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ASSESSMENT AND DEVELOPMENT OF MUNICIPAL WATER AND WASTEWATER TARIFFS AND EFFLUENT CHARGES IN THE DANUBE RIVER BASIN.

Volume 2: Country-Specific Issues and Proposed Tariff and Charge Reforms: Romania – Case Study

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WORKING FOR THE DANUBE AND ITS PEOPLE

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PREFACE

The Danube Regional Project (DRP) consists of several components and numerous activities, one of which was "Assessment and Development of Municipal Water and Wastewater Tariffs and Effluent Charges in the Danube River Basin" (A grouping of activities 1.6 and 1.7 of Project Component 1). This work often took the shorthand name "Tariffs and Effluent Charges Project" and Phase I of this work was undertaken by a team of country, regional, and international consultants. Phase I of the UNDP/GEF DRP ended in mid-2004 and many of the results of Phase I the Tariffs and Effluent Charges Project are reported in two volumes.

Volume 1 is entitled *An Overview of Tariff and Effluent Charge Reform Issues and Proposals*. Volume 1 builds on all other project outputs. It reviews the methodology and tools developed and applied by the Project team; introduces some of the economic theory and international experience germane to design and performance of tariffs and charges; describes general conditions, tariff regimes, and effluent charges currently applicable to municipal water and wastewater systems in the region; and describes and develops in a structured way a initial series of tariff, effluent charge and related institutional reform proposals.

Volume 2 is entitled *Country-Specific Issues and Proposed Tariff and Charge Reforms*. It consists of country reports for each of the seven countries examined most extensively by our project. Each country report, in turn, consists of three documents: a case study, a national profile, and a brief introduction and summary document. The principle author(s) of the seven country reports were the country consultants of the Project Team.

The authors of the Volume 2 components prepared these documents in 2003 and early 2004. The documents are as up to date as the authors could make them, usually including some discussion of anticipated changes or legislation under development. Still, the reader should be advised that an extended review process may have meant that new data are now available and some of the institutional detail pertaining to a specific country or case study community may now be out of date.

All documents in electronic version – Volume 1 and Volume 2 - may be read or printed from the DRP web site (www.undp-drp.org), from the page Activities / Policies / Tariffs and Charges / Final Reports Phase 1.

We want to thank the authors of these country-specific documents for their professional care and personal devotion to the Tariffs and Effluent Charges Project. It has been a pleasure to work with, and learn from, them throughout the course of the Project.

One purpose of the Tariffs and Effluent Charges Project was to promote a structured discussion that would encourage further consideration, testing, and adoption of various tariff and effluent charge reform proposals. As leaders and coordinators of the Project, the interested reader is welcome to contact either of us with questions or suggestions regarding the discussion and proposals included in either volume of the Project reports. We will forward questions or issues better addressed by the authors of these country-specific documents directly to them.

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Abbreviations

EUR	Euro
FCR	Full cost recovery
IEB	Investment European Bank
ISPA	European Grant Programme
GD	Governmental Decree
HH	Household
NNR	Black Sea Level
MAKK	Hungarian Environmental Economics Center
MU	Management unit
SA	Company on shares
SC	Commercial company
SU	Service user
ROL	Romanian Lei
WWTP	Wastewater treatment plant

Executive Summary

City Pitesti, located at 120 km West of Bucharest, is the capital of the Arges district and is located at the confluence of Arges and Doamnei rivers. Drinking water treatment and distribution, wastewater collection and treatment for Pitesti fall under the responsibility of APA-CANAL-PITESTI. At present, neither the drinking-water treatment installation nor the wastewater treatment installations operate to international standards. In addition, the water distribution network and the sewerage systems need substantial rehabilitation. The existing installations and pipe works are old and much equipment is in need of modernization and/or replacement. Given the importance of providing adequate water and wastewater services, both to the population and industries, APA-CANAL-PITESTI has undertaken initiatives towards rehabilitation of the installations.

APA-CANAL-PITESTI is a Romanian juridical person, registered in the Commercial Register and has a status as commercial company on shares, with an unique share holder – Pitesti Local Council, which approves the Rules of Organizing and Operations. The company signed in 2001 with the Local Council Pitesti one Concession Contract which has as object of activity the concession of the public service of local interest referring to the activity of drinking water production, transport and distribution, as well as the wastewater and storm water collection, transport and treatment. The contract was signed for a period of 20 years. According to the contract stipulations, all the actives in the Local Council property used for drinking water supply, transport and treating wastewater collection, transport and treatment are given for administration to the contractor.

The company performs services for around 207,000 inhabitants and the important economical agents in the Pitesti city area, the surrounding villages (Albota, Maracineni, Bascov, Stefanesti, Bradu) and the area Platforma Cotmeana. The drinking water produced in 2002 was 30,035 thousands m^3 (invoiced 76%) and around 27,428 thousands m^3 (invoiced 70%) in 2003. The metering activity covers 92.9% from the water delivered but for dwellings only 63.4%.

The average level in 2003 of the water & sewerage tariffs of APA-CANAL are 6,462 ROL/m^3 and 5,236 ROL/m^3 and are the same for population and economic units & industries. The tariff for drinking water is the tariff for cold water. The tariffs in 2003 charged by APA-CANAL-PITESTI were in the lower range, compared to other Romanian cities. In the chapter 6.1 the operation and maintenance costs are given for material costs, energy costs, salary costs and other costs and in chapter 6.2 is detailed the total costs of the investments amounted to 53 million €, for rehabilitation of the drinking water and sewerage networks as well as of the drinking water and the wastewater treatment plants. Financial sources are: the IEB loan, the ISPA Grant that was approved in October 2003 and the contribution by APA-CANAL-PITESTI.

Tariffs of drinking water and sewerage treatment will have to be adapted to cover all investment costs, financing costs and operations and maintenance costs caused by the new investments in the drinking-water production & treatment and sewerage collection & treatment.

For the Pitesti case study a financial model ASTEC was used and three scenarios were implemented. For each scenario, five situations for APA-CANAL-PITESTI was given and the results obtained (cash-flows, profit and losses and the balance sheet) are in terms of: drinking water and wastewater tariffs, drinking water consumption and wastewater discharges, revenues of drinking water services and wastewater services, balances of drinking water service accounts and wastewater service accounts and balance of drinking water and wastewater service accounts.

As can be seen from the results obtained with the ASTEC model, the financial effects for APA-CANAL-PITESTI are the largest under the effect of metering and investments (from loans and grants) that will decrease the consume and discharge of water, will decrease leakage and will diminish the operation and maintenance costs.

Drinking Water and Sewerage Systems of Pitesti, Romania

1 Physical Conditions

Pitesti, located at 120 km West of Bucharest, is the capital of the Arges district and is located at the confluence of Arges and Doamnei rivers (see Map 1) and at the crossing of the Northern latitude 44^0 51' 30" parallel with Eastern longitude 24^0 52'. The mean altitude of the city is 287 meters, with an altitude level difference between 252 m, at the minor bed of Arges river (in the South), and 356 m in the Trivale area (in the Western part).

Map 1 Romanian Main Rivers

Pitesti is stretched out in a shallow valley, where the center of the city is situated in the middle and deeper part. It is divided into three terraces. The soil exists of rocks and pebbles in the higher parts of the city, and of coarse and fine coarse sand in the lower parts of the city. The groundwater level ranges from several meters below ground surface at the higher situated parts, up to one meter in the lower situated parts of the city.

South and east of the city are the flat, empty plains, that stretch out to Bucharest and further; north of the city are hills and forests. The Carpathians are located ninety kilometers further to the north.

The Pitesti city and its surroundings have a mild - continental climate. This climate is determined by the influence of Western and North – Eastern continental marine air. Its geographical position offers to

the city the advantage of a mild climate. Consequently, during the winter months, the temperatures are not very low and during the summer months, the temperatures are not too high. The mean temperature of January is -2.4 ^{0}C; the mean temperature of July is 20.7 ^{0}C. The annual rainfall level is higher than the country mean, varying between 680 – 700 mm.

All these characteristics influence the water resources of the region, namely the surface water flow, the water resources and their exploitation, the pluviometric water collection system size, drinking water distribution reservoirs configuration etc.

Water supply treatment, drinking-water distribution, wastewater collection and treatment for Pitesti fall under the responsibility of APA-CANAL-PITESTI, the utility company of Pitesti. The company operates one drinking-water treatment facility at Budeasa and one wastewater treatment facility at Prundu.

At present, neither the drinking-water treatment installation nor the wastewater treatment installations operate to international standards. In addition, the water distribution network and the sewerage systems need substantial rehabilitation. The existing installations and pipe works are old and much equipment is in need of modernization and/or replacement. Given the importance of providing adequate water and wastewater services, both to the population and industries, APA-CANAL-PITESTI has undertaken initiatives towards rehabilitation of the installations.

Most industries are supplied with water from the municipal water supply network, and are discharging their wastewater untreated into the municipal sewerage system. A few industries have separate water resources and only the refinery Arpechim has a wastewater treatment plant.

2 The Company: APA-CANAL-PITESTI

APA-CANAL-PITESTI is a Romanian juridical person, constituted by the Pitesti Local Council Decision 28/ 17.02.2000. The company is registered in the Commercial Register as J03/185/2000, SIRUES code 033218232, fiscal code R13009001. The APA-CANAL-PITESTI is a commercial company on shares, with an unique share holder – Pitesti Local Council, which approves the objectives of the company, established by the Rules of Organizing and Operations. It develops its activity in accordance with the Law for the commercial companies 31/1990 and according to the Constitutive Act of the company approved by the Local Council Decision 89/05.10.2000 and notary authenticated.

The social capital integrally deposited at the date of constituting has an estimated total value of 10,700,000,000 ROL, of which: in cash – 110,441,563 ROL and in tangible assets – 10,589,558,437 ROL. According to the Constitutive Act stipulations, the social capital is divided in 107,000 nominative equal shares, each having a value of 100,000 ROL.

According to Law 137/2002 stipulations, referring to the measures to accelerate privatization, the obligation of the commercial companies to elaborate and present to the entitled institutions the necessary documentation for the license certifying the right on the land used for activity developing. In the period when was constituted APA-CANAL-PITESTI started the procedure for the plot surfaces included in the previous companies' patrimony RA Regocom being assumed by the effect of reorganizing by division into commercial companies. APA-CANAL-PITESTI accomplished its obligations erecting from the stipulations of the Law 213/17.11.1998, concerning the private propriety and the juridical regime of the land and the duties erecting from the stipulations of the GD 548/08.07.1999, referring to the possession inventory of the public area of the villages, towns, cities and counties. The land is not a propriety of the company but can be used under the concession contract with Pitesti Local Council.

The object of activity of the company APA-CANAL-PITESTI is the drinking water producing and distribution and the wastewater collection and treatment. The company performs services for around 207,000 inhabitants and the important economical agents in the Pitesti city area, the surrounding villages (Albota, Maracineni, Bascov, Stefanesti, Bradu) and the area Platforma Cotmeana (see map 2).

Map 2 Pitesti and Adjacent Villages

Based on the Law of the local public administration 215/2001 stipulations, the Local Council is responsible for the public and private patrimony administration and is entitled to lease or rent the goods and services of pubic utility, being allowed to create, organize and supply services, either by their direct administration or by permitting some physical or juridical persons to administrate them by signing proper contracts.

The concession regime is now controlled by the following norms:

- Law 219/1998 referring to the concession regime, supplemented by Governmental Decree 216/25.03.1999, having as object of activity the regulation and organizing the concession regime of the local and central public services. The regulations refer to the goods under public or private propriety of the state, county, town or village;
- Governmental Decree 216/1999 for the approval of the application framework of the Law 216/1998 which stipulates the framework contents of the tender documents of the concession, instructions referring to the organizing and development of the concession procedure, as well as the general framework referring to the juridical regime of the concession contracts under the conditions of Law 219/1998.
- Law 139/2002 referring to the authorities' right to sign contracts of delegation to a third part for administration and concession.

Under this legal general framework APA-CANAL-PITESTI signed with the Local Council Pitesti The Concession Contract 8268/04.01.2001, which has as object of activity the concession of the public service of local interest referring to the activity of drinking water production, transport and distribution, as well as the wastewater and storm water collection, transport and treatment. The contract was signed for a period of 20 years.

According to the contract stipulations, all the actives in the Local Council property used for drinking water supply, transport and treating wastewater collection, transport and treatment are given for administration to the contractor – APA-CANAL-PITESTI.

Based on 2002 census, the water company APA-CANAL-PITESTI Pitesti performs services for 206,494 inhabitants, 64,563 dwellings (see Table 1), as well as for public institutions and the commercial agents that are developing their activity in the area. The activity area includes besides Pitesti City, the surrounding areas – Albota, Maracineni, Bascov, Stefanesti, Bradu, and the area Cotmeana Platform.

Table 1 Town Pitesti and Surrounding Villages (Population and Dwellings Connected to Drinking Water and Sewerage APA-CANAL-PITESTI Systems)

	Population	Dwellings connected to:		
		Drinking water	Sewerage system	Only with drinking water
Town Pitesti	168 756	60 049	59 558	491
Surrounding villages				
Albota	3 917	99		99
Bascov	8 873	1 222	1 205	17
Mărăcineni	4 526	866	817	49
Bradu	5 158	430		430
Ştefăneşti	13 005	1 839	1 699	140
Cotmeana	2 259	58		58
TOTAL villages	37 738	4 514	3 721	793
TOTAL Pitesti + villages	**206 494**	**64 563**	**63 279**	**1 284**

Sources: Census 2002

In 2002 the total volume of the distributed water by APA-CANAL-PITESTI Pitesti was 22,754 thousand m^3 (see Table 2), meaning 27.4% less than in 2001. The estimation of invoice delivery of water in 2003 is 19,200 thousand m^3, meaning 15.6% less than in 2002. The decreasing volume of drinking water distributed by the company was reported on the background of an important diminishing of the water consumed in the households, because of: 1) metering systems introduced in the flats and 2) of the reduction by about 5-7% of the commercial companies including industry and public institutions consume.

Table 2 Volume of Drinking Water Production and Invoiced Amounts, in 2002 and Estimation for 2003 (Delivery for Semester I and Estimation for Semester II)

	2002 thousands m^3	**2003** thousands m^3
Drinking water production	**30,035**	**27,428**
Drinking water delivered	**22,754**	**19,200**
Of which:		
* for Households	11,675	9,696
* for public institutions and commercial companies including industry	11,079	9,504
Sewerage services	**16,526**	**14,784**
Of which:		
* for Households	8,286	7,466
* for public institutions and commercial companies including industry	8,240	7,318

Source: APA-CANAL-PITESTI

The drinking water produced in 2002 was 30,035 thousands m^3 (invoiced 76%) and in 2003 will be 27,428 thousands m^3 (invoiced 70%). The wastewater collected by the sewerage system in scope of the further treatment was in 2002 72.6% of the total delivered drinking water volume, the collection degree being in 2003 in a value of 77%. The total wastewater volume collected by the company decreased by 10% in 2002-2003 and respectively about 10% for the Households and about 11% in case of public institutions and commercial companies including industry.

APA-CANAL-PITESTI offers services of wastewater collecting to the inhabitants in the urban as well as rural areas, but in different percentages. In Pitesti city, the multi-floor buildings with dwellings and administrative center area are totally served, the water services offered by the company being the only way for the moment to assure the water necessary to the households and public institutions. The economical agents accept the services offered by APA-CANAL-PITESTI, as they do not have proper supplying facilities (especially groundwater).

There are also households in the urban and rural area which keep using their own supplementary water sources, usually from groundwater wells, for their yards and gardens.

The metering activity covers 92.9% from the water delivered but for dwellings only 63.4%.

Even though the extension of individual metering for the households and the impact of the unfavorable economical environment on the companies and institutions activity in the area served by APA-CANAL-PITESTI led to important decreases in the service market, in the medium and long term, a reestablishment of the demand is expected. To support this statement at least the following arguments can be mentioned:

- trends of relative increase registered in local budget revenues of Arges County;
- similar economic growth of reestablishment at the Arges County level will follow the positive evolutions of economy at national level and will be reported also in case of mean values of the income per capita, per employed person and per employee.

3 Drinking Water System of APA-CANAL-PITESTI

There are two sources of water, the river Arges provides 2,135 l/s potable water (after treatment) and the groundwater sources provide 225 l/s. Groundwater is only chlorinated in a separate substation. On the north banks of the river are many shallow ground water wells with an average depth of 10 meters. This water is collected and pumped into storage tanks in the town.

Seven artificial reservoirs have been created in the Arges river, of which the Budeasa Lake (one but last) is used for the abstraction of raw water for drinking water production. The five reservoirs upstream control the water levels in the river; the water level fluctuations in the last reservoir, the Bascov reservoir, are less than one meter throughout the year.

The Drinking Water Treatment Plant consists of two lines of filters built in 1969 and 1980 respectively. The existing drinking water production plant Budeasa has a design maximum capacity of 3,000 l/s (94 million m^3/yr). Under normal circumstances, the capacity of the plant is 2,135 l/s (7,686 m^3/hr or 67 million m^3/yr) but the plant was designed in the past for a vast expansion of industry.

Water is abstracted right at the exit of Budeasa reservoir near the dam. The level in the reservoir is normally maintained at 301m NNR (reference standard Black Sea Level) and is maximum 306 m NNR. Water is abstracted through 2 meters high intake screens. The raw water is transported through two 1400-m long mains.

There is also the possibility to abstract water from the reservoir Bascov; this is done at the dam near the exit of the reservoir. The problem with the second reservoir is that due to insufficient maintenance by Romanian National Water Authority - the owner of the reservoirs - the reservoir Budeasa is becoming blocked and shallower with growth of water plants. At the top of the Budeasa reservoir, this process of sedimentation and plant growth is also starting and might cause problems for the future water supply. Water is abstracted from reservoir Bascov on average once every three months. This is done for maintenance, to avoid the pumps not being in working order when they are not used for a long period.

The incoming water is pre-chlorinated (doses varying from 1 to 3 mg/l Cl_2), next aluminum sulphate (doses varying dependant on incoming water quality/turbidity between 5 and 130 mg/l), with average concentration 15 mg/l and lime (doses approximately half the doses of aluminum sulphate). From the mixing chambers the water is transported to three radial decanters (line I) and to one cyclator decanter (line II). Residence time in the radial decanters 1 to 1.5 hrs and in the cyclator 40 minutes.

The clarified water is fed to rapid sand filters (ten in line I and three in line II). The rapid sand filters are back-washed, with cleaned water and air, approximately every 36 to 40 hours. Sludge and backwash water is discharged downstream of the plant in the Arges River. The filter bed consists of 0.6 m support layer of coarse sand and the actual filter material 1.10 m of fine sand 0.85 – 2.0 mm. Currently experiments are carried out to optimize the back washing process through the use of a different type of nozzles that are less prone to obstruction by particles. After filtration, the water is post-chlorinated (doses 2 to 5 mgCl_2/l).

Since the plant is 20 to 30 years old, most mechanic and electric equipment, although reasonably well maintained, has approached the end of the normal life span. All mechanic and electric equipment is of Romanian origin and most equipment has a lower efficiency than we can expect from modern equipment.

The treatment required depends on the raw water quality and on fluctuations in raw water quality. The treatment of the raw water needs to achieve the following improvements:

- Full removal of coli form bacteria;
- A decrease in turbidity of the water from 5-80 FTU to below 2 FTU;

- Removal of algae especially Asterionella and Cyclotella during the spring bloom, and Fragillaria during the autumn bloom.

The quality of the raw water is very high, though with seasonal fluctuations in phytoplankton and turbidity. The raw water generally meets the requirements of the highest water resources Category I.

The current treatment process as it is operated at the moment is not always able to produce drinking water that meets the turbidity and aluminum standards. This is thought by the improper design of the plant (especially the rapid sand filters) and ineffective operation of the plant.

There is no monitoring of substances in drinking water that result from the treatment, such as Tri-Halo-Methane from the disinfections process and there is insufficient knowledge of the nature and occurrence of part of the organic matter (seasonally) present in the raw water (including the significance of pesticides present in the reservoir).

The backwash water and sludge produced is simply dumped in the Arges river downstream of the Pitesti plant. This is not an environmental friendly solution especially because of the high aluminum content and possibly other pollutants in the sludge.

Water from the treatment, is pumped through different pipes to five pumping stations in the city (see Table 3). Each pumping station has one or more storage tanks and a number of distribution pumps. The water from the groundwater wells is pumped via a chlorination station to the storage tanks of Razboieni. A number of booster stations are present for the distribution to the different pressure zones.

Table 3 The Pumping Stations and Booster Stations for Water Distribution

	Name	**Storage Volume (m^3)**	**Pumping Capacity m^3/hr**
1	Razboieni	4x5,000	5,000
			2,350
2	Smeura	2x5,000	1,360
		1x3,000	
3	ZIN	2x5,000	4,000
		2x2,500	
4	Gavana	2x50,00	1,400
5	Booster stations		220
Total		**58,000**	

Source: APA-CANAL-PITESTI

The layout of the drinking water network is stretched out over the town centered around a ring main. The water is pumped from the drinking water treatment plant to the four operating booster stations, which also have a storage capacity. The pressure in the distribution mains varies from 4 to 6 Bar.

The total length of the pipe network is estimated to be 768 km from which the major part – approximately 80% - is made of steel. The pipes are usually situated 1 to 1.5 meters below ground surface. The groundwater level has no influence on the pipes.

There were about 800 major incidents in 1998 causing damage to the network. The costs of repair were 4,500 million ROL (346,000 US$ in 1998) and most of the repairing is done as a reaction on the damages. About 90% of the damages are at the welded joints of the steel pipes, due to corrosion. The steel pipes are badly coated and at the joints, the coating is damages because of the welding.

Furthermore, there is no cathodic protection applied against corrosion. The pipes made of ductile iron and asbestos cement are performing well and are far less damaged than the steel pipes.

Most of the pipes have an inside layer of sand and lime caused by sedimentation. This influences the hydraulic performance of the network, and with the expansion and rehabilitation of the network, it is recommendable to clean the network.

The booster pumps are about 30 years old and ready for replacement in due time. The storage tanks are to be cleaned and disinfected.

APA-CANAL-PITESTI has plans to rehabilitate and replace large parts of the existing network by using HDPE for pipes with a diameter up to 350mm, and ductile iron or polyester reinforced polyethylene for larger pipes.

Because of the serious damage and corrosion, the replacement of the steel pipes should have the highest priority. However, 70% of the network consists of steel pipes older than 10 years. The replacement of the older pipes (concrete and ductile iron) together with the steel pipes up to 10 years (about 15% of the total network) should have a medium priority. The remainder 15% of the network consists of well functioning and younger pipes made of ductile iron, concrete and asbestos cement.

Based on the data recorded by APA-CANAL-PITESTI for the first half of 2003 and the estimates for the second half, the drinking water activities of the company will be characterize by data presented in Table 4.

Table 4 Drinking Water Activities of APA-CANAL-PITESTI for 2003

	m^3	Number of entities	m^3/year/entity
Water delivered	**19,200,000**		
1. Households	***9,696,000***		
A. Total city	9,007,000	59,558	
• Households without metering		21,799	165
• Households with metering		37,759	140
• Households without sewerage		491	165
B. Villages (total)	689,000		
• Households with water and sewerage		3,721	160
• Households only with drinking water		509	160
2. Public and economic units	***8,084,000***	2,594	3,116
3. Industry (ARPECHIM)	***1,420,000***		

Source: Census 2002 and APA-CANAL-PITESTI

4 Sewer System of APA-CANAL-PITESTI

The oldest part of the sewerage system is a combined system, where wastewater and storm water flow in one sewer. This comprises 20% of the total system; the other 80% consist of separated sewers for storm water and wastewater. About two times a year the water flows over from the storm water sewers via sumps to the Arges River.

The total length of the sewers is 450 kilometers and consists of reinforced concrete. The sewers are buried 1.5 to 5 meters deep, depending on the frost, groundwater level and grade of the sewers.

The high infiltration rate and the large content of sand in the waste and storm water indicate bad jointing. However, for the large content of sand in the sewers is another explanation possible. There is a lot of fine coarse sand at the streets that easily flushes into to the sewers during a storm event or during street cleaning. The bad condition of joints could be caused by insufficient installation or by ground settlement. Due to the high groundwater level, especially at the lower parts, and due to the sediments, settlement is likely to occur.

The occurrence of cracks and corrosion in the sewers can be explained by way of accumulation of organic material. Under the circumstances, sewage is conveyed in closed pipes, complex organic reactions can take place resulting in the attendance of organic acids. In sewers made of acid-soluble materials, such as concrete and iron, this acid formation could lead to destruction of the sewer. Sewer corrosion could be combated by chlorination, forced ventilation and lining with inert materials. Chlorination halts the biological activity. Forced ventilation reduces the anaerobic and moist conditions required for the reactions. Another cause of cracks is high external load e.g. traffic. This is could be a major cause in Pitesti, as most of the sewers are installed under the roads.

APA-CANAL-PITESTI gives priority to replacing the existing sewerage system with new PVC sewer pipes. PVC sewers are durable and better resist on corrosion and settlement.

Taking into account the main problems - probably caused by bad jointing- it is recommended to at least examine the possibility to rehabilitate the existing network. Used pipes in good condition could be excavated and cleaned. New lining, e.g. epoxy coating could be applied, as well as rubber rings at the joints to prevent water and sand infiltration. Probably this alternative is less expensive because material costs are 30% (for the smaller sewer diameters) to 75 % (for the larger sewer diameters) of the total costs. Only when the structural lining should be applied because of the bad condition of the pipe, might it be less expensive to install new sewers.

The wastewater treatment plant (Prundu plant) is discharging its effluent to the Arges River. The effluent is supposed to meet extra strict environmental criteria, because this river is used, 120 km further to the east, as a drinking-water source for the city of Bucharest.

The public institutions and commercial companies including industry, that discharge into the Pitesti sewerage system important quantities of polluted water, have the pretreatment plants. The obligations for pretreatment plants are included in contracts with APA-CANAL-PITESTI. The refinery ARPECHIM do not discharge used water into the town sewerage system.

5 Water and Sewerage Tariffs in Pitesti

The level of the water & sewerage tariffs of APA-CANAL-PITESTI is given in Table 5. Two categories of users are distinguished: population and economic units & industries. In the next table the 2003 tariffs per m^3 are given. The tariff for drinking water is the tariff for cold water. APA-CANAL-PITESTI do not produce warm water but invoiced the drinking cold water delivered to the companies that produced warm water and heating.

Table 5 Drinking Water and Sewerage Tariffs in Pitesti (2003)

	Drinking water ROL/m^3	**Sewerage ROL/m^3**
First Half - 2003	5 903	4 720
Second Half – 2003	7 020	5 752
Average for 2003	**6 462**	**5 236**

Source: APA-CANAL-PITESTI

The tariffs for drinking water and sewerage in 2003 are the same for population and economic units & industries.

For illustrative purposes, the tariffs of APA-CANAL-PITESTI are compared in Table 6 for 2001 with the tariffs in other towns. This shows that the water and sewerage tariffs charged by APA-CANAL-PITESTI were in the lower range, compared to other Romanian cities situation that remained the same in 2003.

The big difference between 2001 and 2003 water tariffs in Pitesti is caused (mainly) do to the high rate of inflations.

Table 6 Comparison of Drinking Water and Sewerage Tariffs in Romanian Cities (December 2001)

CITIES	ROL/m^3		
	Total	Water	Sewerage
Alba Iulia	7 063	5 875	1 518
Arad	9 114	7 010	2 688
Baia Mare	3 285	2 441	1 079
Bistrița	8 766	7 044	2 200
Botoşani	11 899	8 747	4 027
Braşov	9 408	8 308	1 405
Bucureşti	7 227	6 159	1 365
Buzău	5 117	3 728	1 775
Cluj	8 862	7 765	1 402
Constanța	14 649	10 470	5 340
Craiova	8 862	7 765	1 402
Deva	5 692	4 906	1 004
Focşani	13 110	10 630	3 169
Galați	6 061	5 530	679
Giurgiu	5 541	4 059	1 894
Iaşi	14 190	11 152	3 882
Oradea	12 547	9 474	3 926
Piteşti	**5 601**	**3 749**	**2 366**
Ploieşti	4 821	4 314	648
Râmnicu Vâlcea	4 025	3 260	978
Satu Mare	5 195	4 085	1 418
Sibiu	3 831	2 768	1 358
Târgovişte	19 022	16 345	3 420
Târgu Jiu	3 141	2 733	521
Târgu Mureş	11 094	8 080	3 851
Timişoara	10 555	7 698	3 650
Tulcea	6 140	4 841	1 660

Source: former Ministry of Public Administration

6 Economic Costs and Burden Indices

6.1 Operations and Maintenance Costs

In Table 7, the operation and maintenance costs are given for the networks and the treatment plants for the year 2002.

Table 7 Operation and Maintenance Costs (materials, energy, salaries, others) of APA-CANAL-PITESTI in 2002

Cost factor	2002	
	Thousand EURO	Thousand ROL
Material costs	1 175	36 689 668
Energy costs	1 471	45 932 342
Salary costs	2 043	63 793 185
Other costs	897	28 009 049
TOTAL	**5 586**	**174 424 244**

1EURO 2002 = 31,255.25 ROL

In 2003 the total operation and maintenance costs represents the increase of reported costs for 2002 with only 5% due to the fact that the drinking water delivered decrease (from 2002) with around 18.5 % and the number of personnel of APA-CANAL-PITESTI decrease (from 2002) with around 13 % and these will cover 95% from 2003 inflation.

6.2 Investments

Previous chapters described the necessity for rehabilitation of the drinking water and sewerage networks as well as of the drinking water and the wastewater treatment plants. It has been assumed that the total costs of the investments amount to 53 million €, as specified in Table 8.

Table 8 Capital Investments for Rehabilitation (EURO and thousand ROL)

Financial sources	EURO			thousand ROL	
	TOTAL	Drinking water	Sewerage	Drinking water	Sewerage
Grant ISPA	42,060,000	11,918,000	30,142,000	417,163,000	1,054,970,000
IEB Loan	6,511,500	1,953,450	4,558,050	68,370,750	159,317,500
APA-CANAL	4,206,000	1,261,800	2,944,200	44,163,000	103,047,000
TOTAL	52,777,500	15,133,259	37,644,250	529,696,750	1,317,334,500

1EURO = around 35,000 ROL for 2003

The ISPA Grant was approved in October 2003 and it has been assumed that the Loan from Investment European Bank will have 4% interest rate, 5-years grace period and 25 years return period.

7 Affordability of Pitesti Population

The World Bank mentioned in the last report concerning poverty in Romania that the poor population decrease from 36% in December 2000 and 31% in December 2001 to 26% in December 2002 when extreme poverty represent 12.2% from total population.

The income of the Pitesti population presents the same trend as the country and continue thus making more families incapable to perform and fulfill the responsibilities concerning the development of their own members. The living standard in Pitesti has been also affected as a result of the transition period and the condition of the poorest population (jobless and retired population) grew worse.

From the total number of households, 31.2% represent the jobless and retired population in the Pitesti urban area and 38.9% in rural area. Any water tariffs reform has to consider this important segment of customers.

After the 2002 census, in Romania, the average size of a household is 2.79 person in urban areas and 3.01 in rural areas and the total mean income per household (cash plus in kind) represented around 153 EUR/month. This, of course, differs from urban to rural and from prosperous to poorest families.

The National Federation of Public Services Employers citation mentioned that in 2003 the monthly expenses for drinking water and sewerage represent 3% from the average household monthly budget. The World Bank found that people could afford generally 4% to 6% of the household income for water services. Evidence shows furthermore that this norm equally applies to all socio-economic strata, rich and poor. It can be seen that the affordability-norm included in World Bank studies is never exceeded in Romania and Pitesti.

In 2002, the price of heating, electricity, gas, transport, telephone, etc. rise pressure on budget of households and determined the decreasing (even to zero) of the share for purchase of non-alimentary goods.

The lowest income groups from Pitesti area spend around 3.8% from the household monthly budget on water and sewerage services. This suggests that the total water and sewerage bill could be little increase and still remain within the lower limits of affordability (4% from the average household incomes).

8 ASTEC Financial Model

Tariffs of drinking water and sewerage treatment will have to be adapted to cover all investment costs, financing costs and operations and maintenance costs caused by the new investments in the drinking-water production & treatment and sewerage collection & treatment.

For the Pitesti case study a financial model ASTEC was used. The model requires Excel software with Solver installed and Excel enabled to run macros. Eight worksheets of the model are displayed for use, while a number of sheets containing side-calculations are hidden. The model allowed a number of loops during optimization. For the Pitesti case study 10 to 15 loops were utilized. The precision of the model (maximum allowed difference between costs and revenues in case of cost recovering scenarios) was selected 0.1% or 0.5%.

The ASTEC model allows clustering of commodity charges. For the Pitesti case study service users that have the same commodity charge was chosen in the same "cluster". Users belonging to the same cluster had the same commodity charge after the model finished the optimization process.

The basic input data included in the ASTEC financial model are presented in Table 9, Table 10 and Table 11

Table 9 Specification of Service Users and General Data

Name of the Service User category	No. of entities	The service	Baseline annual water use per entity (m^3/year)	Water commodity charge (1000 ROL/m^3)	Baseline annual discharge as % of water use	Baseline annual discharge per entity (m^3/year)	Wastewater commodity charge (1000 ROL/m^3)
Household A, unmetered (Pitesti)	21,799	Water & Sewer	165	6.462	77%	127	5.236
Household A, metered (Pitesti)	37,759	Water & Sewer	140	6.462	77%	108	5.236
Household B (Pitesti)	491	Water	165	6.462		0	
Household C (villages)	3,721	Water & Sewer	160	6.462	77%	123	5.236
Household D (villages)	509	Water	160	6.462		0	
Industry E (Refinery)	1	Water	1,420,000	6.462		0	
Economic units	2,594	Water & Sewer	3,116	6.462	77%	2,399	5.236
Leakage[1] and storm water[2]			[1)] 5,735,000			[2)] 500,000	

Table 10 Variable Costs in 2003

COSTS	Costs 2002 (1000 EURO)		Costs 2003 (1,000 ROL)		Water* invoiced (million m^3)	Sewe-rage* water invoiced (million m^3)	Costs 2003 per m^3 (ROL)	
	Labor cost	Materials, energy, maintenance, etc. costs	Labor cost	Materials, energy, maintenance, etc. costs			Labor cost	Materials, energy, maintenance, etc. costs
1	2	3	4	5	6	7	8	9
TOTAL from which:	**2,043**	**3,543**	**67,047,200**	**116,274,218**	-	-	-	-
drinking water supply system	***1,430*** (70% from total)	***2,480*** (70% from total)	***46,933,040*** (70% from total)	***81,391,953*** (70% from total)	**19.2**	-	**2,444**	**4,239**
sewerage system	***613*** (30% from total)	***1,063*** (30% from total)	***20,114,160*** (30% from total)	***34,882,265*** (30% from total)	-	**13.5**	**1,490**	**2,584**

Note:

1 EURO 2002 = 31255.25 ROL

* data use in ASTEC model for 2003

column 8 = column 4 / column 6

column 9 = column 5/ column 7

Table 11 Fixed Costs and Grants

	Drinking water	Wastewater
Treatment for drinking water (cost)	44,163,000	
Pumps (cost)	68,370,750	
Distribution pipeline (grant)	417,130,000	
Sewerage (grant)		600,000,000
WWTP (grant)		454,970,000
Machinery, equipment (cost)		21,638,000
Sewerage (cost)		81,409,000
WWTP (cost)		153,317,500

For the drinking water and sewerage systems, administrated by APA-CANAL-PITESTI, the following scenarios "building blocks" was used for Pitesti application of the ASTEC model:

- *Switching from unmetered consumption to metered consumption* for those households (HHs), which lack metering at present. This will very likely result in decreased consumption and subsequently decreased commodity charge payment for them. Examination of subscenarios: how will the installation of meters be financed: grant or loan. If financed by loan, costs to be recovered by HHs through fixed tariffs or commodity charges or not at all.
- *Past investment costs* are sunk (no repayment obligation on them).
- *Calculation of variable costs* of water service. 1. This was done by taking the annual level of specific categories of variable costs and dividing them with the level of water *consumption;* 2. Alternatively, was divided them with the level of *production*, which is higher than consumption, therefore variable costs in this scenario are also allocated to leakage, therefore the costs of leakage need to be redistributed among SUs.
- *Redistribution of the costs of leakage* 1. Based on consumption 2. A higher ratio of costs to be born by households in the suburbs and villages due to higher leakage per HH there. In case investments reduce leakage of water, related adjustment of the quantity of leaked water is needed (this makes sense when the costs of leakage are identified and redistributed among SUs, operating costs will decrease due to less leakage).
- *New investments* into both the water service (treatment, pumps, pipelines) and wastewater service (network, equipment and treatment). Examination of the role of ISPA grants on the financial accounts and the level of tariffs in case of cost recovering scenarios. Examination was performed of the effect of commercial loans (instead of ISPA grants) on the level of tariffs.
- When *investments* are financed from loans: *repayment* in 10 years (because it may not be possible to receive a commercial loan for more than 10 years) or repayment during the lifetime of the equipment.
- Distribution of investment costs among SUs based on the volume of consumption, or based on a percentage algorithm. This in combination with an assumption that tariff are set to just recover the costs (FCR)
- Examination of scenarios of full cost recovery with or without marginal cost pricing; marginal cost pricing without full cost recovery.

In the ASTEC model for Pitesti no effluent charge scenario was elaborated because the wastewater discharged into the river (after the treatment plant) do not exceed the pollution limits and the investment hypothesis simply is used to maintain the current system. With the model the Scenario A, Scenario B, and Scenario C scenarios are elaborated and each scenarios for S1, S2, S3, S4 and S5 situations, as follow:

Scenario A

S1	Baseline tariffs and water use, sunk investment costs
S2	New investments, ISPA grants
S3	New investments, ISPA grants, FCR
S4	New investments, ISPA grants, FCR, op.cost savings

S5	Scenario S4 + reallocate leakage and maintenance costs

Scenario B

S1	Scenario A(S5) + 3 million m^3 decrease in leakage due to investments in the distribution network
S2	New investments, without ISPA grants, repayment through the lifetime, no full cost recovery
S3	New investments, without ISPA grants, repayment through 10 years, no full cost recovery
S4	New investments, without ISPA grants, repayment through the lifetime, full cost recovery
S5	New investments, without ISPA grants, repayment through 10 years, full cost recovery

Scenario C

S1	Baseline, sunk investment costs
S2	Baseline, sunk investment costs, switch to metering in HH A
S3	Baseline, sunk investment costs, switch to metering in HH A, no grant
S4	Baseline, sunk investment costs, switch to metering in HH A, no grant, HHs pay for it through fixed tariff
S5	Baseline, sunk investment costs, full cost recovery with marginal cost pricing

In the ASTEC model, the three scenarios that were described above were implemented. For each scenario five situations for APA-CANAL-PITESTI was given and the results obtained (cash-flows, profit and losses and the balance sheet) are in terms of: drinking water and wastewater tariffs, drinking water consumption and wastewater discharges, revenues of drinking water services and wastewater services, balances of drinking water service accounts and wastewater service accounts and balance of drinking water and wastewater service accounts. For example, in Annex 1 are presented the results obtained for Pitesti with ASTEC model for Scenario A.

As can be seen from the tables included in Annex 1, the financial effects for APA-CANAL-PITESTI are the largest under the effect of metering and investments (from loans and grants) that will decrease the consume and discharge of water, will decrease leakage and will diminish the operation and maintenance costs.

Tariffs of drinking water and sewerage treatment will have to be adapted to cover inflation and all investment costs, financing costs and operations and maintenance costs caused by the new investments (from ISPA grants, already approved, from IEB loan and from the company self financing) in the drinking-water production & distribution and sewerage collection & treatment.

The tariffs have to be set at a level that allows for financial sustainability. APA-CANAL_PITESTI will have to get enough revenues from their operations that they can pay the debt service from the investments and still have enough cash balances to run their business and to have a proper cushion against uncertainties.

9 Tariff and Charges Reforms

The tight State and local-authority budgets make it difficult to implement the construction programmes for rehabilitation of obsolete drinking water facilities, sewerage and wastewater treatment plant. Available ISPA aid is not even sufficient to solve the problems of identified hot spots, and demand an additional domestic contribution is unable to afford.

For Pitesti and surrounding villages the company APA-CANAL-PITESTI is responsible for the drinking water production and distribution and the wastewater collection and treatment. This company should ensure water services for sustainable development of Pitesti area and has to preserve the water quality of Arges river for downstream water users (Bucharest). For these reasons APA–CANAL-PITESTI is facing to solve the following issues:

Issue 1 Water production and consumption

The demand for drinking water for household and socio-economic units is still at a very high level and this is, in fact, due to:

i) water losses in the obsolete distribution network, and

ii) water wastage by the consumers caused by:

   (a) not enough individual water meters, and

   (b) the bad state of in house plumbing

The results of water wastage and losses are a correspondingly supplementary production and distribution of drinking water and excessive volume of diluted wastewater generated by the user. Therefore, it is needed a correspondingly oversized drinking and sewerage network and treatment facilities and consequently unnecessary investments. When starts the process of metering the flats in apartment blocks the hot and cold water consumption decreased significantly (in some cases by 40%).

The reduction of drinking water production caused by drinking water wastage and losses should be a priority in rationalization of drinking water use in Pitesti. To solve this problem it is necessary to:

i) Rehabilitate the drinking water supply system. This implies the rehabilitation and upgrading of drinking water supply system and in house installations. The results will be in joint benefits for reducing losses and improving reliability which will increase the value of service and the willingness to pay more for that service;

ii) Extend the installation of individual water metering;

iii) Develop economic incentives to encourage owners of buildings and flats to repair their water infrastructure. For instance if a person will improve his water infrastructure to be allowed 1) to deduct the expenditures from his municipal tax bill or 2) to have access to some subsidy or soft loan.

Issue 2 Management system

APA-CANAL has in plan to increase the performance of the company and for these have to:

i) Extend the activities inside and around the city;

ii) Increase the quality of drinking water and wastewater discharges into the river Arges;

iii) Externalize some activities (install and maintenance of water meters, etc.)

Issue 3 Water tariffs

Water tariffs for APA-CANAL are subject of depreciation by inflation and by augmentation of electricity tariff. To update water tariffs APA-CANAL has to fulfill a long procedure each time without to have the possibility to cover the economic losses until the new tariffs has been approved. To avoid this situation, APA-CANAL intends to propose for approval a formula for automatic calculation of water tariffs. Once the formula is approved, the water tariffs can be easy updated.

Issue 4 Economic sustainability

Economic sustainability of MU is poor. It is very difficult to raise the capital needed for development. Therefore, there is a severe problem throughout Romania in the financing of environmental infrastructure projects from local budgets. This problem extends to the co-financing of ISPA supported projects; the 25% minimum that is required is still beyond the direct funding capacity of local budgets. On the one hand, there are difficulties in raising tariffs owing to limited affordability to pay and on the other hand, private finance is limited.

So far, Pitesti Municipality Council is allowed to issue bonds on the internal financial market up to 20% of the budget value. In the future, more than the ISPA grant mechanisms should be initiated and completed with alternative mechanisms such as:

i) state-guarantee soft loans combined with revolving funds;

ii) financial contracts in public-private partnership;

iii) mixing up with other international financial assistance programs;

iv) softening the venture capital input from business sector, assigned to environmental protection, including public utilities;

v) better planning the new investments by grouping of projects by hydrographic basin basis.

Phasing in these financial instruments will be gradual and will take time.

Annex 1

ASTEC Model Results for Pitesti, Scenario A

1 Water tariffs (Commodity charges in 1000 ROL/ m^3)

Service user category	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Household A, unmetered (Pitesti)	6.46	6.46	7.30	7.30	7.34
Household A, metered (Pitesti)	6.46	6.46	7.28	7.30	7.37
Household B (Pitesti)	6.46	6.46	7.30	7.30	7.37
Household C (villages)	6.46	6.46	7.28	7.30	7.37
Household D (villages)	6.46	6.46	7.30	7.30	7.39
Industry E (Refinery)	6.46	6.46	7.30	7.30	7.38
Economic units	6.46	6.46	7.28	7.30	7.37

2 Wastewater tariffs (Commodity charges in 1000 ROL/ m^3)

Service user category	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Household A, unmetered (Pitesti)	5.24	5.24	5.59	5.57	5.31
Household A, metered (Pitesti)	5.24	5.24	5.56	5.58	5.32
Household B (Pitesti)					
Household C (villages)	5.24	5.24	5.56	5.24	5.32
Household D (villages)					
Industry E (Refinery)					
Economic units	5.24	5.24	5.56	5.58	5.32

3 Water consumption (m^3/entity/year)

Service user category	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Household A, unmetered (Pitesti)	165.00	165.00	164.17	164.18	164.30
Household A, metered (Pitesti)	140.00	140.00	136.63	136.53	136.95
Household B (Pitesti)	165.00	165.00	160.05	160.05	159.68
Household C (villages)	160.00	160.00	156.15	156.94	156.51
Household D (villages)	160.00	160.00	155.20	155.20	154.72
Industry E (Refinery)	1,420,000.00	1,420,000.00	1,377,398.36	1,377,435.35	1,373,741.84
Economic units	3,116.00	3,116.00	3,040.95	3,038.85	3,048.04

4 Wastewater discharge (m^3/entity/year)

Service user category	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Household A, unmetered (Pitesti)	127.05	127.05	126.41	126.42	126.51
Household A, metered (Pitesti)	107.80	107.80	105.20	105.13	105.45
Household B (Pitesti)	0.00	0.00	0.00	0.00	0.00
Household C (villages)	123.20	123.20	120.23	120.85	120.51
Household D (villages)	0.00	0.00	0.00	0.00	0.00
Industry E (Refinery)	0.00	0.00	0.00	0.00	0.00
Economic units	2,399.32	2,399.32	2,341.53	2,339.91	2,346.99

5 Water consumption (m^3/year)

Service user category	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Household A, unmetered (Pitesti)	3,596,835	3,596,835	126.41	126.42	126.51
Household A, metered (Pitesti)	5,286,260	5,286,260	105.20	105.13	105.45
Household B (Pitesti)	81,015	81,015	0.00	0.00	0.00
Household C (villages)	595,360	595,360	120.23	120.85	120.51
Household D (villages)	81,440	81,440	0.00	0.00	0.00
Industry E (Refinery)	1,420,000	1,420,000	0.00	0.00	0.00
Economic units	8,082,904	8,082,904	2,341.53	2,339.91	2,346.99

6 Wastewater discharge (m^3/year)

Service user category	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Household A, unmetered (Pitesti)	2,769,563	2,769,563	2,781,762	2,792,639	2,781,938
Household A, metered (Pitesti)	4,070,420	4,070,420	4,164,915	4,241,295	4,162,806
Household B (Pitesti)	0	0	0	0	0
Household C (villages)	458,427	458,427	469,070	470,257	468,830
Household D (villages)	0	0	0	0	0
Industry E (Refinery)	0	0	0	0	0
Economic units	6,223,836	6,223,836	6,368,322	6,485,110	6,365,085

7 Revenues of water services (Commodity charges in 1000 ROL/ m^3)

Service user category	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Household A, unmetered (Pitesti)	23,242,748	23,242,748	26,133,724	26,117,199	26,286,236
Household A, metered (Pitesti)	34,159,812	34,159,812	37,575,940	37,652,756	38,089,807
Household B (Pitesti)	523,519	523,519	573,613	573,566	577,618
Household C (villages)	3,847,216	3,847,216	4,231,954	4,265,213	4,289,916
Household D (villages)	526,265	526,265	576,622	576,575	582,023
Industry E (Refinery)	9,176,040	9,176,040	10,054,064	10,053,254	10,134,561
Economic units	52,231,726	52,231,726	57,455,122	57,572,577	58,241,470
TOTAL	123,707,326	123,707,326	136,601,039	136,811,140	138,201,631

8 Revenues of wastewater services (Commodity charges in 1000 ROL/ m^3)

Service user category	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Household A, unmetered (Pitesti)	14,501,432	14,501,432	15,397,920	15,357,636	14,644,586
Household A, metered (Pitesti)	21,312,720	21,312,720	22,105,842	22,153,233	21,176,106
Household B (Pitesti)	0	0	0	0	0
Household C (villages)	2,400,325	2,400,325	2,489,649	2,354,474	2,384,930
Household D (villages)	0	0	0	0	0
Industry E (Refinery)	0	0	0	0	0
Economic units	32,588,006	32,588,006	33,800,721	33,873,184	32,379,055
TOTAL	70,802,482	70,802,482	73,794,133	73,738,527	70,584,677

9 Balance of water service accounts (1000 ROL/year)

Service user category	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Household A, unmetered (Pitesti)	-787,707	-2,961,127	15,184	-3,902	-4,927
Household A, metered (Pitesti)	-1,157,691	-4,351,961	-74,905	27,017	22,428
Household B (Pitesti)	-17,742	-66,696	90	13	130
Household C (villages)	-130,384	-490,135	-8,436	3,060	2,527
Household D (villages)	-17,835	-67,046	90	13	132
Industry E (Refinery)	-310,980	-1,169,028	1,573	232	2,288
Economic units	-1,770,156	-6,654,323	-114,532	41,310	34,298
TOTAL	-4,192,495	-15,760,317	-180,936	67,744	56,874

10 Balance of wastewater service accounts (1000 ROL/year)

Service user category	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Household A, unmetered (Pitesti)	3,218,232	-857,673	32,397	-10,393	-11,822
Household A, metered (Pitesti)	4,729,828	-1,260,520	-44,129	16,591	15,283
Household B (Pitesti)	0	0	0	0	0
Household C (villages)	532,692	-141,965	-4,970	-153,111	1,722
Household D (villages)	0	0	0	0	0
Industry E (Refinery)	0	0	0	0	0
Economic units	7,232,098	-1,927,385	-67,475	25,368	23,373
TOTAL	15,712,850	-4,187,543	-84,177	-121,545	28,556

11 Balance of drinking water and wastewater service accounts (1000 ROL/year)

Service user category	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Household A, unmetered (Pitesti)	2,430,525	-3,818,800	47,581	-14,295	-16,749
Household A, metered (Pitesti)	3,572,137	-5,612,481	-119,034	43,608	37,711
Household B (Pitesti)	-17,742	-66,696	90	13	130
Household C (villages)	402,309	-632,100	-13,406	-150,051	4,248
Household D (villages)	-17,835	-67,046	90	13	132
Industry E (Refinery)	-310,980	-1,169,028	1,573	232	2,288
Economic units	5,461,942	-8,581,709	-182,007	66,678	57,671
TOTAL	11,520,355	-19,947,860	-265,113	-53,801	85,430