAT that have be applied starting in January 1, 1999.

4.9 Penalties for violation of norms regarding water abstraction from source and discharge of wastewaters

Type of violation	*Magnitude of violation UM*	*Level of penalties lei/U.M.*
1. Exceeding abstracted flow or volumes as legally or contract regulated		
	over 10 per cent, up to 20 per cent	Twice the supply price
	over 20 per cent, up to 50 per cent	three times the supply price
	over 50 per cent	four times the supply price
2. Exceeding during restriction periods of abstracted flows or volumes provided by legally approved plans, by water management units		
	over 10 per cent, up to 20 per cent	Twice the supply price
	over 20 per cent, up to 50 per cent	three times the supply price
	over 50 per cent, up to 75 per cent	four times the supply price
	over 75 per cent	six times the supply price
3. Abstracting volumes of groundwater larger than those provided by regulations		
	volume	five times the supply price
4. *a*) Abstracting water from surface or groundwater sources without a permit		
	volume	10 times the supply price or tariff
b) Using products or services without a contract	volume	10 times the supply price or tariff
5. Using water for a different purpose than regulation provides	volume	three times the supply price
6. Exceeding the average daily value of permitted quality indicators		
	The difference between permitted amounts and amounts actually achieved.	

Type of violation	*Magnitude of violation*	*UM*	*Level of penalties lei/U.M.*
— total suspensions		kg	47.84
— chlorides, sulphates, magnesium, sodium, calcium		kg	72.20
— nitrates, organic compounds (CCOCr)		kg	96.40
— organic compounds (CBO5)		kg	214.80
— ammonium, nitrites, cobalt		kg	479.25
— trivalent chromium, detergents, active anions, fluorine, total iron		kg	958.55
— ammonia, total phosphorus, manganese, nickel, oil products extractable in petrol ether		kg	2,875.65
— hexavalent chromium, molybdenum, lead, copper, zinc, sulphide or hydrogen sulphide		kg	9,588.50
— silver, arsenic, selenium		kg	19,180.00
— cyanides		kg	28,768.65
— free residual chlorine (Cl2)		kg	38,360.00
— cadmium, phenols, nitrotylbenzene		kg	47,948.00
7. Very toxic substances banned from discharge into water sources			
— Mercury		kg	575,377.00
— persistent organo-halogenic, persistent organo-silicic, organo-phosphoric pesticides		kg	958,970.00
— carcinogenic substances (benziprene and its compounds, nitroderivative dinitro-ortocresole, dinitro-btylphenole, etc.)		kg	2,397,425.00

Chapter V: Raw Water Pricing Policy at the National Company Apele Romane

5.1 Case Study Somes-Tisa River Basin

Raw water prices are the same throughout Romania although some basins have much higher costs than others. Uniform pricing over a large area enables investment costs to be spread over a large number of consumers. On the other hand it involves transfers of money (subsidies) between basins and does nothing to discourage the use of water in areas of shortage. It may disguise a very high marginal cost of water (e.g., through construction of a new dam) and it does not encourage demand-side management, waste reduction and leakage control in areas of shortage.

In Romania, tariffs are supposed to cover only operation and maintenance (historically the State has provided infrastructure investment funds) and yet Apele Romane recovers only 60-80 per cent of these expenses. In Romania the cost of flood protection is included in the raw water price and some reservoirs have more than one function (water supply, flood control, hydropower, amenity).

The cost of raw water includes three main components:

- operating costs of the organisation responsible for raw water supply
- cost of servicing investments in capital assets (dams, pipelines etc.)
- environmental costs of exploiting the resource

The environmental costs are difficult to calculate in monetary terms and are often ignored. Nevertheless they are real and may reduce amenity value, impacting on tourism, or by reducing river flows, can reduce the dilution of waste discharges and either increase their effects or force the discharger to install more expensive waste treatment to compensate.

5.2 Legal framework

5.2.1 Water Law 107/1996

The Water Law aims at conservation, development and protection of water resources by applying a unified, rational and complex water management policy in river basins. To effect this primary objective, 112 articles are provided for in seven chapters of the Law. Outlined are significant provisions of the Water Law, categorised by subject matter, that are closely related to water pricing policy.

a) *General Provisions*

- *Public Ownership of Water:* in principle, the public shall own surface water and groundwater.
- *Jurisdictions in Water Use Regulation:* The establishment of water use regulation is an exclusive right of the government, in principle, to be exerted through the Ministry of

Water, Forests and Environmental Protection. Apele Romane shall administer public-owned waters.

- *Jurisdiction Relating to Water Management:* The Ministry of Water, Forests and Environmental Protection shall carry out the development of the national water management strategy and policy, and shall ensure coordination and control in applying internal and international regulations. Apele Romane shall carry out quantitative and qualitative water management, operation of water management structures and implementation of national water management strategy and policy.

b) *Regulation of Water Use*

- *Authorisation of water use and discharge:* The right to use surface and groundwater shall be established by the water management license except for minor uses. The right also includes the discharge of wastewater.
- Priority is given to drinking water supply
- *Water quality standards:* Water quality standards and drinking water quality standards shall be approved, on proposal of the Ministry of Water, Forests and Environmental Protection and of the Ministry of Health, respectively. The effluent limits of pollutants in wastewater discharge shall be approved by Government Decision, on proposal of the above two ministries. The effluent limits provided in the water management permit/ license are maximum allowable limits.
- *Forbidden activities to protect water resources:* The increase of wastewater contamination contents caused by (i) setting into operation of new industrial facilities, (ii) development and introduction of modified production technologies in existing industrial facilities, and (iii) establishment of new human settlements is forbidden, unless a sewer network/ wastewater treatment plant are set into operation, or unless works/measures are carried out to ensure effluent limits stipulated in the water management license are respected.
- *Wastewater discharge into the sewer system:* wastewater discharge into the sewer network may be admitted only with the agreement of and in compliance with conditions established by the network holder, and only if the wastewater treatment plant has the necessary technological profile and available capacities. Pre-treatment of wastewater by water users is mandatory, in all cases.
- *Obligations of wastewater treatment plant operators:* Continuos monitoring of wastewater treatment plant operation, through laboratory analysis. Record keeping of analysis results. Making data available to the inspection and control personnel of Apele Romane and others.
- *Mining/industrial wastewater discharge:* Mining wastewater may be discharged into surface water bodies only after proper treatment.
- *Accidental water pollution:* Apele Romane shall organise activities to prevent accidental water pollution. Water users are obliged to prepare and apply their own plans, in accordance with the framework-methodology of the Ministry of Water, Forests and Environmental Protection. In case of pollution occurrence, Apele Romane shall immediately warn water users and local public administration authorities downstream to effect water protection and damage-mitigation measures.

c) *Economic Mechanism for Water*

- *Specific economic mechanism to include payment system:* for quantitative and qualitative water management, the specific economic mechanism shall include the payment system, allowance and penalties as part of the financing practice of the water management system development and of ensuring the functioning of Apele Romane based on economic principles. The payment system is based on the ’user pays’ principle, according to the service provided, and services related to the rational use of water resources.

- *Allowances and penalties:* an allowance shall be granted to water users who demonstrate a permanent concern for rational use and protection of water quality, and who discharge higher quality and lower quantity treated wastewater than is stipulated in their water management license. The penalties shall be applied to water users for both exceeding the quantity of the extracted water, and the quality and quantity of the discharged wastewater. Apele Romane is the only authority empowered to identify the cases for granting allowances or for applying penalties. The allowances shall be granted with the approval of the Ministry of Water, Forests and Environmental Protection.

- Water Fund

  The Water Fund was first established by HG 1001/1990 in 1990. This is a special fund not included in the state budget. Thereafter, its functions were revised and upgraded by the Water Law promulgated in 1996.

  The purpose of the Water Fund is to assist in the financing of investment for works with a significant contribution to the improvement of water supply sources, to water quality protection, and to expenditures required for studies and appreciative research in the water field. The Water Fund is managed by Apele Romane and is used, together with other sources, as financial support of various activities in the water field. The activities closely related to the present project are as follows:

a) strengthening of the water quantity/quality monitoring system including laboratories;

b) participation in the installation and upgrading of the wastewater treatment plants in order to improve surface water quality;

c) studies for the development and management of water resource quantity and quality;

d) granting allowances to those with significant results in the protection of the water environment.

5.2.2 Regulatory Legislation

Under the Water Law, the water management permits and the water management license application are obligatory for all water users and for works on water or related to water, except for those meeting household needs on a small-scale. Promulgated Acts relating to the issuing of water management permits/licenses are:

- Order 148/1997 of the Ministry of Water, Forests and Environmental Protection: on procedures and competence to issue water management permits/licenses;

- *Order 277/1997 of the Ministry of Water, Forests and Environmental Protection:* on technical documentation required for obtaining water management permits/licenses.

Prior to the promulgation of the Water Law, the Government Decision HG 1001/1990 setting forth a unitary payment system of water products and services.

- *HG 1001/1990:* regarding a unitary payment system for water management products and services.

- Order 242/1990 of the Ministry of Water, Forests and Environmental Protection: on technical instructions to apply HG 1001/1990.

5.2.3 Regulatory Procedures

Water management authorisation

Water management authorisation consists of the issuance of a water management permit and a water management license.

The water management permit is required for water users to carry out the works built on or related to water. A decision to set into motion, or put into operation, the works shall be made only on the basis of the water management license.

The Water Law also stipulates that the right to use surface or groundwaters, including water from artesian wells, is established by the water management license. Such right also includes discharge into water resources, of wastewater, drainage water, meteoric water, and mine or deposit water, after being used.

The water management permit and the water management license are issued by Apele Romane and its river basin branches. To obtain the water management permit, technical documentation with a copy of a letter of public disclosure shall be sent in a prescribed manner to Apele Romane.

The water management license does not exclude the obligation of applying for and obtaining a separate environmental license.

The water management permit and the water management license contain almost the same items relating to water use, but the items for wastewater discharge are not included in the water management permit.

Unitary payment system for water management products and services

As stipulated in the Water Law, only Apele Romane is a supplier of surface water and groundwater. They have the right to directly manage waters; therefore, they are exclusively entitled to receive the payment for water. The payment includes the following prices, tariffs and penalties:

a) Raw water prices: raw water extraction prices of surface and groundwater for various water uses.

b) Tariffs for water management services: including (i) tariffs for pollution loads discharged into surface waters within the permitted limit, and (ii) tariffs for water used for hydropower generation.

c) Penalties for violating the standards: including penalties for (i) exceeding the permitted intake volume of surface and groundwater, (ii) using water for a purpose other than the permitted one, (iii) exceeding the permitted water quality values in wastewater discharge, and (iv) discharge of highly toxic substances forbidden by the Law.

The unitary payment system has provided Apele Romane with its financial basis for autonomous operation. Based on the water management license issued, Apele Romane concludes a commercial contract with water users, and collects revenues from the sale of water management products and from providing water management services.

The price of raw water, tariffs on water management services, and penalties, shall first be approved by the Competition Bureau, the Ministry of Finance. Based on the approved prices and tariff, Apele Romane will establish the standard prics and tariffs applicable nation-wide.

Prices of raw water and tariffs for water management services as of August 31, 1998 are shown in Table 5.1.

Table 5.1: Raw water price and tariffs for water services

Category	*Type of Water/Service*	*Unit*	*Unit Price/Tariff*	*Unit price/tariffI.*
I.	Raw Water		Surface water	Groundwater
	Industrial use	lei/1,000 m^3	67,721	83,358
	Domestic use	lei/1,000 m^3	67,721	19,015
	Irrigation/fishery	lei/1,000 m^3	901	3,289
	use	lei/1,000 m^3	67,721	25,243
	stock-breeding			
II.	Pollution Load Discharge			
	SS	lei/tonne	24,395	
	BOD	lei/tonne	98,658	
III.	Hydropower Use		Capacity < 4 MW	Capacity > 4 MW
	mean head	lei/m	442,028	732,414
	turbine water use	lei/1,000 m^3	900	1,988

Local Romanian water companies establish the price of treated water within their respective areas of authority, by adding the cost of water intake, treatment, transport and a 10 per cent profit to the basic price of raw water.

The penalties under the unitary payment system, stipulated in the Water Law, are assessed through inspections by Apele Romane personnel. Fines are imposed for infringement of the Water Law provisions, different from the penalties under the unitary payment system. Due to non-payment by water users, only small amounts of money are collected out of the total assessment value of fines.

5.3 Institutional Framework

5.3.1 Ministry of Water, Forests and Environmental Protection

The Ministry of Water, Forests and Environmental Protection is a central public administrative organisation set up to apply government strategies for water management, Forests management, and environmental protection. Following its recent reorganisation (Government Decision 104/1999 March 1999) it has created a General Directorate for Water Management. This unit is directly responsible for water management. Its main tasks are to substantiate and promote the measures for water resource protection, conservation and rational management. Its specific functions include:

- Strategic planning and coordination in water management;
- State budget allocation and management for water management;
- Preparation of legislation and policy;
- Provision of guidance and technical assistance to other institutions in water management;
- Control and monitoring of compliance with national standards, policies and regulations concerning water management;
- Coordination and control in applying the domestic and international regulations.

5.3.2 National Company Apele Romane

Apele Romane is an operational agent of the Ministry of Water, Forests and Environmental Protection under the General Directorate for Water. Apele Romane is charged with the implementation of the National Water Management Strategy (quality and quantity), and in this capacity, it has responsibilities:

1. administrate the water resources of the country;
2. promote rational use of water resources;
3. protect water resources against pollution;
4. prevent over-use and exhaustion of water resources;
5. control destructive effects of water;
6. coordinate reservoir operation;
7. develop new water management works.

Organisationally, Apele Romane is composed of a headquarters and 12 basin branches. The specific responsibilities of the basin branches include:

a. preparation of river basin management and investment plans in accordance with the strategies issued by the Ministry of Water, Forests and Environmental Protection;

b. administration of investment funds supported by the collected fees that are used to provide economic incentives in the financing of investments;

c. operation and maintenance of the monitoring system of hydrological and water-related information in support of a better understanding in the basin.

5.3.3 Local Public Services Companies

The drinking water supply, sewage, solid waste disposal, central network, street maintenance, real estate and housing, are the responsibilities of the local public service companies set-up at the level of each Local Council. These are mostly autonomous bodies established by the Local Councils to provide public services.

5.4 The Need for Change

There are many reasons why the current raw water pricing system will have to change:

1. Romania's water resources are relatively poor and unequally distributed in time and space, deriving from surface waters—inland rivers, lakes and reservoirs, the Danube River—and from groundwater reservoirs.

   Black Sea water resources; although very important, cannot be exploited for the time being because of technical and economic difficulties in seawater desalination.

   Water resources of inland rivers and lakes are estimated at about 40 billion m^3/year (with an average multi-annual flow of 1,300 m^3/s), of which, in the natural flow regime, only 5 billion m^3/year are utilisable, and, in the actual river training regime, 13 billion m^3/year are available. Taking into account only inland rivers, the specific resource is of about 1,700 m^3/inhabitant/year, a value relatively low compared to endowment levels in other European countries.

   Out of the Danube's theoretical resources, Romania consumes 85 billion m^3/year, but the possibilities of its use in the natural regime are limited because of the river's navigable character. Thus, technically, only 30 billion m^3/year contribute to the water stock that can be used for consumption.

Although in Romania there are about 3,450 natural lakes with a water capacity of 2 billion m^3, these are only of local importance in water management because only 400 million m^3 are fresh water. Because only 12 per cent of the potential resource can be used in the natural flow regime, many reservoirs had to be developed for water volume redistribution in time. Inter-basin diversions for a territorial reallocation of water resources according to local demands had to be developed as well. In 1996, existing reservoirs were storing a total volume of 13 billion m^3 of which 5.5 billion m^3 was useful volume. Taking into account existing and future reservoirs, inland rivers can provide about 25 billion m^3 in a drought year, which represents a maximum limit that cannot be increased through reuse of purified wastewater or by intensifying industrial wastewater recycling through improved production processes.

Groundwaters, generally of better quality than surface waters, are estimated at an available annual amount of 9 billion m^3, of which about 3 billion m^3 can be accessed under existing technico-economic conditions.

Technically utilisable resources can not be used without the establishment of certain significant investments in complex development works in the hydrological basins and in treatment installations because:

- the most important water resource, the Danube river, can not be used but to a small extent, due to its position, at the southern limit of the country;
- inland rivers are unequally distributed over the country, presenting significant areas with insufficient resources and important flow variations in time and space;
- pollution of certain inland rivers exceeds admissible limits, which makes their use difficult and sometimes even prohibitive.

Because of unevenly distributed water resources, some river basins are rich in water resources, with low costs for water supply, and others poor in water resources, with very high supply costs, thus the current uniform water price cannot cover all the required expenses, including capital costs in structural intervention.

2. Strong indication of Romania ’s commitment to comply with the IPPC Directive and with the approximation process in general.
3. Requirement under the Romanian Water Law and the new Government Decision for the reorganisation of the National Company Apele Romane (HG 982, December 1998).
4. The river basin is the natural self-contained unit for water management. Water within the basin should be priced to cover the cost of supply within that basin. Economic pricing will provide correct incentives for water users.
5. The low price of raw water discourages municipal water companies from spending money on leakage control and industry from spending money on water conservation. Higher prices are needed to encourage economical water use in order to restrain increases in demand as the Romanian economy recovers.
6. Flood protection does not confer benefits in proportion to raw water consumption. It is therefore not appropriate to include the cost of flood protection in the raw water price. Unless the government chooses to meet the costs of flood protection itself, the cost of flood protection needs to be recovered from those who benefit, perhaps according to land area.
7. Apele Romane will be expected to recover all of its operating costs.
8. Romania’s application to join the EU requires its legislation conform to that of the EU. The proposed framework directive on water policy requires that water prices should be

sufficient to cover the full economic cost of supply and that, in the long term, there should be no subsidies.

9. Municipal water companies will need to make substantial investments in wastewater collection and treatment and this will require increases in tariffs.

10. Compliance with the drinking water directive will focus attention on raw water quality. Poor quality water needs more expensive treatment and the water suppliers may be reluctant to pay the same price for raw water regardless of its quality.

11. The State is unlikely in future to be able or willing to provide subsidies and support to the water sector, which will have to become self-financing.

12. The current water pricing system contributes to unsustainable water use, leading to a continuous degradation of the water services quality and consequently to the increase of non-paying users.

5.5 Likely problems to be encountered

1. Some assets are multi-purpose. A reservoir, for example may be used for hydropower, flood control and water supply as well as having an amenity value. Methods will be needed to allocate costs between uses and to recover the relevant costs from each user. At present, most of the costs are covered by the raw water tariff and deficiencies are made up by the government. Failure to allocate and recover costs correctly will risk a disproportionate part of asset costs being paid for by water users in supplementary charges.

2. Reconciling the need to keep raw water tariffs down with the need to include the recovery of the costs of new capital investment, and the cost of new regulatory agencies without access to state subsidies, will require large efficiency improvements in the operation of the system.

3. Typically 90 per cent of water costs are fixed and only 10 per cent are variable. Reducing water use will result in tariff increases because fixed costs must be recovered from the sale of a smaller volume of water. The environmental benefits of stopping over-abstraction of groundwater and increasing river flows have an economic value but do not generate cash flow.

4. Failure to collect all revenues due will create serious difficulties. The reason for the current failure to collect debts needs to be investigated. If households cannot pay their water bills then households should receive subsidies from the Social Security budget, and not from other customers who would then have to pay higher tariffs to compensate.

5. Water for irrigation must also be charged at its full economic cost. If farmers cannot pay they should be subsidised from the agricultural budget and not by increasing the water tariff for other users.

6. Efficiency gains take time to achieve. Reorganisation tends to increase costs in the short term before benefits materialise. There will need to be a short transition period and possibly a payment from the government during this period.

7. In the absence of competition for raw water suppliers, there will have to be a mechanism for price regulation.

5.6 Case study: Water pricing in Somes-Tisa river basin

5.6.1 General data

The Somes-Tisa river basin has many specific characteristics compared with other river basins. First, water resources are relatively abundant, with many sectors of rivers polluted as a result of untreated wastewater being discharged. The area of this river basin, Romania's largest, is 22,300 km^2. It is situated in the northwestern part of the country. The river basin comprises, apart from the territories relevant to the Somes and Tisa rivers, the sub-river basins of its tributaries—such as Crasna and Tur. Because of its location, the typical climate is temperate continental. The mean annual temperature ranges between 2 and 4° C in the mountain zones, and 11° C in the plains area. Its forms of relief have large diversity: mountains, hills and meadows with elevations from 70 m to 2,500 m. One of the most important characteristics is related to the long length of its rivers. The Forests in this river basin plays a very significant role in relation to its hydrological, climatic, counter erosion and environmental protection functions. The specific physical and geographical characteristics, including the various forms of relief, represent main elements contributing to the hydrological evolution of the water regime in Somes-Tisa river basin.

5.6.2 Surface and Groundwater Resources

Both surface (rivers and natural lakes) and groundwaters (phreatic and large depth aquifers) represent the water resources. Characteristic of this river basin is the variation in time and space of water distribution—floods occur in spring, produced by the combination of heavy rainfall and melting snow and alternate with long periods of draught. The most severe floods occurred in 1970, 1975, 1981 and 1997.

The multi-annual average volume of flow of the Somes-Tisa River is around 6.05 km^3. The groundwater flow is average in value compared with other river basins: 0.315 km^3/year. In many areas, groundwater quality is influenced by the high contents of minerals and surface water pollutants.

The basin's population, industries and agriculture represent its most important water consumers supplied by both surface and groundwaters of the river basin.

5.6.3 Water Demand

The total water demand for all water users is assessed to be 407 million m^3/ year, of which 158 million m^3/ year is for the population living in urban areas and 10 million m^3/ year for the rural population. The actual registered demand for the water flow required for industrial water supply connected to the public network is 108 million m^3/ year and for those having their own supply sources, 69 million m^3/ year. To this may be added the water needed for livestock breeding (5 million m^3/ year) and for fish farming (57 million m^3/ year).

Within the river basin there are four reservoirs (91.0 million m^3) which ensure the water supply for users located in the Somes-Tisa river basin. The hydropower scheme includes four reservoirs totalling 218 million m^3 of usable capacity, at 501 GWh/year.

The most significant adverse impacts are due to floods, erosion and excess of humidity.

5.6.4 *Water Demand Prognosis*

Water demand was calculated by taking into account a percentage of 0.2 per cent for the yearly increase in population. The evolution of the water demand was assessed based on the restructuring strategies of the main industries, together with the updating of technologies.

Table 5.2: Water demand prognosis

	Actual	*2000*	*2010*	*2020*
Population Inhabitants	1,953,000	1,957,692	1,965,536	1,973,412
Connected to the drinking water network (mil. inhabitants)				
– urban areas	958,259	871,173	942,278	1,074,523
– rural areas	168,000	292,675	485,409	754,830
Domestic consumption				
1/s urban areas	303	4,710	5,341	6,410
1/s rural areas		606	1,256	2,672
% of losses reduction		1	5	10
Water demand (million m^3)				
– population				
= urban			168	
= rural			35	
– industry				
= connected to public network			128	
= own sources			222	
Total 553				

Water demand was adjusted by taking into account the reduction of existing water losses in distribution systems.

5.6.5 *Rationale for Water Pricing in the Somes-Tisa River Basin*

Low water pricing for the past thirty years has resulted in a gap between supply and demand of the order of 15 to 20 per cent of the total water consumption. The reason for this policy failure is that economic planners took neither the full-cost of water, nor the development of the utility industry, into consideration.

A recent expert estimation for the Somes-Tisa river basin total water demand in the year 2010 placed demand at 553 million m^3, with residential demand at about one fourth of this total.

5.6.6 *Methodology*

For a transition economy, resource pricing policies play an important role in sustainable development. Prices, established based on economic, social and ecological criteria, can be an important tool of natural resource management. This study applies the Marginal Opportunity Cost (MOC) pricing approach to analyse the full economic cost for raw water in the Somes-Tisa river basin. The principle of MOC pricing outlines three principal components for the supply of a natural resource: a) marginal production costs; b) marginal user costs; and, c) marginal external costs. The socially optimal price, P, should equal the sum of these components, that is:

$$\mathbf{P = MPC + MUC + MEC}$$

Where:

MPC is the direct cost paid by the resource users in the process of resource production. In the case of water pricing within a river basin, it includes investment and operation costs and added diversion works in the river basin as well as the cost of surveying, planning and monitoring.

MUC is the net gain or loss to future generations that will use the water resources. In the case of water pricing within a river basin, it includes net gain or loss of water resources imposed on the future generation.

MEC is the cost imposed by the resource users on other users or society. External costs are principally included in this component. In the case of water pricing within a river basin, it includes added treatment cost for sewage, added protection cost for water sources and water quality, added cost of the loss of water quality caused by over utilisation or pollution discharge. Various other marginal external costs include depletion costs in the area, downstream costs, construction costs, as well as restoration costs. The main component of MEC is the environmental cost incurred through water supply projects which are not included in current prices. This includes the cost of increased sewage flows, the cost of preserving the quality of the water, and the cost of the loss of water quality caused by pollution.

The adopted methodology takes into consideration:

- Raw water demand for the next 10-12 years. Usually the period should be longer, 20-25 years, but the current budgetary and economic constraints prohibit such long term projections.
- Current incremental costs of water management activities and hydraulic structures maintenance.
- Calculated capital incremental costs of the water management activities and hydraulic structures maintenance.
- Calculated capital incremental costs related to external costs.

In this project, only the MPC is included as the direct cost paid by the resource users in the process of raw water resources production.

From the 1998 reference year, the evolution of the current costs has been considered in relation to the anticipated water demand. (Figure 5.2 and 5.3)

With these elements, the incremental average raw water cost was calculated using the relation:

$$Cmi = \frac{\sum_{t=1}^{T} (R_T - R_0 + I_t)/(1+r)^t}{\sum_{t=1}^{T} (Q_t - Q_0)/(1+r)^t}$$

where:

C_{mi} = incremental average cost

R_T = annual cost for water activities in the year t

R_0 = annual cost for water activities in the base year

I_t = lump-sum development investment cost in the year t

Q_t = raw water demand in the year t

Q_0 = raw water demand in the base year

r = return period

t = time period

The discount rate, r = 12 per cent, is used for calculating the full-cost water price.

Input data is given in the estimation file (Section 5.6.9)

Results:

Actual value of the costs for water management activities: 147,822 million lei

Water volume consumed: 553 million m^3

Raw water incremental average cost: 267.31 lei/m^3

Presented in Figure 2 is the variation of the actual costs with the supplied water volumes and in Figure 3 the influence of the costs on water consumed.

5.6.7 Discussion

This study has been undertaken at this time because the transition resulting from Romania's revolution has induced several changes that warrant an examination of water pricing policies, user demand for improved services and the government's ability to provide improved services. At the local level, service delivery strategies are failing rapidly, and the cost of service provision is rising, while household incomes are falling. Consequently, service levels are falling due to inadequate financing. Finally, several pre-revolution institutions remain in place, impeding the sustainable financing of these services by creating perverse incentives for producers and consumers. Perhaps one of the most serious sector-wide policy problems is that of financial debts due to partial payment by consumers. There are several factors contributing to non-payment by users. First, incomes have fallen in real terms after the revolution while prices have risen. Second, previous incentives and enforcement mechanisms are non-operative. Third, the current approach of using a water price that does not reflect economic reality plays a major role. Several hydraulic structures and water works have deteriorated as a result of lack of funds for proper maintenance and operation.

One of the appropriate measures to remediate these situations is the introduction of a differentiated water prices in each river basin.

The 1998 raw water price is much lower than the full economic price calculated in this paper. In order to compensate for the full-cost of raw water, its price should be raised.

The water price must incorporate social, economic and ecological considerations. The analysis considered only the economic factors. The principle of marginal cost underlies the water pricing policy of the Somes-Tisa river basin study. Moreover, current costs and capital costs were taken into account.

The resulting water price is 267.31 LEI/ m^3 compared to 67.72 LEI/ m^3 which is the current raw water price for the whole country.

5.6.8 Policy Implications

The price reform should be gradual/incremental.

Raw water tariffs should calculated to cover:

- Operating costs of National Company Apele Romane
- Capital charges associated with water resources and supply infrastructure

- Operating costs of flood prevention and protection
- Capital charges associated with flood prevention and protection infrastructure

In the short term, price should be raised, at the minimum, to a level which covers the full economic cost of provision.

In the long term, it is undesirable that flood prevention costs should be included in the water tariff since the benefits of flood protection do not correlate with raw water consumption. In the short to medium term, flood protection costs will either be included in the raw water tariff or paid directly by the state, but the accounts for flood prevention and protection should be presented separately from those for raw water supply.

In the long run, user costs and the environmental costs of exploiting the resource should also be included in the raw water price:

- Differential pricing is permissible between users as long the price reflects real differences in the cost of supplying water to different users. These differentials will be essential incentives for developments with a large demand for water in basins with abundant supplies and low costs, rather than in basins of shortage, and correspondingly high costs.
- The raw water price reform should be integrated into the economic reform as a whole and should be adjusted in accordance with piped water price reforms.
- Research may be carried out to ensure that water prices reflect the varying costs to different users of extraction from a particular source, distribution system and sewerage system. In addition, alternative methods of recovering the cost of flood protection need to be developed, possibly through land or property taxes.

5.6.9 Estimation File

Here are estimates of cost inputs to determine the water price in the Somes-Crasna-Tisa river basin (as established by National Company Apele Romane Branch Cluj):

mil. lei

1.	Materials expenditures	6,306
2.	Energy costs	1,185
3.	Current maintenance and capital repair spending	3,965
4.	Publicity costs	500
5.	Depreciation spending out of which	5,500
	• public patrimony	4,240
6.	Other costs	4,050
A.	**TOTAL MATERIAL EXPENDITURES**	**21,056**
B.	Salaries and salary-related expenditure	24,076
C.	Reduced spending in relation to revenues from other activities	-6,205
TOTAL	**PRODUCTION EXPENDITURES**	39,377
D.	Risk expense for the prevention and abatement of natural phenomena 5 per cent of production expenditure (could be considered insurance-reinsurance premium	1,969
E.	Development fund (15 per cent of production spending)	5,907
F.	Concession spending 1 per cent of the value of public patrimony	2,049

TOTAL EXPENDITURES		49,302
G.	PROFIT 10 per cent	4,930
TOTAL		54,232
H.	Water volume contracted in 1998	413,380 thousand m^3
I.	Water cost price (m^3)	131.20 LEI
J.	Selling price (including VAT) (m^3)	131.5 x 22 = 160 LEI
RAW WATER PRICE RECAPITULATION		
	Effective Costs	33,877
	Development Fund	7,167
	Water Fund	6,289
	Profit	4,930
	Risk Fund	1,969
TOTAL		54,232
K.	Water Price Structure	
	Effective expenditures	62.5
	Funds	37.5
L.	Water Fund	
	Public patrimony liquidation	4,240
	Public patrimony concession 1 per cent	2,049
	Penalties	400
	Licenses/permits according to Law 107/1996	300
TOTAL		6,989

Methodology using two-level pricing of water

$P = Pc + Pv$ [LEI/m^3]

$Pc = f(Qmax\ aut) = Cc/SVaut$ [LEI/m^3]

$Pv = f(Qef\ prelevat) = Cs/SVp$[LEI/$m^3$]

where

Cc = water management expenditures which do not have direct influence on the actual water abstraction

Cs = water management additional expenditures for the actual water abstraction

Vaut = maximum licensed volume

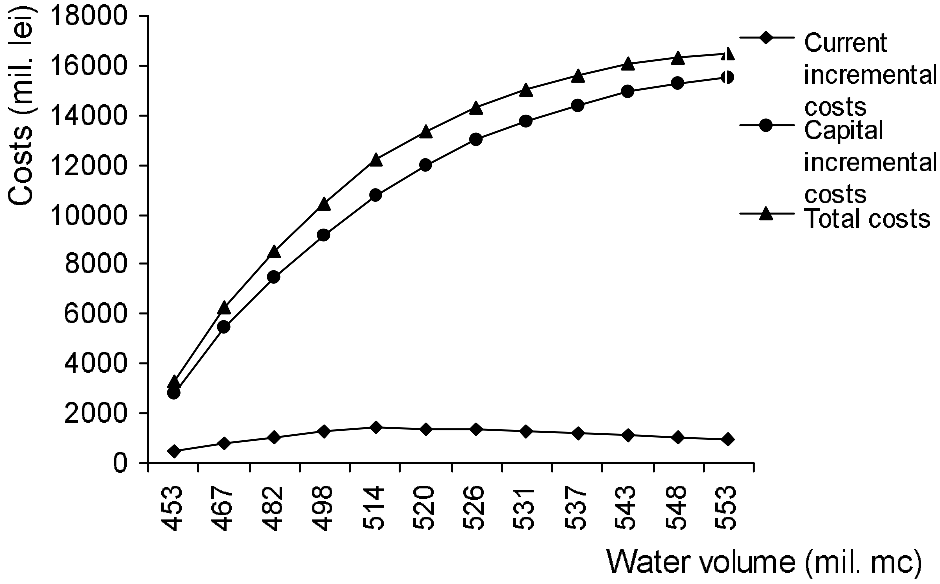
Vp = actual volume abstracted

As an assessment of the significance of two terms:

$Pc = 0.75\ P$

$Pv = 0.25\ P$

Figure 5.2: Actual costs change with supplied water volumes



Calculated marginal costs

Year	*Current Incremental costs (mil. lei)*	*Incremental costs for capital (mil. lei)*	*Total incremental costs (mil. lei)*	*Total incremental costs at present value (mil. lei)*	*Incremental consumption of raw water (mil. m³)*
1	462	2802	3264	3264	15
2	898	6093	6991	6243	29
3	1351	9356	10707	8533	44
4	1818	12876	14694	10462	60
5	2300	16963	19263	12251	76
6	2465	21067	23532	13343	82
7	2633	25641	28274	14335	88
8	2802	30424	33226	15018	93
9	2973	35585	38558	15577	99
10	3146	41299	44445	16045	105
11	3280	47316	50596	16292	110
12	3414	53935	57349	16459	115

$$p = \frac{147822}{553} = 267{,}31 lei / mc$$

$$V = 438 + 115 = 553 mil.mc$$

Chapter VI: Water Services Tariffs in the Municipality of Satu-Mare

6.1 Introduction

The supply of urban environmental services becomes the exclusive domain of local governments. Local governments are responsible for matching the supply of local services with households' demand for these services. Unfortunately, at the local level, service delivery strategies are failing rapidly. The cost of service provision is rising, while household incomes are falling. In addition, the role of the central government in funding and directing local services is diminishing as reforms proceed. Consequently, service levels are falling due to inadequate financing. Finally, several pre-revolution institutions remain in place, which are impeding the sustainable financing of these services by creating perverse incentives for producers and consumers.

Finished water is supplied by municipal water supply systems. Municipalities buy raw water from Apele Romane, treat the water, difference the price 10 to 100 fold, and supply it to households or other users. As households characteristically are not metered, charges to residential users are based on the number of inhabitants in each residential unit. Water prices were very in the past: drinking water prices at the end of 1977 for most of the country ranged between 300-8,000 Lei/m^3 and 1,400 Lei/m^3 in Bucharest. In 1999, the water price may be between 1,500 (Bucharest) and 6,000 lei/m^3 (Petrosani). Generally, in each locality the degree of metering is between 30 to 50 per cent. Usually, water delivered to each household is not metered. The level of metering is very low and varies from locality to locality. Taking into account the latest changes in water policy, metering activity becomes a priority. At present, revenues cover the costs for the maintenance and operation of drinking water systems and a very small part of development costs.

6.2 Survey on consumer demand and preferences

Providing water services, the Autonomous Community Authority Satu Mare (RACSM) is a countywide utility, which purchases raw water from Apele Romane, the national raw water producer. RACSM treats the water and sells it locally to consumer associations, directly to consumers, to industry or to the hot water utility. By law, RACSM must price its water to cover its variable costs of production in addition to which it is allowed to add five per cent for profits.

A major information input required in developing the final recommendations for the water pricing policy is how coverage is likely to vary in different river basins with different water prices and tariffs. Water consumers were polled on how much they are willing to pay (WTP) for the amount of water they consume. The information was obtained through WTP surveys. The respondents included planners, households, industrial water users, and agricultural water users.

First of all we interviewed a random sample of officials at the Ministry of Industry and Trade (MIT), the National Privatisation Agency, (NAP), the State Ownership Fund (SOF), the Chamber of Commerce and Industry (CCIR), The Romanian Register of Commerce, (RC), the Ministry of Water, Forests and the Environmental Protection (MWFEP) the national raw water producer

(Apele Romane), the National Company Apele Romane branch Satu Mare, the Bucharest Environmental Protection Agency (EPA) and National Commission for Statistics (NCS).

During the second phase, the questionnaire asks individuals for their opinion on particular questions related to water services and water-pricing policy, and to identify what would happen if the water price were raised, maintained or lowered.

The questionnaire was distributed to 200 people living in the municipalities of Satu Mare and Bucharest. Responses were received from 71 per cent of total surveyed population.

6.3 Satu Mare Water supply system

The drinking water demand for Satu Mare City is supplied from groundwater located in the Somes river basin using the following intakes:

- Gradina Romei—made of 8 medium depth wells with a designed capacity of 100 l/s and a headrace water conveyance of 1.1 km;
- Martinesti-Noroieni-Micula water withdrawal front with 64 medium depth wells, a designed capacity of 1300 l/s and headrace water conveyance of 26.161 km.

The treatment of raw water is realised through deferrisation and demagnetisation at two wastewater plants:

- Gradina Romei water treatment plant with a capacity of 100 l/s including: aero-tanks, filters, chlorinating plants and a pumping station;
- Martinesti water treatment plant with a capacity of 1,300 l/s including: aero-tanks, filters stage I and II, chlorinating plants, a recycling station for industrial waste water, a water-air pumping station for filter washing, and two pumping stations for water treated in the network.

The storage of treated water and maintenance of fire-fighting water storage are done in storage tanks with a total volume of 45,000 cubic metres: 31,000 cubic metres at the Martinesti water treatment plant, and 4,000 cubic metres at the Gradina Romei water plant.

The transport-distribution network for drinking water is a circular system with a total length of 167.7 km with 22 km of trunks and 145.7 km of water supply networks.

Table 6.1: Structure of water distribution in 1997

Water supply networks age (years)	*Length (km)*
1 to 7 years	15.1
7 to 15 years	29.9
15 to 25 years	85.3
25 to 35 years	4.1
over 35 years	33.3
Total	167.7

Table 6.2: Structure of production costs in 1997

Cost elements	*Water* %	*Sewage and Purification* %
Raw water	2.6	-
Taxes of Romanian Water Authority	-	2.2
Materials	4.9	4.0
Fuel + natural gas	2.3	2.6
Transport, supplies	1.3	2.2
Electric power	49.6	28.2
Depreciation	4.1	6.8
Salaries	15.9	24.3
Insurance and social protection	4.9	7.5
Charges for third parties	4.8	2.8
Maintenance and repairs	4.5	10.9
Other charges	5.1	8.5
TOTAL	100.0	100.0

According to Table 6.2, raw water acquisition represents only 2.6 per cent of the total production costs of the Water Services Company.

To develop its environmental services, Satu Mare Water Authority has developed a long-term strategy for gradual improvements until the year 2005. The application of this strategy will lead to the modernisation and development of both the water supply system of Satu Mare City and of the intake and wastewater treatment system.

6.4 Consumer Preferences

The basis for the new water service strategies should be consumer preferences since ultimately consumers will have to pay, through higher user fees and local taxes, for improvements in the existing system.

From the respondents we obtained information on: 1) respondent's attitudes with regard to water supply services and full-cost water pricing policy, and 2) consumers' preferences, and willingness to pay for improvements in these services. This information was then analysed using a variety of statistical techniques.

The survey revealed that the average family consists of three members (sample mean = 2.9). In the average household, there is one member employed full-time (sample mean = 1.6) earning an average income of 1,150,000 Lei ($100) per month. From the sample, 85 percent were employed, 11 percent were either self-employed or in the private sector, 4 percent were students.

Through the contingent ranking and valuation components of the survey we asked several questions regarding the improvement of currently inadequate services, and to what level consumers are willing to pay for these improvements. The questionnaire also included questions related to institutional reforms and users' attitudes to the water sector and its policy-makers.

6.4.1 The Questionnaire Model

The questionnaire used in this study is reproduced below:

____

This questionnaire asks your opinion on several issues that relate to the water sector in Romania. Please think thoroughly about each question and then give your best answer. Your sincere responses will help the planners and policy makers in identifying the best alternatives for a water sector financing strategy.

1. From the following list, check two options of what you think is the most important goal for the water sector in Romania for the next ten years:

   1. ______should the government be involved
   2. ______eliminate government subsidies
   3. ______democratise and strengthen the capacity of water-sector institutions
   4. ______decentralise the sector
   5. ______ improve the infrastructure and the quality of water service
   6. ______ privatise the water sector
   7. ______ reduce losses within the distribution network

2. From the list in question 1) above, write the line number for what you think is the second most important goal for the water sector in Romania in the next ten years: __________

3. In designing water prices, do you think that water should be treated more like an ordinary "economic good" such as clothing and food, or more like a "special commodity" which requires special principles for determining its price?

   _____ Yes, it is like an ordinary economic good

   _____ No, it is special commodity that requires special pricing principles

4. As the economy of the country improves, what goal should be set for the amount of subsidy that the government provides to the water sector? Should the government subsidy cover (check one)?

   a._____ much more than half the total cost of water supply
   b._____ about half the total cost of water supplies
   c._____ less than half the total cost of water supply

5. Municipal, agricultural and industrial wastewater can cause pollution. In setting the water prices for cities, industries and farms, should the tariffs cover (check one):

   a._____ both the cost of the water and pollution control, or

   b._____ only the cost of the water. The cost of pollution control should be charged in a separate bill.

6. Suppose that the same water system of a city serves both household and industrial customers. As a matter of principle, should the price of water be (check one):

   a._____ about the same for industries and households
   b._____ higher for industries than for households
   c._____ lower for industries than for households

7. What is the optimal frequency for reading water meters and sending water bills to domestic and industrial customers (check one);

   a._____ once every month

   b._____ once every two months
   c._____ once every 3 to 6 months
   d._____ once per year

8. What is the optimal frequency for reading water meters and sending water bills to irrigation users (check one);

   a._____ once every month
   b._____ once every two months
   c._____ once every 3 to 6 months
   d._____ once per year

9. Which of the following two basis for water tariffs is preferable for households?

   a._____ one that charges a certain amount for each cubic meter of water
   b._____ one that charges a certain amount each month per household

10. As a general principle, water prices should primarily cover (check one):

    a._____ the costs of water service such as collection, pumping, treatment, transport, and distribution
    b._____ the above costs of water service plus the costs of administration at the national, and basinal levels
    c._____ the above costs of water service and administration plus the value of water as a natural resource

11. For the irrigation sector, which level do you think should play the primary role in setting prices? (check one):

    a._____ national level
    b._____ basin/user/association level

12. For the municipal and industrial sector, which level do you think should play the primary role in setting prices? (check one):

    a._____ national level
    b._____ municipal/user/association level

13. Should power generation, navigation and irrigation users be supplied water free of charge or should they have to pay for water (check one):

    a._____ water should be free
    b._____ they should have to pay for water

14. Should water revenues be allocated to the units that provide water service (check one):

    a._____ on the basis of fixed percentages
    b._____ on the basis of water-related costs incurred by each unit

15. There is a hypothetical choice of proposing a higher water price for domestic use. How much are you willing to pay above the existing level of water services to get an improved water service in your house?

a.______2,500 Lei/m^3
b.______3,000 Lei/m^3
c.______3,500 Lei/m^3

16. For you as a customer, what are your main dissatisfactions: (check three)

a._____poor quality water services
b._____high water price and tariffs
c._____tourism decline and tax revenues fall
d._____lack of actions on improvements in service levels
e._____inadequate institutional services

17. What is your occupation?

a._____worker in a factory
b_____engineer
c_____retired
d_____housewife
e_____clerk (office)
f_____student
g_____government

18. What level of education have you attained?

a_____high school
b_____university

19. Have you ever enjoyed the following activities in or near the river?

a._____fishing
b_____swimming
c_____boat

20. Are you satisfied with the current water price

a._____Yes
b_____No
c_____I do not know

21. What level of water service improvements do you want to see in the future?

a._____Cold water supply
b_____Hot water supply
c_____Solid waste disposal
e_____ I do not know

22. What do you like to do in order to improve rational water use and diminish losses.

a._____I shall be more aware of related information

b_____ I shall try to reduce household wastewaters

c_____ I shall actively participate in environmental activities.

e_____ I do not know

6.4.2 Results of the Survey

About 30 per cent of the respondents marked the options of questions 1 and 5. The respondents indicated the top two priorities for the water sector in Romania during the next ten years. The options included government involvement and the need to improve the infrastructure and the quality of water service. The results are in the following table.

Question	Percent	Rank
Government involvement	29	1
Eliminate Subsidies	7	5
Democratise water institutions	7	5
Decentralise the sector	10	4
Ameliorate infrastructure	28	2
Privatise the water sector	2	6
Reduce losses	17	3

The column marked "Percent" indicates the frequency distribution of checks. For example, 7 per cent of all the check marks were for eliminating subsidies. The column marked "Rank" ranks the items according to the frequency of check marks. For example, eliminating subsidies had the fifth highest number of check marks. In Romania, water prices for industries are consistently higher than those for households. This probably derives from the common belief that households are poor and need to be cross subsidised by industry and that government's role is to ensure provision of such subsidies. The lowest priorities were to privatise the sector.

- On water pricing attitudes, most of the respondents generally accepted pricing principles apply or that water is a "special good" for which special pricing principles are needed; 90 per cent said water is a special good.
- When asked (question 5) whether water prices for cities and industries should include a component for pollution abatement or whether pollution costs should be charged separately; about two-thirds of the respondents said the water price should cover pollution control and only one-third thought that pollution should be covered separately.
- This was confirmed in a separate question about what should be "covered" by water prices. Every individual who was separately interviewed discussed the need to charge a price for "water as a natural resource."
- When asked what should be covered by water prices: cost of service, or cost of service plus administration, or cost of service plus administration plus the value of water as a natural resource, 90 per cent of respondents specified the latter (question 10 c).
- The highest willingness to pay for water rests with industrial users.
- The questionnaire asked about volumetric and flat rate prices for households: which are preferable? About 80 per cent of respondents said volumetric, and 20 per cent said flat rates.

6.5 Concluding Comments

- Many of the attitudes are rational and project optimism for the water sector in Romania, such as preferring volumetric prices over flat rates, expecting willingness to pay for water to be highest in the industrial sector, and preferring water revenues to be allocated on the basis of costs.
- There are obstacles to a targeted metering programme in Satu Mare. There are, however, substantial institutional and financial obstacles to implementing pricing using meters. The current institutional setting presents several obstacles to the introduction of a metering programme. First, an improved metering programme would require the utility to significantly expand its capacity by requiring it to read and maintain the meters, set performance standards for meters and implement a billing process based not on buildings or complexes, but on either staircases or individual households. Second, if the utility were to take on these responsibilities, the role of the building or complex manager as a mediator between the utility and the consumer would need to be reconsidered.
- To install meters in either households or staircases will require surmounting engineering and cost constraints. The ability of consumers to meet these costs is questionable given the utility's inability to bear additional debt and the low incomes of the population.

Chapter VII: Water Costs And Trade Competitiveness: A Synthesis Of The "Trade And Environment" Literature

7.1 Introduction

This section of the paper reviews key literature that is relevant for answering the following question: *What is likely to be the impact of higher water costs to industry and agriculture on trade competitiveness?* This literature is intended to provide information on when higher water costs are likely to have an important impact on competitiveness and to provide insight into appropriate methods for addressing this question in detail for relevant industrial and agricultural sectors in Romania.

To begin this review, it is first necessary to be clear on a *concept of competitiveness* and the components of water costs relevant for the Romanian economy. In theory, the impact of any price or regulatory change on competitiveness can be defined as the effect of the policy change on net exports, holding real wages and exchange rates constant (Jaffe, et al. 1995). While this definition of competitive impact has not really been used to address the impact of past policies on past competitiveness, as Jaffe et al. (1995) note because of data limitations, it is clearly possible to use this criteria to evaluate/simulate the effects of future policy changes on future net exports (see, e.g., Smith and Espinosa 1996; Lueck, et al. 1995). Thus, for the purposes of this study, the focus will be to evaluate the likely impacts of higher water prices on net exports.

Given this notion of competitive impacts, it is next necessary to be clear about how government policy directly alters water costs and then how these changes affect net exports of specific commodities. From the perspective of an enterprise, it is possible to disaggregate industrial and agricultural water use (hereafter called industrial water use) into four components:

- raw water intake to an enterprise:
- treatment of water by the enterprise prior to use;
- recirculation of water within the enterprise; and
- water discharge by the enterprise to a receiving water body or sewer system.

As noted in previous chapters of this paper, Apele Romane currently permits quantities of water allowed to be used by enterprises and charges for raw water based on source (e.g., groundwater, inland surface water, and Danube water) and users (industry, energy, agriculture, and public water supply companies). While in theory the price that Apele Romane charges to industry should reflect delivery costs as well as environmental costs associated with water abstraction from the water body, the enterprise paying the water bill just considers this water price to be the same as the price of any other factor of production.

Thus, this section surveys relevant literature that investigates how higher input costs (water, energy, others) affect input use, output supplies, and net exports.

Apele Romane also regulates water discharge into natural water bodies through a combination of quantity and quality restrictions (e.g., 1,000 m^3 discharge per period with an average quality of 'x' mg/l of total suspended solids). Recent policy changes indicate that Apele Romane will continue to control raw water prices, within the hoped-for constraints of a publicly regulated monopoly, while the MWFEP will become more directly responsible for water discharge/pollution policy.

These costs related to water discharge (both quantity and quality) are clearly perceived as regulatory 'environmental' costs by industry. These regulatory costs, depending upon how implemented, are likely to raise total production costs in short run. As a result, profits, input use, output supplies, and net exports will change. This more general question of overall environmental regulatory costs and net exports are addressed to varying degrees in portions of the 'trade and environment' literature. *The last part of this chapter surveys the relevant 'trade and environment' literature for additional guidance for the Romania study.*

While government policy directly affects water entering and exiting an enterprise, within the enterprise, treatment and recirculation are enterprise decisions that government policy does not directly effect. Nonetheless, policies that affect intake or discharge will affect incentives for treatment and recirculation. Depending on production technologies and relative costs, industries may also be able to mitigate the impacts of higher intake or discharge costs through altering treatment and recirculation within the enterprise.

7.2 Higher inputs costs, output supply, and net exports

At a basic level, raw water is an input to production just like any other variable input. When faced with higher input prices, enterprises can be expected to adjust levels of inputs, outputs, and as a result net exports, depending on substitution possibilities as well as input and output market structures. By how much is the relevant question.

The general economic literature on modelling input demands and output supplies, often using an econometric approach for estimating relevant parameters, provides clear guidance on how it is possible to proceed to empirically respond to these questions. These results can then be used in partial or more general equilibrium models for policy simulations.

For example, Renzetti (1992) and Babin, Willis, and Allen (1982) provide two relevant examples on how to model industrial water demands directly, while there is a vast literature modelling agricultural water demands. The main purpose of such studies is to estimate-input demands and related price elasticities.

As will be shown in methodology section of this report (Chapter VIII), these water demand elasticities provide one key piece of information for addressing the impact of higher water costs on production and net exports.

Since the methods used in these industrial and agricultural studies are essentially identical except for function forms and related econometric details, the Renzetti (1992) and Babin, Willis, and Allen (1982) are discussed here. Renzetti (1992), based on Canadian manufacturing data, focuses on estimating water demands for Canadian manufacturing enterprises, where 'water' is disaggregated into the four components outlined above.

It is assumed that water inputs are separable from other inputs in the production function, which essentially implies that the four water inputs can be aggregated as total water input into the final production function. This assumption is important because it allows Renzetti (1992) to estimate the water input demands based directly on the four water-input prices and output levels (using the assumption of cost-minimisation). This simplifies greatly the amount of data that needs to be collected and developed (all other input and output prices can be ignored).

Renzetti (1992) estimates own-price elasticities for water intake in the range of -0.15 to -0.58. In other words, for a one-percent increase in water intake price, it is expected that enterprises would reduce water demand by about 0.15-0.58 percent.[1] Pulp and paper enterprises, which are relatively high users of water, had the highest water demand own-price elasticities. Renzetti (1992) also found that water intake and water recirculation are substitutes in the production process. Thus, a higher intake price, which reduces water intake, creates appropriate incentives to increase water recirculation in the enterprise.

Babin, Willis, and Allen (1982) complete essentially the same analysis as Renzetti (1992), except that they consider total water as a production input but include other inputs into their analysis (water, capital services, production employees, and non-production employees. While the water demand own-price elasticity was estimated at -0.56, cross-price elasticities were also estimated.

Most importantly, because water costs as a share of total costs were quite low, the impact on other inputs (e.g., capital) for higher water costs was estimated to be modest, while water demand responded more strongly to higher prices for other inputs such as capital. For example, the elasticity of capital services with respect to water price was -0.14, but the elasticity of water demand with respect to capital price was -1.11. Higher water costs were estimated to have almost no impact on labour use.

While these water demand studies are adequate for estimating demand elasticities related to input prices and the target output level, they do not provide enough information to evaluate how industrial output levels would be expected to change.[2] To date, the authors have not found a study of industrial water demand that evaluates water demand within a profit-maximising framework, although such analysis probably exists.

While there are several articles for U.S. agriculture that estimate water demands within a complete profit-maximising framework with multiple outputs and inputs, perhaps most relevant for this study is the research on agricultural trade policy modelling with environmental taxes. Lueck, Haley, Liapis, and McDonald (1995) provide a concise review of several relevant studies related to EU fertiliser policy reform (i.e., the EU Nitrate Directive and nitrogen taxes).

These models are mainly partial equilibrium trade models based on systems of net output supply equations, equilibrium conditions for world market clearing, and supply elasticities taken from a variety of sources. While inputs, such as fertiliser and water, are not incorporated directly into the main model (e.g., USDA's model called SWOP-SIM version ST-86), various authors have created related input models that can be linked to the agricultural commodity trade models.

For example, Garcia and Randall (1991) provide a simple yet reasonable approach to evaluating the impact of environmental policy (a tax on nitrogen) on net exports. Garcia and Randall (1991) first estimate a system of input demand equations using the same method as discussed above in Renzetti (1992) and Babin, Willis, and Allen (1982). Then, based on the estimated cost function, it is possible to calculate the relative elasticities between nitrogen price and output levels. As a result, Garcia and Randall (1991) estimate the 'shift back' in the output supply function due to a higher nitrogen price using the assumption of profit-maximisation (so that marginal cost equals output price). These fertiliser-price-induced output changes are then reintroduced into the

[1] Renzetti (1992) also summarizes the results of several other earlier studies that estimate industrial water demand elasticities. These studies, which focus on total water demands, also found that water demands are inelastic to water prices with elasticities in about the same range as reported by Renzetti for water intake.

[2] Unfortunately, Renzetti (1992) does not report all parameter estimates directly in the report. As a result, the impact on water use of higher output levels cannot be calculated directly from the data reported although in principle, for the translog cost function case, the input demand elasticity with respect to output level can be calculated as $\eta_{xY} = \beta_I/S_I + \eta_{CY}$, where β_I is the parameter estimate on the term $\ln P_I \ln Y$ in the translog cost function, SI is the intake water cost share in total water costs, and hCY is the elasticity of cost with respect to output. The Babin, Willis, and Allen (1982) article assumes the cost function is linear homogenous in output Y, which implies that $\eta_{xY} = 1$.

SWOP-SIM (version ST-86) framework to look at impacts on world agricultural commodity markets.

Summarising, the basic theoretical and empirical methods used in the studies summarised here, based on partial equilibrium models and assumptions of cost-minimisation and profit-maximisation, provide clear conceptual guidance on practical approaches to modelling the impact of higher water prices on net exports of industrial and agricultural products.

It is of course possible to move from partial equilibrium to more general equilibrium approaches. For example, the vast literature on general equilibrium modelling of energy prices and carbon taxes provide directly relevant examples on how to evaluate the impact of higher water costs on input demands, output supplies, and in some cases net exports.

For the most part, these econometric studies related to energy prices, such as Jorgenson and Wilcoxen (1993) for the U.S. economy, are founded on similar frameworks as used into the industrial water demand studies summarised about. In these aggregate economy models, inputs are often defined as capital services, labour, and everything else (intermediate inputs). In principle, water is part of intermediate inputs.

As a result, the economy wide impacts of higher water costs to industry could be evaluated in two steps: identifying how higher water costs would increase the price of intermediate inputs, and then how changed prices for intermediate inputs would alter the equilibrium results of the model. Jorgenson and Wilcoxen (1993) show that higher energy prices could have important impacts on the U.S. economy's growth (and presumably net exports although the information is not provided in this study directly).

Of course, energy costs are an important share of overall production costs for many sectors of the economy, while water costs are not.[3]

7.3 Environmental regulations and trade competitiveness

While Section 7.2. provides a brief survey of literature that directly evaluates the impact of higher water costs (or other input costs) on inputs, production, and net exports, there is also a large literature more directly linked to the 'trade and environment' debate. At the risk of over simplifying, it is for-the-most-part possible to divide the literature on trade and the environment into three general categories.

The *first* category of literature focuses on the impact of trade, and especially more open trade regimes, on the consumption of natural resources and the pollution (see, e.g., Low, 1992;). The research on 'pollution havens' and international location of dirty industries as well as research on the shape of the 'environmental Kuznets' curve' is essentially a subset of this literature.

A *second* category of literature focuses mainly on the role of trade policy for meeting environmental policy objectives (see, e.g., Anderson, 1996; Barrett, 1990). Here the focus is mainly on global externalities, international environmental agreements with trade-related provisions (e.g., CITIES, Montreal Protocol, etc.), GATT, and the possibility of anti-trade groups using environmental issues to justify additional trade barriers (see, e.g., GATT, 1992).

A *third* category of literature attempts to focus on evaluating the impact of domestic environmental regulations on international competitiveness (see, e.g., Jaffe, Peterson, Portney, and Stavins, 1995; Dean, 1992, U.S.O.T.A., 1992). Given the first objective of this project-to analyse international competitiveness effects of full-cost water pricing, this third category of literature is

[3] The main constraint to implementing such approaches in Romania at this time are data and time. In principle it could be possible to adopt existing 'generic' computable general equilibrium (CGE) models. This remains difficult and time consuming work as well.

useful for this study. A concise summary of the main state of knowledge on the general topic can be found in Smith and Espinosa (1996, p.20), who write that:

"We have learned, as a result of the research to date, that domestic environmental regulations will either increase or decrease the international competitiveness of the products traded by the country undertaking them".

This conclusion on the state of knowledge reflects to some large degree the fact that these 'trade and environment' studies do not actually address the same question. For example, Jaffe, et. al (1995) note that, while they could find over 100 articles potentially relevant for addressing these topics, the main problem was that the studies did not ask the same question or even address similar problems. As a complement to the Jaffe et al. (1995) point, Smith and Espinosa (1996, 20) emphasis that the details matter, especially each country's situation in relation to world markets for major commodities matters, so that clear cut conclusions cannot usually be made.

The basic concern within this literature is to evaluate whether costs related to environmental regulations can influence the relative competitiveness of economies as a whole and various sectors. The basic idea is that if environmental regulatory costs affected competitiveness, this loss of the competitiveness should be reflected in, for example, declining exports, increasing imports, and a long-term movement of manufacturing capacity to other countries.[4] Several studies have attempted to investigate these general concerns by analysing if: (i) there are differences of trends in net exports between highly regulated industries relative to lightly regulated industries; (ii) production of highly regulated industries moves abroad to less regulated countries; and (iii) whether basic indicators such as productivity are adversely affected in highly regulated industries.[5]

To date that is a large literature focused on such questions. In fact, it is almost possible to complete a literature review just on the articles that review the literature. For example, the literature review by Dean (1992) summarises her review as follows:

More stringent regulations in one country are thought to result in a loss of competitiveness, and perhaps in industrial flight and the development of pollution havens. The many empirical studies that have attempted to test these hypotheses have shown no evidence to support them.

Other reviews have reached the same conclusions. A recent OECD (1996) volume summarising a symposium on trade and environment concluded:

Empirical studies shown that the costs of pollution are a small part of total costs in most sectors and that nearly all the OECD countries have introduced similar environmental measures at roughly the same time. Environmental measures have not been the source of significant cost differentials among the major competitors and have had minimal effects on overall trade between OECD and non-OECD countries.

Lastly, the recent review by Jaffe et al. (1995) reaches the same conclusion:

We assess the evidence and find that there is little to document the view that environmental regulations have had a measurably adverse effect on competitiveness. Although the long-run social costs of environmental regulation may be significant, including adverse effects on productivity, studies attempting to measure the effect of environmental regulation on net exports, overall

[4] Environmental regulations impose constraints on industry's choice of enterprise location, technologies, product and activity design, production capacity. Industries face investment allocation and operating funds to reduce environmental impacts and meet regulatory requirements. It is possible that stringent environmental regulations may lead enterprises to develop new less polluting and more efficient products and processes. Such innovation may give firms that respond creatively to environmental regulations a competitive advantage over others. These ideas have been expressed, for example, by Porter and van der Linde (1994) . Jaffe et al. (1995) find little evidence to support such ideas.

[5] The link between environmental regulations and competitiveness in principle could be significant and could differ from country to country. For example, it seems that there is a potential for an effect due to differences in the regulatory stringency between US and other countries. According to the US Environmental Protection Agency, the annual cost of complying with environmental regulations administered by Environmental Protection Agency will be nearly 2.6 percent of U.S. GDP by the year 2000. However, some available data suggest that in other high income economies, such as Germany, regulatory costs are comparable to those imposed on US firms.

trade flows, and plan location decisions have produced estimates that are small, statistically insignificant, or not robust.

Gray and Shadbegian (1993) provide one detailed attempt to investigate the pollution- haven hypothesis within the U.S.. The study evaluates whether differences in the stringency of environmental regulations across states within the United States has had a measurable effect on the investment decisions.

Even in the industries with relatively high compliance costs, environmental regulations had no significant impact on the direction or magnitude of investment flows.

This empirical result is also consistent with the results in Panayotou and Vincent (1997), based on a survey of major business leaders (as part of the World Economic Forum). In this survey, which basically asked business executives their opinions on their investment decisions, concerns about environmental regulatory costs ranked about 17th in overall importance, far behind the obvious concerns about investment climate, ownership, political stability, exchanges, labour laws, etc.[6]

Repetto (1995) provides another way to look at the general issue. The basic idea is that if environmental regulations affect competitiveness then foreign direct investment in pollution intensive sectors should account for a larger share of foreign direct investment from countries with stringent environmental regulations today than it did in the 1960s or 1970s. Repetto (1995) showed that the reverse is true. He concluded that to the extent that "greener" countries seem to be exporting their "dirty" industries, they are predominantly sending them to each other, not to developing countries with weaker regulations.

In 1995, only 5 per cent of US direct investment in developing countries was in pollution-intensive sectors compared to 24 per cent in developed countries with equally stringent (compared to the US) environmental regulations.[7]

If environmental regulations affect competitiveness, net exports should be systematically lower in industries subject to more stringent regulations. Kalt (1988), however found no statistically significant relationship between changes in net exports and changes in environmental compliance cost across 78 US industries during 1967-77.

Similarly, Tobey (1990) found that environmental stringency in five pollution-intensive sectors in other countries had no statistically significant relationship with net exports.

In a more recent study, Grossman and Krueger (1993) found that pollution abatement costs in the US have not affected US imports from Mexico.

If this is the case with Mexico and the US, which share a long common border, have a large volume of trade, and have substantially different environmental standards it is unlikely that environmental regulations have a significant impact on net exports in other cases either.

[6] Another empirical test of the pollution-haven hypothesis is found in Wheeler and Mody (1992), who conclude that multinational firms base their investment decisions primarily on labor costs and market access while corporate taxes rates and, by extension, environmental control costs played little or no role.

[7] A report of World Bank reviewed, for the period 1970 to 1990, the trends in world trade for those industries that spent most to comply with environmental regulations, such as pulp and paper, petroleum products, fertilizer, wood manufactures. The report concludes that international competitiveness is not affected by higher environmental standards (Repetto, 1995).

Table 7.1: Effects of environmental regulations on net exports

Study	*Period of analysis*	*Industrial scope*	*Geographic scope*	*Results*
Grossman and Krueger 1993	1987	Manufacturing	US-Mexico Trade	Insignificant
Kalt 1988	1967-1977	78 Industry categories Manufacturing	US Trade	Insignificant
		Chemicals		Significant
Tobey 1990	1977	Chemicals, Steel, Mining, Paper Metals		Insignificant

While trade and environment literature provides some good overviews on the basic issues and results related to environmental regulatory costs, exports, and foreign investment, the literature does not provide clearly useful methodological approaches for evaluating in detail the impacts of a specific environmental policy change (such as the focus for the Romania study on higher raw water and discharge costs) on specific industrial exports. In sum, the general trade and environment literature suggests at the outset that the impact of higher water prices on net exports is likely to be modest. The methods used in the literature surveyed in Section 7.2. can be used to estimate such changes directly for specific industrial and agricultural commodities in Romania at this time. The following chapter of this document (Chapter VIII) explains these ideas in more detail.

Chapter VIII: Impact of Higher Water Price on Industrial Production and Trade Competitiveness

8.1 Methodology

Tight budgetary conditions have now placed severe constraints on any further expansion in water supply capacity. Although water supply is still significantly greater than demand requirements, there is a foreseeable need to economise on further infrastructure investments and to encourage allocation of water to uses with the highest rates of return. In recent years, there has thus been a shift in water policy away from supply augmentation to demand management by promoting more efficient water use.

Surveys reported earlier in this report were undertaken to establish some baseline information on the conditions faced by water consumers in identifying which "signals" are being received by consumers about the value of water. The results of these surveys have interesting economic implications for the problem posed in this paper related to the impact of an increase of the water price on the competitiveness of economic enterprises. Definitive judgements about whether water prices are effective in terms of cost recovery were also analysed.

The analysis presented here attempts to answer the following question: What is likely to be the impact of higher water costs to industry and agriculture on trade competitiveness?

For the purposes of this study, the focus will be to evaluate the likely impacts of higher water prices on net exports.

As noted in Section I of this paper, Apele Romane currently allocates quantities of water to be used by enterprises and sets prices for raw water based on source (e.g., groundwater, inland surface water, and Danube water) and users (industry, energy, agriculture, and public water supply companies). While in theory the price that Apele Romane charges to industry should reflect delivery costs as well as environmental costs associated with water abstraction from the water body, the enterprise paying the water bill just considers water simply as another factor of production.

At a basic level, raw water is input into production just like any other variable input. When faced with higher input prices, enterprises can be expected to adjust levels of inputs, outputs, and as a result net exports, depending on substitution possibilities as well as input and output market structures. By how much is the relevant question. The main purpose of the methodology is to estimate input demands and related price elasticity.

Water demand elasticity provides one key piece of information to investigate the impact of higher water costs on production and net exports.

To estimate the impact of higher water costs on Romanian exports, it is necessary to develop an empirical link between water use, production, and exports. At a simple level, the goal is to estimate a "shift back" in a supply function due to higher water costs. This shift in supply as an approximation depends on the elasticity of output supply with respect to water price (denoted η_{yw} where $_y$ represents output and $_w$ is the water price.

First, some basic notation is defined:

x = water use by some industry

w = initial water price (in Romania includes raw water and discharge cost)

k = other production inputs

r = prices of other inputs

y = production of output (e.g., cement, grain)

f(x,k) = technical production function relating inputs to output so that y = f(x,k)

p = price of output

As an approximation, it is necessary to assume that enterprises act as if they are trying to minimise production costs and maximise profits. In this case, the profit function $\pi = \pi(p,w,r)$ is defined by the follow problem:

$$\pi\ (p, w, r\ ) = \max_{x,\ k}\ [\,p\ f(x, k) - wx - rk\,] \tag{1}$$

From the profit function, the envelope theorem (Hotelling's Lemma) can be used to identify the profit-maximising level of output supply and water demand as:

$$X = X(p, w, r) = -\frac{\partial \pi}{\partial w}$$
$$and \tag{2}$$
$$Y = Y(p, w, r) = \frac{\partial \pi}{\partial p}$$

where the capital letter notation for water X and output Y is used to denote the profit-maximising level that is the solution to the problem in (1).

The profit function in (1) and the profit-maximising water demand and output supply functions in (2) are important because they provide a direct link between water and other input prices, output price, and water use X and production Y. Using some elementary calculus, the equations in (2) can be used to show that:

$$\frac{\partial Y}{\partial w} = \frac{\partial^2 \pi}{\partial p \partial w} = -\frac{\partial^2 \pi}{\partial w \partial p} = -\frac{\partial X}{\partial p} \tag{3}$$

The results in (3) are important because it shows that the shift back in supply due to higher water prices is identical to the negative of an increase in the demand for water due to higher output prices.

The next step is to decompose the water demand effect in (3), based on profit maximisation, into two effects as follows. It is first necessary to define a cost function C(w,r,y) as:

$$C(w, r, y) = \min_{x,\ k}\ [\,wx + rk\ s.t.\ f(x, k)\ ge\ y\,] \tag{4}$$

Again using the envelope theorem (Sheppard's lemma), it is possible to define the cost-minimising water demand as:

$$X^c = X^c(w, r, y) = \frac{\partial C}{\partial y} \tag{5}$$

When y in (5) is evaluated at the profit-maximising level of production Y, then the cost-minimising level of water demand equals the profit-maximising level of water demand.

In other words:

$$X(p, w, r) = X^c(w, r, Y(p, w, r)) \tag{6}$$

Using the relationship in (6), it is possible to evaluate the impact of higher output prices on water demand as:

$$\frac{\partial X}{\partial p} = \frac{\partial X^c}{\partial y} \frac{\partial Y}{\partial p}$$

In other words, the impact on water use of higher output price can be defined as the product of two terms. The first term shows how water use increases when output increases, while the second term shows how output increases when output price increases.

$$\frac{\partial Y}{\partial w} = -\frac{\partial X}{\partial p} = -\frac{\partial X^c}{\partial y} \frac{\partial Y}{\partial p} \tag{7}$$

Using (3) and (7), we have:

$$\eta_{yw} = \frac{\partial Y}{\partial w} \frac{w}{Y} = -\frac{\partial X^c}{\partial y} \frac{\partial Y}{\partial p} \frac{w}{Y} \frac{p}{p} \frac{X}{X} \frac{Y}{Y} \tag{8}$$

$$\eta_{yw} = \frac{\partial Y}{\partial w} \frac{w}{Y} = -\frac{\partial X^c}{\partial y} \frac{\partial Y}{\partial p} \frac{w}{Y} \frac{p}{p} \frac{X}{X} \frac{Y}{Y} = -\left[\frac{wX}{pY} \right] * \eta_{yp} * \eta^c_{xy}$$

where the notation η^c is used to denote an elasticity for the cost-minimising water demand.

The relationship in equation (9) shows that the impact of higher water prices on output (and as result exports) depends on three components:

1. Water costs as a share of total revenues, wX/pY
2. The output supply elasticity with respect to output price, η_{yp} , and
3. The water demand (cost minimising) with respect to output level, η^c_{xy}.

Each component is discussed separately.

1. Water costs as a share of total revenues, wX/pY

   Water costs wX were developed both from information at Apele Romane and the user, while revenue data pY are just reported sales.

2. The output supply elasticity with respect to output price, η_{yp}.

   The used approach developed appropriate data to estimate the relationship directly. More will be said on this matter after the discussion below of the third component.

3. The water demand (cost minimising) with respect to output level, η^c_{xy}.

The cost function was estimated with the data obtained from the enterprises:

- water intake price
- estimates of all other non-water production costs
- estimate of total revenues

The overall analysis proceeded in two stages. In the stage 1, the approach was implemented at a sector level within the Romanian economy using rough estimates of needed elasticity and actual data on water costs as a share of revenues. This analysis identified which sectors are especially vulnerable to water price increases for raw water. The second stage focuses on a limited number of key sectors. This stage involves direct data collection at the enterprise level (based on two formal surveys) to gather a minimum level of information to provide better estimates on the relevant elasticity and the minimum data necessary to estimate econometrically the parameters needed to calculate elasticity from a cost function.

8.2 Results

Stage 2 is implements the approach at the industrial level within the Romanian economy considering 50 enterprises of various types of activity selected from those especially vulnerable to raw water price increases.

The data set of the selected enterprises belong to: Food Manufacturing, Beverage Manufacturing, Textile and Fibre Mills; Petroleum and Chemical Manufacturing; Non-metallic Mineral Product Manufacturing: Cement Manufacturing; Glass Manufacturing, Fabricated Metal Products, machinery except electrical; Pulp and Paper; etc. The industrial enterprises considered use water for several purposes: cooling intermediate inputs, sanitation, as a direct input (beer production). Water use is assumed separable from other inputs.

The data were obtained based on a formal survey, at company levels, following the questionnaires proposed and approved at a Round-Table meeting. To obtain the set of data that were desired for each enterprise more than one source was accessed to get that information. The analysis was followed by data entry into Microsoft EXCEL format.

The elasticity, written in the form resulting from the methodology, is decomposed into three terms that were calculated and discussed separately:

$$\eta_{yw} = \frac{\partial Y}{\partial w}\frac{w}{Y} = -\frac{\partial X^c}{\partial y}\frac{\partial Y}{\partial p}\frac{w}{Y}\frac{p}{p}\frac{X}{X}\frac{Y}{Y} = -\left[\frac{wX}{pY}\right] * \eta_{yp} * \eta^c_{xy}$$

where the notation η^c is used to denote an elasticity for the cost-minimising water demand.

This decomposition of the supply impact from higher water prices into three separate components is important because it is easier to develop data and estimate each of the three components separately.

The relationships in this equation show that the impacts of higher water prices on output and therefore on exports depend on three components considered as coefficients (C1; C2; C3 and C4), in the EXCEL file:

C1: Water costs as a share of total revenues, wX/pY

C2: The output supply elasticity with respect to output price, η_{yp}.

C3: The water demand (cost minimising) with respect to output level, η^c_{xy}.

C4: The elasticity η_{yw}.

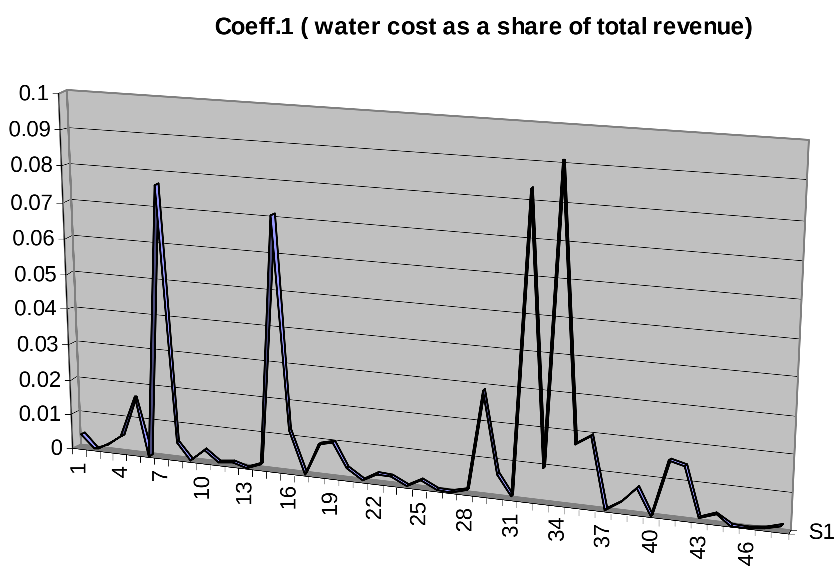
The results of the analysis provide several interesting insights into the structure and role of the water use by Romanian enterprises. The results indicate that industrial companies are sensitive to the costs of their water use.

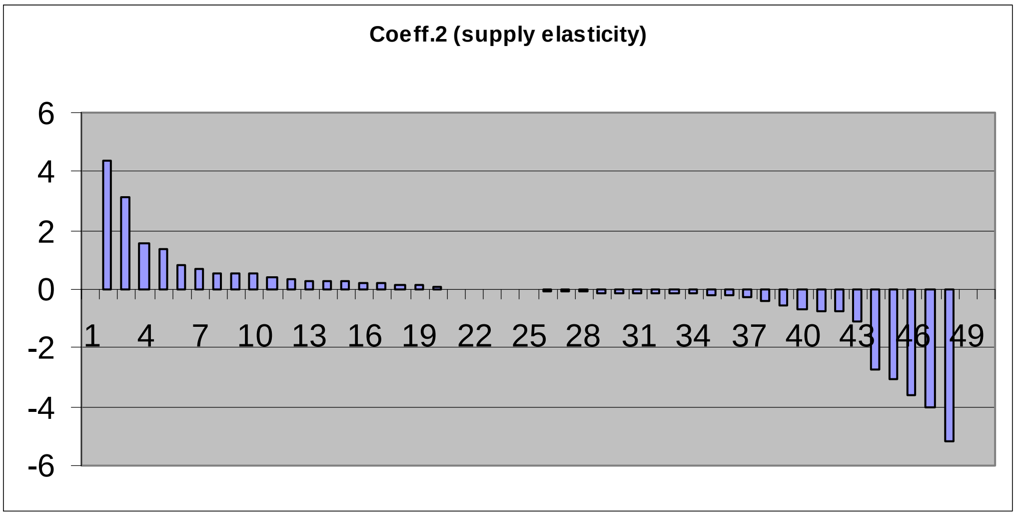
The estimates of C1: Water costs as a share of total revenues, wX/pY

Water costs wX were developed from information of enterprises and Apele Romane. The revenue data pY were given by the enterprises from the reported sales.

We analysed the weighting of water costs on enterprise revenues pY. With respect to the coefficient 1, we grouped the industrial products into four main categories:

- in the first category, where the influence of the water costs reaches values between 7 and 9 per cent of the total revenues, included are: thermal-power generation, pulp production, oxygenated water production and mainly the products which demand the largest ratio of water intake and water-related expenditures to value of output;
- the second category, for which the water costs vary between 0.7 and 3 per cent of total revenues, covers products from the wood industry, paper production and mainly products which require medium water quantities or have a high degree of recirculation and reuse;
- the third category includes the pigment and medical drugs industries, heavy water production and iron pipe industry, and for these the water costs represents 0.3 -0.7 per cent of total revenues. Despite the fact that these products demand high water quantities, their cost is high compared to the water price and therefore the water price impact is too low.
- the fourth category, in which the weight of water costs is less than 0.3 per cent of total revenues includes metallurgical products, fertilisers and some chemical products with high monetary value, and a recirculation degree over 80 per cent.





The estimates of C2: The output supply elasticity with respect to output price, η_{yp}.

The output own-price elasticity was not taken from the existing literature on sector specific supply elasticity but it was calculated for 50 Romanian industrial enterprises. Coefficient 2 shows the production change with the price variation. Again, the enterprises were grouped into four categories:

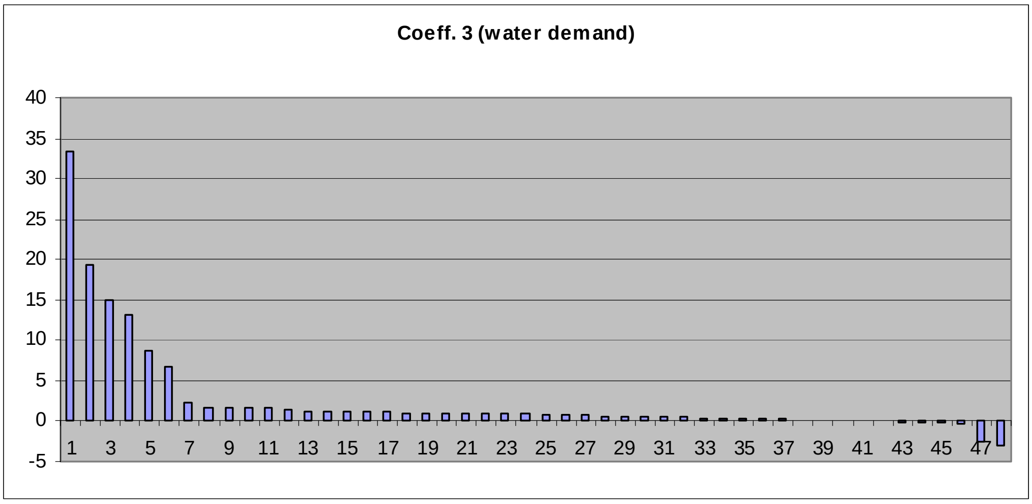
- a 1 per cent increase in output product price will lead to an increase of production between 0.5 and 4 per cent. This group includes pulp, cast iron, and coke, rolled pipes production.
- a 1- per cent increase in output product price will lead to an increase of production between 0 and 0.5 per cent. This group includes medical drugs, liquid chloride, lye, ammonium sulphate, and textile thread production.
- the third group where the output product price modification will not have any influence includes leather and thread production.
- for the fourth group, a product price change will not lead to an increase but a decrease in production. We can offer many explanations: low demand of a product that is too expensive or of low quality. In this group, we have power generation, organic pigments, some leather products for which a production decrease reaches limits between 0.01 and 5.7 per cent at a price increase of 1 per cent.

The estimates of C3: Water demand (cost minimisation) with respect to output level, η^{c}_{xy}.

Using both enterprise level data and AR information on costs and production levels, water costs, all other non-water production costs, estimates of total revenues, and water intake quantity, it was possible to estimate the cost function econometrically.

The findings show that five product groups can be identified:

- the first group generally covers large water ratio consumers for which a production variation of 1 per cent will produce a substantial change of abstracted water demand, which can increase by 15-40 per cent . These will include leather and some chemical products, where water is recirculated.
- in the second group, with water variation between 6 and 15 per cent at a 1 per cent variation of production, we can find poliamidic and thread products. The explanation is related to the high degree of water recirculated (around 85 per cent).
- the third group includes the products for which water quantity variation is between 1 and 4 per cent for a variation of 1 per cent in production. Here are included metallurgical prod-



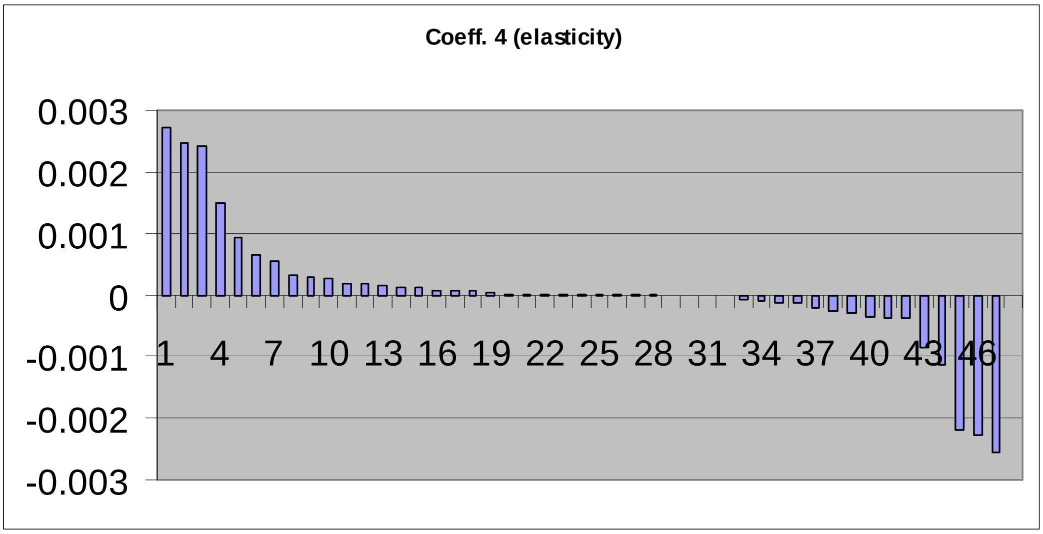
ucts, paints, varnish, and resins, with low water consumption and a recirculation degree of 70 per cent.

- in the fourth group, with water demand variation between 1 and 4 per cent for a 1 per cent variation of production, are included thermal-power generation, printing paper, heavy water, urea, etc.
- the last group includes products for which an increase of production will not lead to water demand increase. Here we can include the medical drug production.

The estimates of C4: The output supply elasticity with respect to water price

From this point of view, the products could be grouped according to elasticity.

- first, we have those products for which a 10 per cent increase of water price would lead to a production decline in the range of 2 to 11 per cent . This group includes oxygenated water production, caustic soda and paper production.
- another product group has for a main feature the fact that a 100 per cent increase in water price would lead to a production decrease ranging between 0.01 and 2 per cent . This category includes medical drugs, varnish, paints, and resin and liquid chloride production.
- there is a group of products for which an increase in water price, even by 100 per cent , would not influence production. Here we include rolled products in particular.
- there is a group of products of economic agents that use raw water for a price 20-100 times lower than the water from public networks. Therefore, the increase in water price will not have any effects on them.



8.4 Discussion of results

- The study identifies international competitiveness as one of several issues to be addressed if economically sound sustainable growth policies are to be successful
- While the first stage of the study was influenced by some constraints: data limitations, budget, and time available, this second stage focuses on an extended number of enterprises (50) and a limited number of key sectors. These stages involved complete information and direct data collection at the enterprise level, to gather information to provide better opinions and recommendations on the relevant elasticity and the minimum data necessary to estimate the parameters econometrically.
- Until recently, command-and-control mechanisms, based primarily on legislative and regulatory provisions implemented through directives from the central regulatory authorities, were almost the only instruments used. Wherever economic instruments have been used in Romania, supporting regulations have also been applied to allow for adaptive choice and decentralised decision-making by those whose behaviour is to be changed. Economic instruments promote more decentralised decision-making than do direct regulations. By creating markets for natural resources and the environment, the instruments can signal true resource scarcity to users, creating economic incentives for wiser management. In simple terms, the Romanian Government can influence use patterns by controlling the quantities/ qualities of environmental or natural resource attributes that are traded, or by controlling their prices, either directly, where there is a mandate to set prices, or indirectly, through charges, taxes, subsidies and other economic incentives. These management systems are considered to result in a more efficient use of natural resources and environmental services, commonly referred to as the 'efficiency gains' from economic instruments.
- A first major observation is that price structures actually encourage overuse of public water supplies. This has been witnessed by the high costs of supplying water and waste treatment services, and the consequent overbuilding of water facilities. The current financial problems in the municipal water industry are hardly surprising under these conditions. Until water prices better reflect the value of the resource to society, incentives for technological change will continue to be significantly delayed.
- Tradable rights in water use could be one of the solutions. The ability to transfer water use rights has a number of economic advantages; the main one being that water allocations are no longer linked with other rights, but are traded in a separate market for water as a commodity. In fact, water may be traded as a range of commodities, differentiated in terms of location, quality, environmental constraints and security of supply. The main rationale for permitting trades is that water, as an input to production activities, will be allocated to the activities with the highest rates of return on water inputs, that is, the highest marginal revenue.
- A major problem of environmental management arises because environmental resources are, almost without exception, undervalued in relation to their contribution to economic activities.
- The inability of the market system to motivate technological change when full-cost pricing of water is not present. The market system provides incentives for private gain, which, in turn, leads to the generation of new technologies. The key to these process lies in the ability of prices to reflect accurately the value of the resources devoted to respective economic activities. In water management, the mechanisms underlying technological change have not been fully supported.
- The data provided in this paper show that Romanian water prices are very low. Low prices mean that little or no account is taken of economic factors in forecasting water demands, resulting in forecasts that are upwardly biased, with the consequent overbuilding of systems. Low prices also mean that cost recovery is not achieved.

Chapter IX: Conclusions

The proposed legislative actions required to support the implementation of the selected economic instrument (*full-cost pricing*) include:

a. Drafting water pricing methodology, based on the strategy developed in this project by the Center for Environmentally Sustainable Economic Policy in collaboration with the General Directorate of the Ministry of Water, Forests and Environmental Protection and National Company Apele Romane.

b. The implementation of the methodology over a six month testing period on a pilot basis.

The stakeholders involved in this project agreed to:

- incorporate social and environmental impacts of SAPs, including trade and development policies, into the incentives and disincentives for efficient water resources use and environmental protection;
- enhance the institutional and human capacities of Romania to integrate economic and environmental considerations into development planning;
- democratise structures and decentralise the decision making process to allow for a strengthening of the direct relationship between water management services suppliers and beneficiaries;
- the need to ensure sustainable financing mechanisms to assist self-financing of water sectors management and protection activities;
- recover from beneficiaries the full-costs for the service provided;
- delimit river basins by a costs and benefits internalisation perspective;
- stimulate institutions to supply provided services based on minimum administrative and economic costs.

The recommendations of the project include:

1. Price reform should be gradual/incremental.
2. Raw water tariffs should be calculated to cover:
   - the operating costs of the National Company Apele Romane related to water resources management and water supply
   - the capital charges associated with water resources supply infrastructure
   - the operating costs related to flood prevention and protection
   - the capital charges associated with flood prevention and protection infrastructure
3. In the short term, prices should be raised to a level, which can cover the full economic cost of provision. In the long term, it is undesirable that flood prevention costs should be included in the water tariff since the benefits of flood protection do not correlate with raw water consumption. In the short to medium term flood protection costs will either be included in the raw water tariff or paid directly by the state, but the costs for flood prevention and protection should be presented separately from those for raw water supply.

In the long run, user costs and the environmental costs of exploiting the resource should also be included in the raw water price.

4. Differential pricing is permissible between users as long the price reflects real differences in the cost of supplying water to different users. These differentials will be essential incentives for developments towards large water demand to locate in basins with abundant supplies and low costs rather than in basins of shortage and high costs.
5. Raw water price reforms should be integrated into economic reform as a whole and should be adjusted in accordance with piped water price reforms.
6. Beyond the immediate findings, research may be carried out to ensure that water prices reflect the varying costs to different users of extraction from particular sources, and use of distribution systems and sewerage systems. In addition, alternative methods of recovering the cost of flood protection need to be developed, possibly through land or property taxes.

ANNEX 1

LIST OF MEETINGS: ROUND TABLES, WORKSHOPS AND CONSULTATION MEETINGS

Round table

1. Criteria and questionnaires for field studies, Bucharest, June 29, 1998

National Workshops

1. Economic reform impacts on water resources management, Bucharest, May 8,1998
2. Impact of higher water price on competitiveness of industrial economic enterprises in Romania, Bucharest, March 23, 1999

Consultation meetings

Each month, between April 1998 and June 1999.

ANNEX 2A

CENTRE FOR ENVIRONMENTALLY SUSTAINABLE ECONOMIC POLICY

"WORKSHOPS ON ECONOMIC REFORM IMPACTS ON WATER RESOURCES MANAGEMENT"

Bucharest, 7-8 May 1998

LIST OF INVITEES

United Nations Environment Programme
Scott Vaughan
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Arturo Polese

United States Agency for International Development
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United Nations Programme for Development
Valentin Alexandrescu

World Bank
Doina Rachita, Director

European Bank for Reconstruction and Development
Dana Craciunescu, Programme Coordinator

International Monetary Fund
John Hill, Resident Representative

UNESCO
Victor Iancu, General Secretary

Embassy of the Netherlands at Bucharest
Jan van Weijen, Commercial Secretary

Senate Commission for Health, Ecology and Sport
Ion Carciumaru, President

Chamber of Deputies Commission for Public Administration, Land Planning and Ecology
Ion Cirstoiu, President

Senate Commission for Economy
Viorel Catarama, President

Chamber of Deputies Commission for Economic Policy, Reform and Privatisation
Iuliu Vida, President

Chamber of Deputies Commission for Industry and Services
Dan Ioan Popescu, President

Senate Commission for the Privatisation
Nicolae Vacaroiu, President

Senate Commission for Agriculture, Food Industry and Forestry
Trita Fanita, President

Chamber of Deputies Commission for Agriculture, Food Industry, Forestry and Specific Services
Gheorghe Cristea, President

Ministry of Water, Forests and Environmental Protection

Water Department
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Cornel Mitoiu, Chief Water State Inspector
Gheorghe Constantin, Expert
Liliana Bara, Expert

Forestry Department
Ioan Seceleanu, Secretary of State
Angelica Jucan, Director
Claudiu Zaharescu, Expert

Ministry for Privatisation
Sorin Dimitriu, Minister
Ionel Voinescu, Director

Ministry of Industry and Trade
Radu Berceanu, Minister
Cristina Ioan, Director

Ministry of Agriculture and Food Industry
Dinu Gavrilescu, Minister
Adrian Dobrescu, Secretary of State

Ministry of Finance
Daniel Daianu, Minister
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State Owner Fund
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Florin Stadiu, Director

National Forests Authority
Gheorghe Cahnita, General Director
Grigore Caloianu, Director

Mihai Daia, Director
Constantin Corduneanu, Director

National Electricity Authority
Paul Gheorghiescu, Director

Romanian Chamber for Industry and Trade
Felicia Ana Zarojanu, Director
Competition Council
Gheorghe Oprescu, Vice- President

Competition Office
Mihu Miron Biji, Secretary of State

Environmental Research and Engineering Institute
Ioan Jelev, Director
Dan Paduraru, Senior Researcher

Water Management Design Institute
Dan Marinovici, General Director
Ion Tecuci, Senior Engineer

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Vladimir Rojanschi, Vice-President

Water Management Union
Dumitru Preda, Leader

Forestry Union
Marian Stoicescu, Leader

National Wood Institute
Dan Copacean, Expert

Non-governmental organisations
Mircea Selarescu, PROMERO
Calin Georgescu, National Centre for Sustainable Development

Bucharest Polytechnic University
Dorin Cristescu, Vice-Rector
Stelian Iordache, Professor

Centre for Environmentally Sustainable Economic Policy
Mihaela Popovici, Director
Adriana Dragomir, Board Member

Harvard Institute for International Development
Clifford Zinnes

ANNEX 2B

CENTRE FOR ENVIRONMENTALLY

SUSTAINABLE ECONOMIC POLICY

SEMINAR ON
”ECONOMIC REFORM IMPACTS ON
FORESTRY AND WATER RESOURCES MANAGEMENT”

UNEP PROJECT

Location: Bucharest, Ministry of Water, Forests and Environmental Protection

Bucharest, 22-23 March 1999 9,30-14,00

LIST OF PARTICIPANTS

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Konrad von Moltke, UNEP Advisor

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Toader Iulia, Coordinator

Chamber of Deputies Commission for Industry and Services
Ioan Popescu, Expert

Senate Commission for the Privatisation
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Lazea Gheorghe, General Secretary
Liliana Mara, General Director
Cornel Mitoiu, General Director
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Gheorghe Constantin, Head of Division
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ANNEX 3

MAIN PROBLEMS OF THE PRESENT PRICE AND TARIFF SYSTEM FOR WATER MANAGEMENT PRODUCTS AND SERVICES