Regional Infrastructure Program, 2001–2005

A USAID Initiative in South East Europe

Water Project Formulation for Varazdin

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Executive Summary

Under the United States Agency for International Development's Regional Infrastructure Program (RIP), Booz·Allen & Hamilton (BAH) was asked to review the Varkom water utility in Varazdin, Croatia. The purpose of this review is to assist the City of Varazdin in the development and implementation of a rehabilitation and expansion plan for its utility: Varkom. The original focus of this was on investments for the utility's sewage treatment plant. However, the utility's proposed investments also include improvements to the water supply system, a priority that was confirmed by our technical analysis of the utility's needs. Therefore, both investments are considered in this report.

A. Overview

Varkom is the public utility responsible for the provision of water and sewage treatment services in the City of Varazdin and surrounding municipalities. The shareholding utility is owned 51% by Varazdin and 49% by the other municipalities. While the primary mandate of the company is to supply water to both industrial and household consumers, construction activities account for a significant share of business operations.

Varkom is a small operation serving approximately 40,000 connections, which represents 85% of the potential market, according to the most recent data available from the utility. Local consumption increases by 1% per annum on average. The utility claims to have sufficient capacity to sustain operations at this rate but is seeking investment money to rehabilitate the sewage treatment plant which is not presently up to the biological standards set by Croatia Water, the national agency mandated with regulating water services investment throughout the country.

B. Potable Water Distribution Activities

Varkom provides piped water service to 145,000 people, plus industries, businesses and public facilities (schools, hospitals, and government buildings) in an area of about 1,070 sq km, or 85% of the total county. Varkom also provides water storage capacity equivalent to a little more than one day’s average consumption, and manages a water distribution system totaling about 1,200 km of pipeline.

There are three main factors of concern with regard to this system:

1. While the water quality is generally considered of high quality, the water distributed has recorded relatively high nitrate levels that are close to the maximum allowed in Croatia and within the EU (i.e.; 10 mg/l). This reflects the current operational situation with regard to raw water resources where water from high nitrate well fields is blended with higher quality water from low nitrate well fields in order to achieve a final blended product for distribution that meets potable water standard (i.e.; the nitrate levels in the final blended product is less than 10 mg/l).
2. While product water storage capacity and distribution pressure is considered adequate by most standards (i.e.; total water distribution storage capacity exceeds 24 hours of average consumption at pressures of over 3 bar), during peak demand times the pressure in the distribution network falls significantly with the resulting loss in supply to those consumers at higher elevations.
3. Lastly, water losses (i.e.; unaccounted for water - UFW) are estimated to be in the vicinity of 35 to 40%, which is too high and reflects the age and condition of the distribution network.

C. Wastewater Activities

Varkom provides wastewater collection and treatment only to about a third of the people connected to its water distribution network (i.e.; about 49,000 people). Those not connected are said to utilize septic tanks for their wastewater disposal. Three major concerns exist with regard to Varkom's wastewater system. There are:

1. The waste water treatment plant produces offensive odors resulting in numerous public complaints;

2. The plant is not consistently achieving water quality discharge parameters set by Croatia Water; and
3. Industrial discharges into the sewerage system from the meat processing and dairy industries cause occasional spike in Bio-chemical Oxigen Demand (BOD) loads that exceeds the plants ability to achieve the effluent discharge requirements.

D. Proposed Solutions to Identified Problems

The following solutions are recommended in order to successfully address the problems identified. There are as follows:

For the water distribution system

- *Maintaining nitrate levels below 10 mg/l:* Two alternative engineering solutions were considered: 1) Increase the production capacity of higher quality well fields (i.e.; develop new wells); or alternatively 2) Increase the capacity of the distribution storage reservoir to assist in stabilizing the blending of water from the existing well fields and, in the process, increase the elevation and distribution pressure. Reducing the short-term operational need for water from high nitrate well fields during peak period demand would lower overall water nitrate levels.

  Varkom has selected to go forward with the second solution and has already obtained funding from Croatia Water to build a new distribution storage reservoir that should be completed by the spring of 2002.
- *Maintaining water pressure during peak demand times:* The solution Varkom has selected for reducing high nitrate levels also addresses water pressure problems during peak demand times (see above).

- *Distribution network losses are in the range of 35 to 40%:* The proposed solution requires the systematic identification and replacement or remediation of the deficient sections of the network with the goal to reduce UFW to less than 25%.

For the wastewater system

- *Wastewater odors and achieving water quality discharge standards:* There are a number of ways in which the problems could be overcome. The wastewater treatment plant could be reengineered to that of a conventional activated sludge plant with the inclusion of primary sedimentation tanks. This solution would have a high capital investment requirement (2-to-4 million USD) and would require a two-to-three year implementation schedule. The alternate solution would require firstly, changing the diffusers in the secondary reactors to increase the efficiency of the biochemical processes, and secondly to install covers on the secondary tanks together with activated carbon odor control units to contain and treat the odor. The first action alone would sufficiently modify the biochemical processes in the reactors to reduce odors and enhance reactor performance, and hence improve effluent quality so as to meet Croatia's biochemical and physio-chemical water quality standards.

  The estimated cost of this alternate solution would be less than 1/4 million USD of which 50,000 USD would be required for the purchase and installation of new fine bubble diffusers. The timeline to implement this proposed solution would be less than 6 to 9 months; including equipment commissioning. In addition to the above actions, the effluent discharges would need to be disinfected in order to meet bacteriological requirements. This would be most economically achieved by the metering of a chlorine solution into the discharge channels following secondary treatment

- *Industrial discharges:* A review of the logistics, with possible recommendations for logistically making it easier for private industries to comply with the legislation, may help. However this is an age-old problem worldwide and the only long term solution is to increase the policing and enforcement of

the legislation regarding industrial discharges into the sewerage system. This is the responsibility of the City of Varazdin and not of the Operator, Varkom.

E. Proposed Investment Plan

The utility has developed a proposed investment program to deal with water quality and wastewater treatment needs. However, the program lacks some important technical analysis and is somewhat over ambitious (calls for up to 10.8 million USD in investment over the next couple of years). It is recommended that additional value engineering work be undertaken in order to develop a more realistic and beneficial investment program.

F. Financial Performances

Although technically a water utility, Varkom derives a significant portion of its revenues from its construction business. The construction activity has consistently been profitable, while water and wastewater continues to operate at a loss. Construction has declined as a percentage of the company's total business over the last five years, resulting in an overall drop in sales.

A number of factors contribute to the financial losses suffered by the water business. In particular:

- Varkom's overall water sales remained flat (at around 9.5 million cubic meters sold per year) and have little potential for growth in terms of volume;
- Revenue from water sales (excluding connection work revenues) declined in real terms by about 15% under the combined effect of the lack of tariff re-adjustment and the decreasing importance of industrial customers; and,
- Insufficient improvements were achieved in the level of both water distribution losses and commercial losses. A reduction of these losses could have allowed Varkom's to generate significant additional revenues without any increase water production costs.

Among the factors previously examined, the one having the greatest impact on Varkom's ailing revenue picture is the current tariff level. A survey of tariff levels in 36 other cities in Croatia shows that Varkom's tariffs both for industrial and household customers are much lower than the national average that in turn is much lower than the European average.

The current published tariff of 5.5 Kuna per cubic meter paid by households customers covers both water supply and wastewater treatment. This tariff is set by the City Council and the approval by Croatia Water is no longer required. Regardless of this tariff level, Croatia Water, however, must be paid approximately 4 Kuna per cubic meter sold, as it owns the Croatia's water resource. The balance, or about 1.5 Kuna, is how much Varkom receives for each cubic meter sold in order to finance its operations.

A core issue in the negotiation of tariff between the municipal government and Varkom appears to be the reluctance of the City to increase tariffs until it sees some tangible improvements to the water service (i.e.; Varkom needs to meet the effluent standards for wastewater treatment set by Croatia Water, and resolve permanently the problem of odors generated by the secondary reactors).

G. Financing Options

Based on our technical and financial review of the company, it appears clearly that the utility's problems should be addressed not simply with new investment and construction, but also by reforming its operational and financial management. Nonetheless, Varkom is in need of some specific investments, for which financing will need to be obtained. As such, it faces a number of important barriers to financing, including:

- Outstanding loans to Croatia Water, which are not yet recognized on its books (amount to about 3 million USD);
- Stagnating demand for its water services;
- Tariffs that are below its cost recovery levels;
- Low billing collection rates;
- A proposed investment plan significantly beyond its financial means; and,
- An the uncertain future of its construction business.

Under these conditions, it is clear that Varkom's ability to secure financing to carry out its investment plan will be contingent upon its shareholders capacity to offer financial guarantees (i.e.; Varazdin City).

Utilities in Croatia have obtained financing for investments from a variety of sources. Of these, only two appear to be good candidates for Varkom: the National Water Company (i.e.; Croatia Water) and the Croatian Bank for Reconstruction and Development (HBOR). Both represent available funding sources, although Varkom would still likely have to self-finance some of the planned investment using its own generated cash flow. Before going forward, however, we recommend that:

- Varkom's investment plan be re-scaled based on the company's financing capacity;
- Varkom and its shareholders should carefully review the financial burden associated with taking on additional debts and consider adjustment measures (e.g.; tariff increases, company restructuring) that would mitigate associated financial risk; and,
- Proper institutional restructuring of Varkom operations and management be implemented.

H. Proposed Next Steps

Additional support under the RIP would help to ensure that Varkom is in a position to effectively obtain and use investment financing. We recommend moving forward in a cooperative effort framed by two Memoranda of Understanding (MOU) between USAID and the City of Varazdin. As part of the first MOU, USAID would develop materials in support of further reform, including an investment plan, tariff schedule, and restructuring options. Additionally, USAID would procure the diffusers needed to restore the capacity of the wastewater plant so as to meet Croatian's wastewater standards. The City would, in turn, approve the proposed tariff increases, investment plan and restructuring options aimed at restoring Varkom's long-term financial health. Also, it would agree to purchase covers for the secondary tanks together with activated carbon odor control units to contain and treat the odor. Finally, the City would agree to cover the costs associated with the installation of the diffusers. All the work to be performed under this first MOU would have to be completed by November 15^{th,} 2001.

Work to be undertaken under the second MOU would include the development of a business plan and a performance contract agreement to be ratified by the City of Varazdin and Varkom. The implementation of this second MOU would be contingent upon these two parties reaching first an agreement on long-term tariff adjustments and investment levels.

Overall level of efforts for both phases would be:

Personnel Categories	Industry Specialist/Engineer Level I	Business and Finance Specialist Level I	Institutional Development Specialist Level I	Attorney Level I	Legal, Engineer and Financial Specialists CCN/TCN
Task 1: MOU 1	20 days	15 days	10 Days	10 days	30 days
Task 2: MOU 2	10 days	15 days	10 Days	15 days	30 days
Total	30 days	30 days	20 Days	25 days	60 days

Chapter I: Introduction

On 10 June 1999, more than forty partner countries and organizations signed the Stability Pact for South Eastern Europe Cologne, Germany. The purpose of this pact is to strengthen the countries of South Eastern Europe "in their efforts to foster peace, democracy, respect for human rights and economic prosperity in order to achieve stability in the whole region".

The United States Agency for International Development's Regional Infrastructure Program (RIP) for Water and Transport was developed as an important element of the U.S. Government's overall program of support for achieving Stability Pact objectives in the region. Booz·Allen & Hamilton has been retained by USAID to assist in this program by supporting specific efforts to improve water and transportation infrastructure in the Balkans region.

Booz·Allen's current review of Varkom, a Croatian water utility, constitutes a task under the auspices of the RIP. Specifically, the BAH team was asked to 1) review Varkom's existing rehabilitation and expansion plan, 2) validate the plan's adequacy to accomplish stated goals and objectives and 3) develop TORs so as to select consultants to carry out commercial and financial feasibility study. With these objectives in mind our team conducted interviews with key stakeholders, reviewed Varkom's investment plans and financial documents, and consulted with potential lenders (e.g., HBOR, Croatia Water) to perform an assessment and make recommendations for action.

The original focus of this project was on investments for the utility's sewage treatment plant. However, the utility's proposed investments also include improvements to the water supply system, a priority that was confirmed by our technical analysis of the utility's needs. Therefore, both investments are considered in this report.

This preliminary report presents of our findings with regard to technical and financial activities at Varkom, and provides recommendations for further technical assistance to be carried out in support of a loan and investment program for the utility. It is organized in the following manner:

- Chapter I - Introduction
- Chapter II – Review of Varkom's Water Activities
- Chapter III – Financial Performance
- Chapter IV– Review of Varkom Water System's Financing Options
- Chapter V – Recommendations for Further Technical Assistance

The views expressed within this report are those of the consultants and are based on information gained through interviews and documentation. We are grateful to the individuals that generously provided extensive information during our field visits.

Chapter II: Technical Review of Varkom's Water and Wastewater Activities

II.1 Water Supply and Distribution Network

II.1.1 Description of the Water Extraction, Treatment and Distribution system

Varkom provides piped water service to 145,000 people, plus industries, businesses and public facilities (schools, hospitals, and government buildings) over an area of about 1,070 sq km, or 85% of the total county. The 145,000 people served represent about 83% of the 175,000 people living in its service area. Those not connected to the system generally have access to water from springs or private wells.

All of the water is obtained from wells. Varkom's principal sources of water are from wells in three well fields near Varazdin City. There are ten wells in the Varazdin well field, the closest to the city and the first source developed for use in the system. There are four wells in a second well field at Trnovec Bartolovecki, east of Varazdin. The newest well field has two wells at Vinokovscak, north of the city.

The total capacity of the 16 wells is about 600 liters per second (lps), or 51,800 Cubic Meters per Day (CMD). This exceeds the average daily needs of the system, which was stated to be about 350 lps or 30,200 CMD. However, actual water produced in 2000 reached 35,150 CMD, and peak hourly production, while not available, was probably in the order of 1.5 times that amount, or 52,700 CMD.

The water in general is of a high quality and treatment is limited to chlorination prior to being pumped to potable water storage reservoirs.

Varkom provides storage capacity in its system equivalent to somewhat more than one day's average consumption. It has ten ground storage tanks with a capacity of 3,500 Cubic Meters (CM) each, and is currently building a new storage unit with a capacity of 5,000 CM. Total water storage is, therefore, estimated to be about 40,000 CM against an estimated current average usage of about 35,000 CMD

The distribution system has a total of about 1,200 km of pipelines. All customers are directly connected to pipelines, and water is provided under pressure 24 hours per day. More than a third of the mains are made of an older type of polyethylene pipe (not high density) that is subject to a high rate of failure. About 20% of these pipelines are over 25 years old, and need to be replaced. Varkom reports that it currently experiences about 2,400 breaks per year in its distribution system, or 200 breaks per month. This number represents an average of ten breaks per working day, a very large number for a utility of Varkom's size.

II.1.2 Network Operations

Varkom reports that every one of its customer connections is metered, and all meters are read monthly. All apartment buildings are provided only a single meter. About 90% of the meters are manufactured in Zagreb. All the meters are said to be in good operating condition, and provide accurate results. Varkom has its own facilities for the repair and calibration of water meters. Its employees claim to replace all meters every five years with units previously repaired and calibrated.

Unaccounted-for-water – (UFW)

System losses, calculated by comparing the water billed to customers versus that abstracted from the wells, are in the 35 to 40% range. This value is consistent with the mains breakage rates of approximately 200 per month.

II.1.3 Water Quality

Varkom officials consider water quality acceptable with the exception of nitrate level that is near EU and Croatian maxima (i.e.; 10 mg/l). The nitrate problem is, for the most part, attributable to the Varazdin wells field where nitrate levels as high as 22 mg/l are the norm. Under normal operations the water from this field is blended with water from other well fields in order to achieve a final blended product with nitrate level of 7-8 mg/l.

Varkom has conducted test drilling at several Varazdin well sites to determine whether water of higher quality and acceptable quantity can be obtained from deeper aquifer at this site.

II.2 Wastewater Collection System

II.2.1 System Description

Varkom provides wastewater collection and treatment only to an estimated 49,000 people, all of whom live in Varazdin City. This figure amounts to about one third of the 145,000 people connected to the Varkom water system. Those not connected are said to utilize septic tanks for their wastewater disposal. The wastewater system has 743 customers classified as industrial, but this classification also includes commercial and public sector customers. They have 11,773 residential customers, including apartment buildings and single or double family homes, but no breakdown was available for those two categories.

There are reported problems of both blockages and breaks in the system pipelines. Some of the older pipelines in the center of the city, the main cause of the breaks, require replacement. Blockages are often the result of build up of debris discharged to the sewers by some industries. In addition, many of the sewers were constructed at a relatively flat grade, and the lack of slope in the pipelines makes it difficult to achieve self-cleaning velocities, resulting in a build-up of solids. There are a reported five breaks per month, and, as many of these occur in the city center, they are difficult to repair.

II.2.1 System Operations

Local regulations require industries to provide pre-treatment, but compliance is not always practiced. The City is increasing its efforts to enforce the regulations. This is a particularly difficult problem for the operations of Varkom's collection and treatment works, as some of the wastes from poultry, meat and food processing plants, and from woodworking factories, dairies and textile wastes contribute to blockages and to large and variable shock loads of chemical and organic wastes. Few if any restaurants or other industries provide grease traps to prevent the discharge of troublesome grease to the sewer system. Those few that have them are believed not to maintain them, so grease passes unobstructed to the sewers.

The flows carried in the combined wastewater system have four major components. They include (1) wastewater from water supplied by the Varkom water system, (2) wastewater from water supplied by private wells, which is believed to be very significant for many of Varazdin's industrial and commercial customers, (3) storm water from catch basins and from houses and apartments, and (4) infiltration from groundwater entering openings in the pipelines and manholes. There does not appear to be any reliable data on the relative amounts of the contributions from these various sources of flows. Varkom officials indicated that collected rainwater could amount to as much as from 200,000 to 900,000 CMD, or 8 to 36 times as much as the estimated average dry-weather flow. Such storm water flows greatly exceed the capacity of the pipelines, resulting in frequent overflows at many locations.

The strength of a wastewater is measured principally by the demand the wastewater makes on oxygen in the water over time (usually a period of five days). For most essentially household or organic wastes, the unit used to measure this is BOD, or Bio-chemical Oxygen Demand. For industrial wastes, which may include chemicals that do not support living organisms, COD or Chemical Oxygen Demand is sometimes a better measure of the wastewater's polluting capacity. Finally, the amount of solids suspended in the wastewater (total suspended solids or TSS) is also an important measure of its "strength" or polluting capability, and the amount of "sludge" or settled solids that the plant must treat and dispose of. In western countries where individual water use is relatively high, BOD in sewers can often be as low as 150 to 250 milligrams per liter (mg/l).

Varkom officials indicated that BOD levels of about 250 to 300 mg/l were considered average, but BOD had sometimes reached levels of 1,000 mg/l. That is extremely high, and probably indicative of a "slug" (a short

duration passage of flow from a very polluted source, such as dumping a vat of animal entrails into the sewer) from an industrial source. Random records showed an extremely wide range of results for BOD, COD and TSS, by a factor of five or more. While that is somewhat expected for combined flow (when sewage is diluted by storm water at times), it was not uncommon to see BOD levels in the laboratory records of 400 to 600 mg/l during days of dry-weather flow. That seems to indicate that the lacks of control over industrial wastes, and the absence of pre-treatment, are having a serious impact on the operations of the wastewater treatment plant.

II.3 Description of Current Wastewater Treatment Plant Operations

The wastewater treatment plant site is located on the outskirts of the City to the east. While the general surrounding area is relatively unpopulated, the owner of a nearby sand pit operates a popular water theme park, and users of this recreation site are a source of steady complaints about odors from the wastewater treatment plant.

The pre-treatment consists of (1) fine screening of floatable materials, (2) aerated grit removal, and (3) scum removal. The fine screening process works well. It was not possible to determine how effectively the grit removal system operates, but it is clear that the amount of grease and scum in the wastewater exceeds the capacity of these facilities to remove them. This is evident at the aeration basins. There is also an overflow channel at this location, but it showed no signs of recent use.

Whether because of the heavy solids loadings resulting from the lack of primary sedimentation or the inadequacies of scum removal, or more likely a combination of both, the influent end of the first-stage aeration basins suffers from clogged aerators and massive build-ups of floating scum. The system includes second-stage aeration, "secondary" sedimentation and sludge return capacity, with "excess" sludge pumped periodically to one of a pair of open, circular Aerated Sludge Holding (ASH) tanks.

Excess sludge collected from the secondary sedimentation basins that is not re-circulated is pumped periodically to a 1,050 cubic meter circular sludge thickening tank. Sludge in the tank is thickened mechanically and transferred to a second tank of the same capacity. Both tanks are open at the top. The "stabilized" sludge is then transferred to seven open sludge-drying beds, with under-drainage. These beds are not shaped out of earth but have sides of steel. All appeared to be full at the time of the visit.

For odor control, the aeration basins, secondary sedimentation tanks and the sludge drying beds were surrounded by a system of flexible hoses and nozzles that emitted a fine spray of perfumed mist. The mist was based on a chemical manufactured by a firm in New York and supplied by a company in Italy. Despite the best intentions, this system it is not effectively dealing with the plant odor issues.

The final effluent from the secondary sedimentation tanks is conducted to a short pipeline that discharges into an unpaved drainage ditch. The effluent is not chlorinated. The effluent mixes with the essentially clear water from seepage in the ditch, and the combined flow discharges by gravity into the Drava River about four kilometers to the east, just downstream from one of the dams. No data were obtained relative to the proportions of flow of drain water and effluent in the drainage ditch, the conditions in the ditch, or the impact of the effluent on the waters of the Drava River at and beyond the point at which it is discharged to the river.

II.4 Summary of Problems

II.4.1 Water Supply Problems

Varkom's priorities are to maintain the quality and quantity of the water it provides to its customers. As such, there is particular concern over:

1. **Water quality problems due to nitrates.**

The operation of blending waters from different source of varying qualities to achieve acceptable overall product water quality in sufficient quantities to meet demand is, in principle, sound and is widely practiced in the US and Western Europe. The challenge for Varkom, however, is to maintain the blend with a relatively small product reservoir capacity. This makes the blending operations sensitive during high demand periods and runs the risk of breaking the 10 mg/l quality requirement for nitrates or the quantity requirement dictated by peak demand conditions.

2. **Maintaining Distribution Pressures**
   Customers at higher elevations lose supply when demand is high and pressure in the distribution network drops.
3. **Water losses**
   Water losses of 35-40% in the distribution network exasperate problems 1 and 2 in addition to the obvious financial implications of losses amounting to 35-40% of your product. A reduction in water losses would in addition to reducing the operation costs lower the demand on the well fields and, thus, reduce the pressure losses during peak demand.

II.4.2 Wastewater System Problems

Varkom faces three primary wastewater system problems. They are:

1. The secondary reactors at the wastewater treatment plant produce offensive odors resulting in numerous public complaints;
2. The waste water plant is not consistently achieving water quality discharge parameters set by Croatia Water; and
3. The second identified problem is compounded when discharges into the sewerage system by industry exceed their permitted limits.

II.5 Proposed Solutions to Identified Problems

II.5.1 Water Supply and Distribution Network

Proposed solutions are:

1. **Maintaining nitrate levels below 10 mg/l:**
   Two alternative engineering solutions were considered: a) Increase the capacity of higher quality well fields or alternatively b) Increase the size of the distribution storage reservoir. This latter solution features the added benefit of providing the opportunity to increase distribution pressure by selecting a higher water elevation for the reservoir as well as lowering the nitrate level by reducing the system's sensitivity to contamination from high nitrate well fields during peak period demand by increasing the volume for blending.

   Varkom has selected the second solution and has already obtained funding from Croatia Water for building a new distribution storage reservoir that should be completed by spring 2002.

2. **Maintaining water pressure during peak demand times:**
   Proposed solution for reducing high nitrate levels addresses water pressure problems during peak demand times (see above).

3. **Distribution network losses are in the range of 35 to 40%:**
   Proposed solution requires systematic identification and replacement or remediation of the deficient sections of the network with the goal to reduce UFW to less than 25%.

II.5.2 Wastewater System

Proposed solutions are:

1. **Wastewater odors and discharge water quality:**

There are a number of ways in which the problems could be overcome. The wastewater treatment plant could be reengineered to that of a conventional activated sludge plant with the inclusion of primary sedimentation tanks. This solution would have a high capital investment requirement (2-4 million USD) and would require a two-to-three year implementation schedule. The alternate solution would require firstly, changing the diffusers in the secondary reactors to increase the efficiency of the biochemical processes, and secondly to install covers on the secondary tanks together with activated carbon odor control units to contain and treat the odor. The first action alone would sufficiently modify the biochemical processes in the reactors to reduce odors and enhance reactor performance, and hence improve effluent quality, to meet Croatia's biochemical and physio-chemical water quality standards.

A more stabilized sludge of reduced quantity would be produced due to the extension of the aeration process. The commissioning of this action would need to be finely tuned so as to avoid the potholes of over aeration and poor floc formation, and loss of nutrient removal. A commissioning period of 3 to 6 months would normally be required. The resulting stabilized sludge held in aerated sludge holding tanks prior to final treatment on drying beds would produce relatively little odor compared to the current situation where out of operational necessity unstabilized sludges is being transferred to the drying beds. The estimated cost of this alternate solution would be less than 1/4 million USD of which 50,000 USD would be required for the purchase of new fine bubble diffusers. The timeline to implement this proposed solution would be less than 6-to-9 months; including equipment commissioning. In addition to the above actions, the effluent discharges would need to be disinfected to meet the bacteriological requirements. This would be most economically achieved by the metering of a chlorine solution into the discharge channels following secondary treatment. This solution would have a negligible cost, as the amount of equipment to supply would be limited to two metering pumps and a stock tank. Its direct financial benefit would come from reduced power costs, as the plant’s electricity consumption would be lowered significantly thanks to the installation of the new diffusers.

2. **Industrial discharges:**
   A review of the logistics, with possible recommendations for operationally making it easier for private industries to comply with the existing legislation, may help. However this problem is common worldwide and the only long-term solution would consist in increasing the policing and enforcement of the legislation regarding industrial discharges into the sewerage system. This would be the responsibility of the City of Varazdin and not that of the Operator, Varkom.

II.6 Proposed Investment Program

Varkom officials have developed a water and wastewater priority improvement program amounting to about to 90 million Kunas, or 10.8 million USD. This investment program covers capital investment over the next five years and calls for investing 52 million Kunas (6.4 million USD) in the water supply and distribution network and 48 million Kunas in the wastewater system (4.6 million USD).

The solutions presented in Section II.5 of this report clearly indicate that the level of investment realistically required for both the water supply and distribution network and the wastewater system represents only a fraction of what is called for by Varkom's current investment plan. It is, therefore, important that a careful review of Varkom's existing investment plan be conducted as soon as feasible in order to adequately size its real investment needs. This information will be paramount to sizing future tariff adjustment needs. It is also recommended that additional value engineering work be undertaken in order to develop a more realistic and beneficial investment program.

Chapter III: Financial Performance

Our analysis of Varkom's financial results over the last five years is based on a review of the firm's audited accounts as well as meetings with Varkom's officials. At the time of our analysis, it is necessary to note that in our expert opinion the audited accounts provided to us did not fully adhere to international audit standards in several areas (e.g.; treatment of receivables, computation of cash flow, debt accounting) and failed to provide a sufficient level of financial information regarding the cost and revenues associated with the firm's two main businesses (i.e.; construction and water sales).

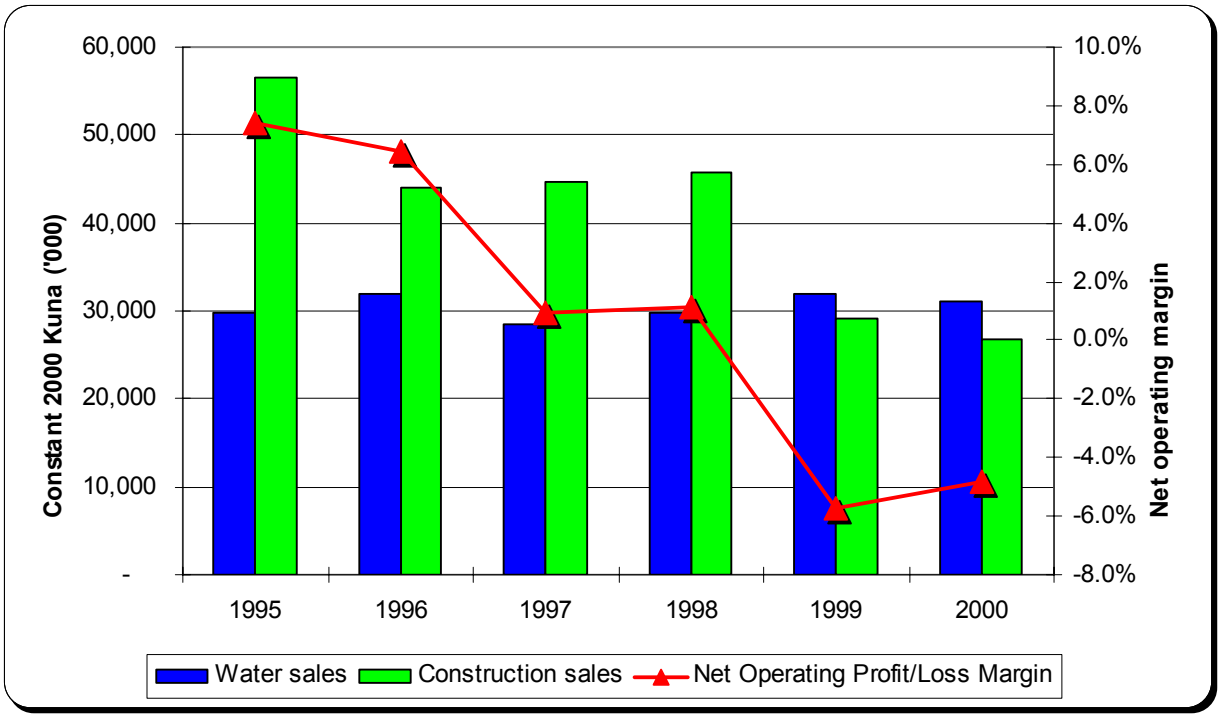
III.1 Profitability Analysis

Varkom's total sales over the last five years declined in real terms at an average annual rate of 8.1%. In 1995, company's total sales amounted to about 90 million Kunas (in 2000 Kunas or 10.7 million USD) while in 2000 they were only 59 million Kunas (7.0 million USD). As shown in Figure II.1, this significant drop in sales is primarily attributable to the rapid decline in the company's construction activity sales whose total amount dropped in real terms by more than 53% from 1995 to 2000. During this same period, Varkom's total water sales (including sales from connection work) managed, however, to increase in real terms by an average of only 0.9% per year and reached 31.1 million Kunas in 2000 (3.7 million USD). The financial impact of this diverging evolution of Varkom's construction and water sales can be seen in the rapid decline of the company's overall financial results over the last five years. While in 1995 Varkom's profit margin stood at 7.4% of sales, it sank well below zero both in 1999 and 2000 with, respectively, -5.7% and –4.8% of sales. Therefore, we can ascertain that a high degree of correlation exists between the company's profitability and the level of its construction activity. Such correlation not only underscores the positive contribution to the firm's bottom line of its construction activity but also highlights the loss making nature of its water activity.

III.2 Revenues Structure Analysis

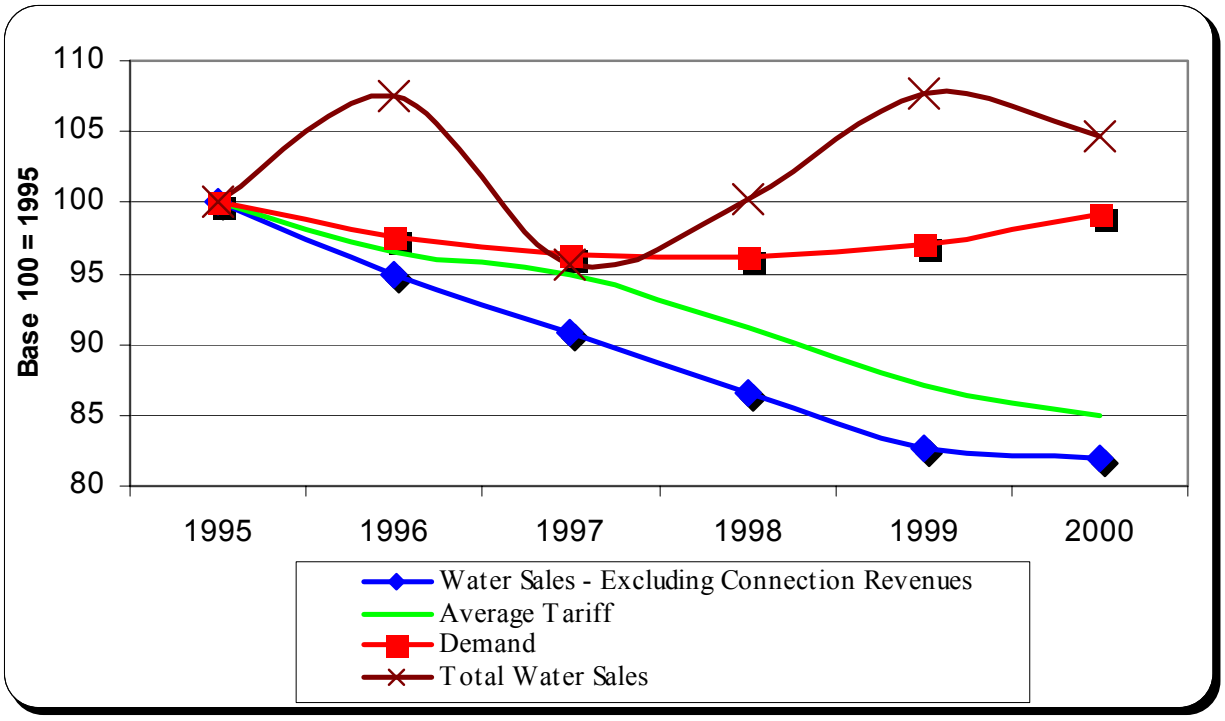
As shown in the previous section, Varkom's revenues are derived from two principal sources, its water sales and its construction activity. In 2000, 52.7% of the company sales (3.7 million USD) came from water sales in comparison to less than 33.0% in 1995. This growing share of the company's water sales in its total sales does not reflect, however, a surge in water sales but rather a very steep decline in its construction activity (see previous section). Figures III-2 and III-3 highlight the primary factors behind Varkom's stagnant water sales between 1995 and 2000:

1) Varkom overall water sales remained flat at around 9.5 million cubic meters sold per year. This lack of water sales growth is primarily due to the fact that the company already services more than 90% of all potential customers in its service area and that its market base (i.e.; the population and the industries its serves) does not appear to be growing.



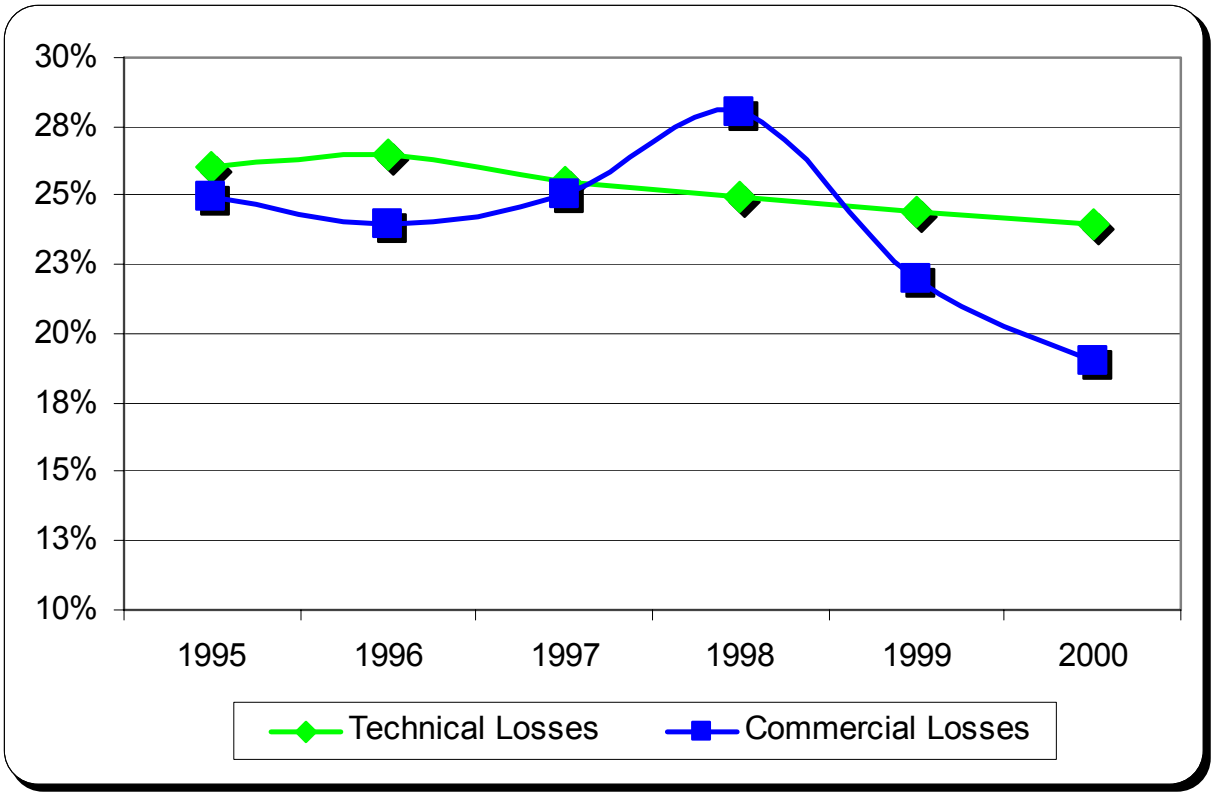
Source: Varkom's audited accounts
BAH, 2001

Figure III-1: Varkom's Sales and Profitability Figures From 1995 Through 2000



Source: Varkom's audited accounts
BAH, 2001

Figure III-2: Varkom's Selected Operational and Financial Indicators

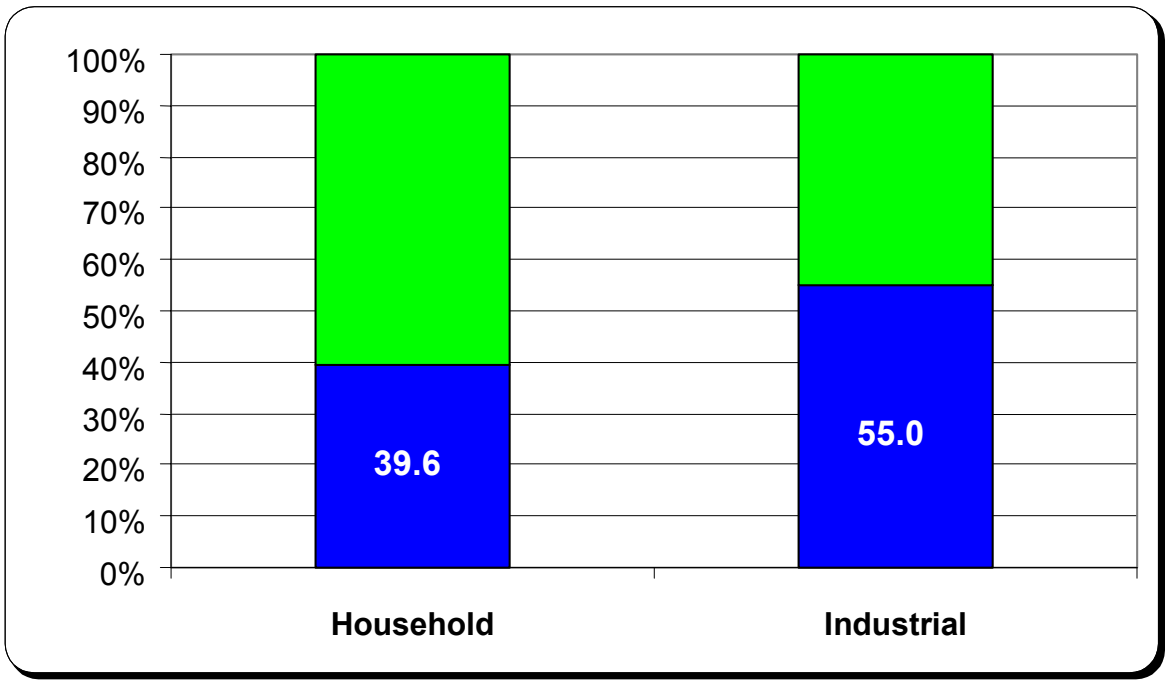


Source: Varkom's audited accounts
BAH, 2001

Figure III-3: Evolution of Varkom's Estimated Technical and Commercial Losses (as reported by Varkom. Actual technical losses may be higher)

2) Water sales (excluding connection work revenues) declined by about 15% under the combined effect of the lack of tariff re-adjustment (i.e., inflationary erosion of tariff -see Figure III-2) and the decreasing importance of industrial customers whose share of total water sales decreased from 42% to 38% of total water sales from 1995 to 2000 (water tariff for industrial customers is 2.7 times higher per cubic meter sold than that of households).
3) Insufficient improvements were achieved in the level of both technical and commercial losses. A sharper reduction of these losses could have allowed Varkom's to generate significant additional revenues without any increase water production costs.

Among the factors previously examined, the one having the greatest impact on Varkom's ailing revenue picture is the current tariff level. Indeed, a survey of tariff levels within 36 other cities in Croatia shows that Varkom's tariffs both for industrial and household customers are much lower than the nationwide average which itself is much lower than the European average. As shown in Figure III-4, Varkom's current household water tariffs amount to less than 40% of the nationwide average while its industrial tariffs are slightly more than half of that average. Additionally, like all other water utilities in Croatia, Varkom collects only a fraction of the tariff actually paid by its customers. A portion of the payment made goes back to the federal



Source: Varkom
BAH, 2001

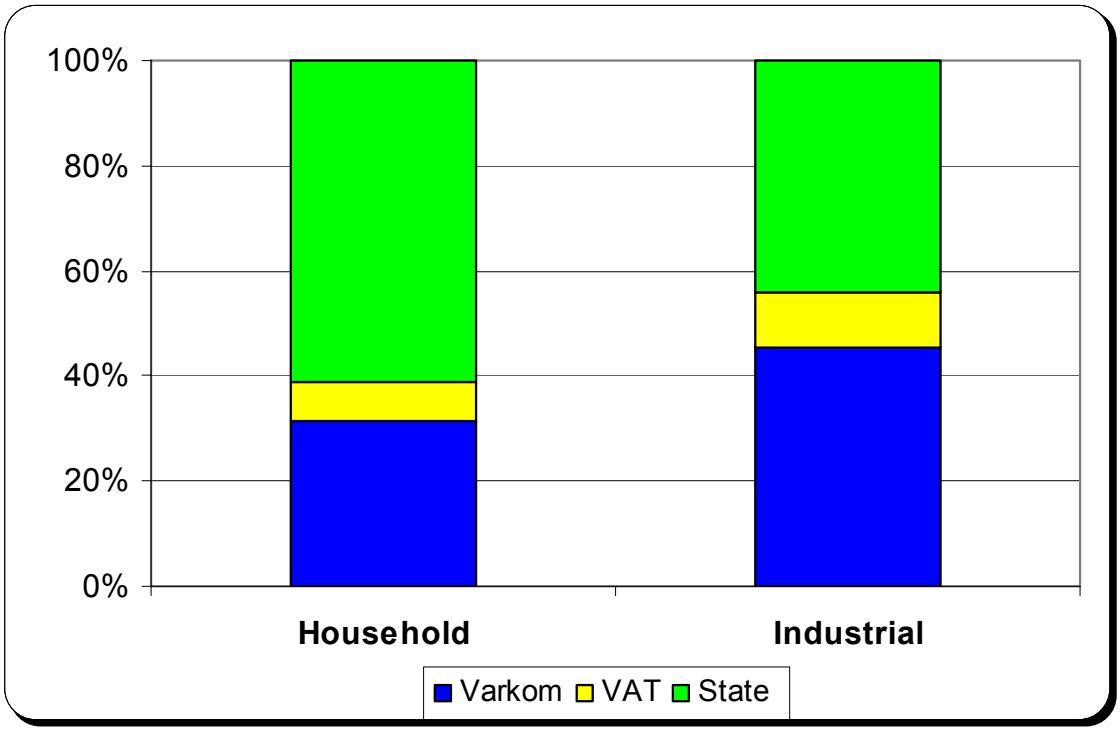
Figure III-4: Varkom's Water Tariff as a Percentage of Nationwide Average Water Tariffs

government in order to fund the activities of an independent agency (i.e.; Croatia Water) whose role is to manage water resources and finance water projects at a nationwide level. In the case of Varkom, the financial drain represented by this transfer of resources back to the federal government is very significant. It amounts to more than 60% of the tariff paid by household customers and by more than 40% of the tariff paid by industrial customers (see Figure III-5).

III.3 Costs Structure Analysis

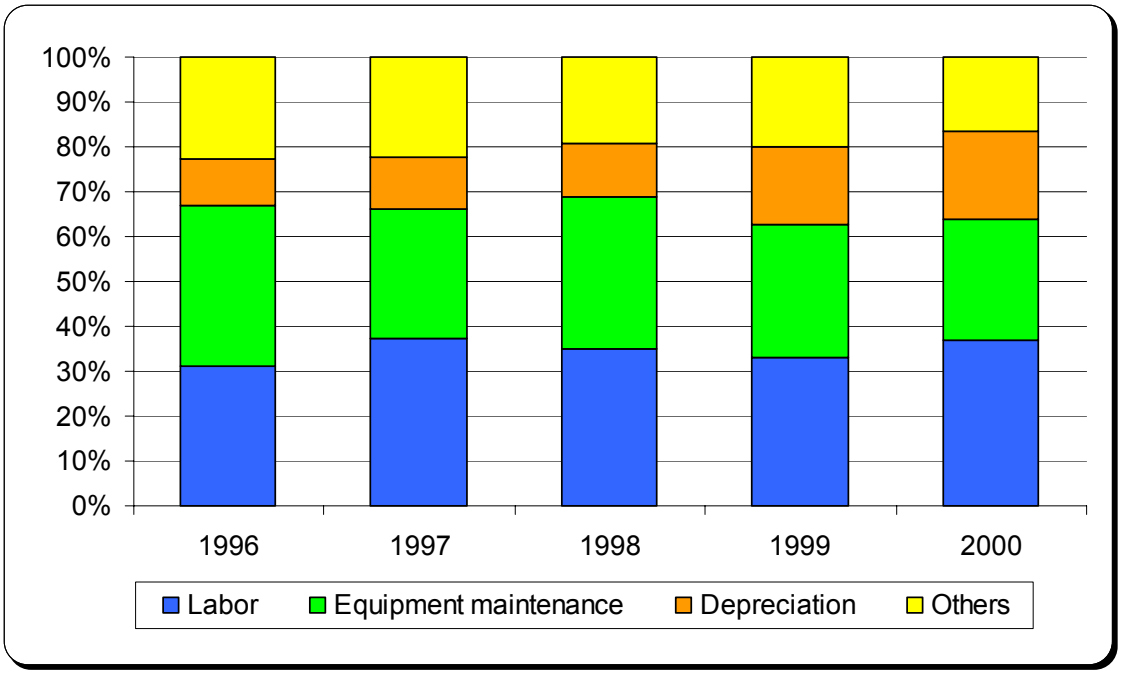
Varkom's operational cost structure is unusual for two primary reasons:

1) It does not include any significant financial debt (see Figure III-6) which is surprising when one considers that Varkom has spent a total of 115 million Kunas (13.7 million USD) on investment projects between 1995 and 1999, or the equivalent of 30% of its cumulative turnover during that period. Such level of investment exceeds significantly the financing capabilities of the Utility and was only made possible through grants from the local municipality and Croatia Water. For the latter, preliminary 2000 audit states that the money provided to Varkom from 1996 to 2000 will have to be repaid. This means that the Utility is facing a potential liability in excess of 30 million Kunas (3.6 million USD) not currently shown on its books.



Source: Varkom
BAH, 2001

Figure III-5: Tariff Revenues Distribution for Varkom's Customers



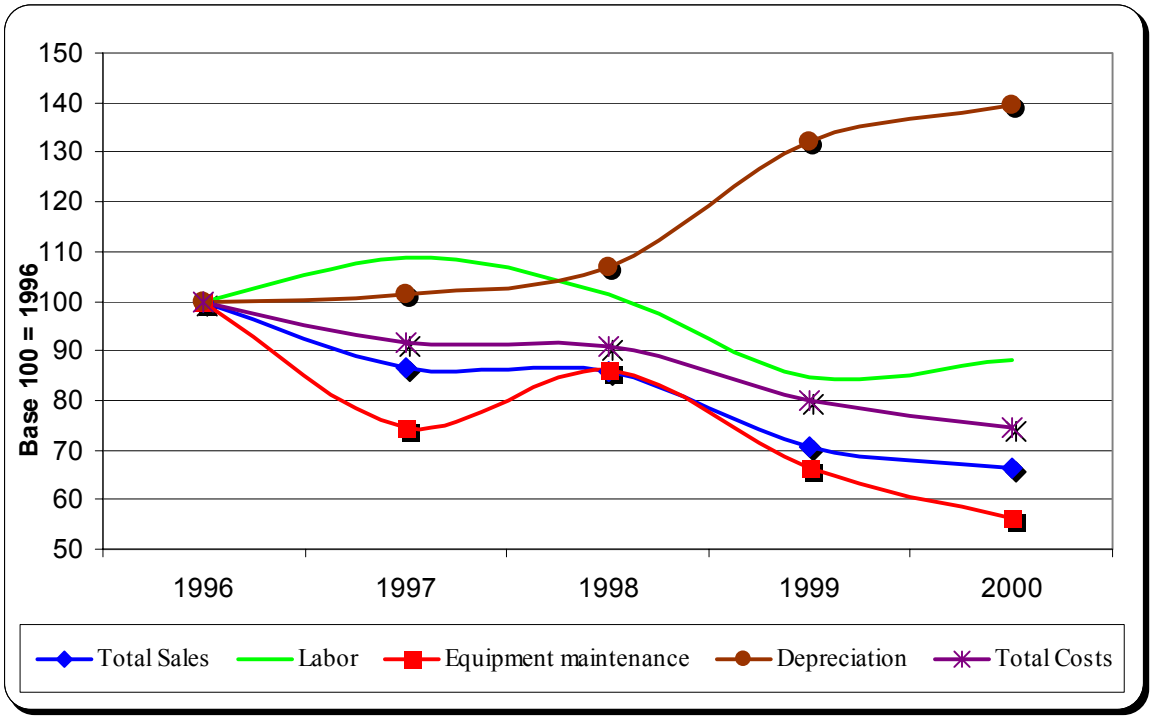
Source: Varkom audited accounts
BAH, 2001

Figure III-6: Varkom's Operating Costs Structure From 1996 Through 2000

2) It does not include a significant amount of extraordinary losses that would reflect the high level of receivables (unpaid bills) currently appearing on the company's books (i.e., about 32.8 million Kunas at the end of 2000, or the equivalent of 102% of total water sales for that year).

Other operating costs aside from labor costs, however, appear to be in line with prevailing industry cost structure with labor, equipment maintenance and depreciation amounting to, respectively, 37.1%, 26.8% and 19.5% of total operating costs in 2000.

Over the last five years, Varkom's overall operating costs have decreased in constant terms at an annualized rate of about 5.8%. This rate is lower than the annual average decline in operating revenues of 8.1% and, thus, explains the worsening trend of the company's financials results. Such cost evolution pattern (i.e.; costs do not decrease as quickly as revenues) is typical of any utility that suffers from a cost structure that is primarily fixed (in the case of Varkom more than 60% of all costs are fixed) due to the financial weight of its stranded assets. In the case of Varkom, we should note, nevertheless, that its management has failed to aggressively control the company's labor costs. This fact is illustrated in Figure III-7 that shows that, in real terms, labor costs only decreased by 10% between 1996 and 2000 while sales plunged by 34%.



Source: Varkom audited accounts
BAH, 2001

Figure III-7: Evolution of Varkom's Costs and Revenues From 1996 Through 2000

Chapter IV: Review of Varkom Water System's Financing Options

Our preliminary review of Varkom's operations underscores the fragile state of its finances and, thus, its limited capacity to secure on its own investment money. While such situation is in no way exceptional within the context of the water sector in Croatia (i.e.; all the countries utilities lack the capacity to finance their investment on their own), in the case of Varkom it is made worst by the following factors:

- **Croatia Water's Loans:** Varkom has yet to recognize 30 million Kunas (about 3.6 million USD) of grants provided by Croatian National Water company between 1996 and 2000 as loaned money. Once this is done, we estimate that interests alone for this unaccounted for "loan" will represent an additional annual charge exceeding 10% of today's water sales (i.e.; about 3.5 million Kunas/year in interest alone).
- **Stagnating demand:** Demand for Varkom water services has increased by less than 1% per year over the last five years (see Chapter II). This situation is unlikely to change in the near future because of the already high rate of connection achieved within the utility service area (more than 90% of all potential customers are connected to the water distribution system) as well as the anemic rate of growth in terms of population and industries in and around Varazdin.
- **Unrealistically low tariffs:** Even by Croatian standards, Varkom's tariffs are extremely low (i.e.; about 42 cts/m^3). The currently proposed 30% increase in water tariffs will fall far short of what is necessary to bring Varkom's tariffs in line with its costs (figures as high as 300% increase in water tariffs have been suggested). Furthermore, no study has been carried out to assess the price sensitivity of customers and, hence, the negative impact that any increase in water tariffs will have on water consumption levels.
- **Low collection rates:** While no officials figures were provided to us on this specific issue, it is quite clear that Varkom management's claim that current collection rate exceeds 80% is not supported by the high level of receivables (i.e.; 102% of water sales in 1999) and the payment of less than 30% of the water bills issued to customers within the standard 30 days.
- **Unrealistically high investment plan:** Varkom's current investment plan calls for more than 90 million Kunas (10.8 million USD) to be spent between 2001 and 2003 for rehabilitation/expansion of the water network. This sum represents a 50% increase in annual investment level when compared to the average investment level of the previous five years (i.e.; 30 versus 20 million Kunas/year) and would amount to 100% of the anticipated water turnover during this period (at current tariff levels).
- **Uncertain future of Varkom's construction business:** As already shown in Chapter II, the negative evolution of Varkom's apparently highly profitable construction business turnover between 1995 and 2000 (i.e.; -41% in real terms), has had a significant impact on the Utility's financial performances.

Under these conditions, it is quite clear that Varkom's ability to secure financing to carry out its investment plan will be contingent upon its shareholders capacity to offer financial guarantees.

IV.1 Available Financing Sources

The water sector in Croatia has yet to entice any private investors. As such, to date, it has had to rely on the following five primary sources of financing to pay for its investment needs:

1) The utilities self-generated cash flow;
2) The loans provided by National Water Company (i.e.; Croatia Water);
3) The loans extended since 1996 by the Croatian Bank for Reconstruction and Development (HBOR);
4) The subsidies provided by the owners/shareholders of the utilities (mostly local municipalities) and, more recently,
5) The loans awarded by the European Investment Bank for Reconstruction and Development (EBRD).

In the case of Varkom, the state of Varazdin municipal finances as well as the utility's own financial resources reduce to only three the number of credible financing sources that can be used. There are: 1) Croatian Water, 2) HBOR and 3) EBRD.

IV.1.1 Croatia Water

The current structure of Croatia water sector is characterized by the predominant role that Croatia Water plays in it. This company, which operates in parallel to all the municipal water companies, is set up as an independent non for-profit federal agency in charge of managing the country's water supply. As such, it does not operate any water systems within the country and relies for its funding both on its right to get a portion (i.e.; more than 50% in the case of Varkom) of the water revenues collected by the country's local water utilities as well as on federal government money. Croatia Water's budget is estimated at about 175 million USD, with about half of this sum coming from federal government contributions and the other half coming from collections from the country water users.

Until 1995 Croatia Water provided grants as well as technical assistance (it employs about 700 persons, including several hundred water engineers) to utilities in order to help them carry out water projects. Following the passage of a new Water Law in 1995, Croatia Water had to start to lend a portion of the money it provided at subsidized rates (2-3% interest rate with repayment period in excess of 10-15 years). The problem to-date with this new approach is threefold:

1) Croatia Water was never intended to act as a Bank and, as such, does not have the proper structure nor the personnel to manage loans disbursement and repayment;
2) Because Croatia Water retains a large portion of the tariffs paid by the water users, most water utilities do not have the financial means to borrow any money; and,
3) In the event that a utility is not able to repay the money it owes, the new Water Law allows it to pay back Croatia Water with shares. This option which Varkom will undoubtedly choose to use to repay the 30 million Kunas it owes to Croatia Water, may result within a couple of years in a transfer of ownership of the country's utilities from local city councils and governments to the federal government.

Additional problems are raised by the activities of Croatia Water. For instance, there seems to be a significant discrepancy between the amount of money collected and the amount of money lent back to the utilities. In the case of Varazdin, we estimate that, between 1996 and 2000, Croatia Water collected in excess of 150 million Kunas (about 17.5 million 2001 USD) from Varkom's customers. This figure is five times larger than the 30 million Kunas (about 3.6 million USD) lent to Varkom during that very same period. Furthermore, there do not appear to be any standardized requirements to be met by Utilities for 1) securing a loan or a grant from Croatia Water, 2) ensuring transparent and equitable disbursement this loan or grant.

IV.1.2 HBOR

As already mentioned, HBOR involvement in project financing in the water sector is quite recent (i.e.; since 1996). As such, the bank's involvement in water sector project financing is still limited in comparison to that of Croatia Water and it seems to have been primarily targeted at larger Croatian cities/utilities. HBOR is currently using three different approaches to finance water projects in Croatia:

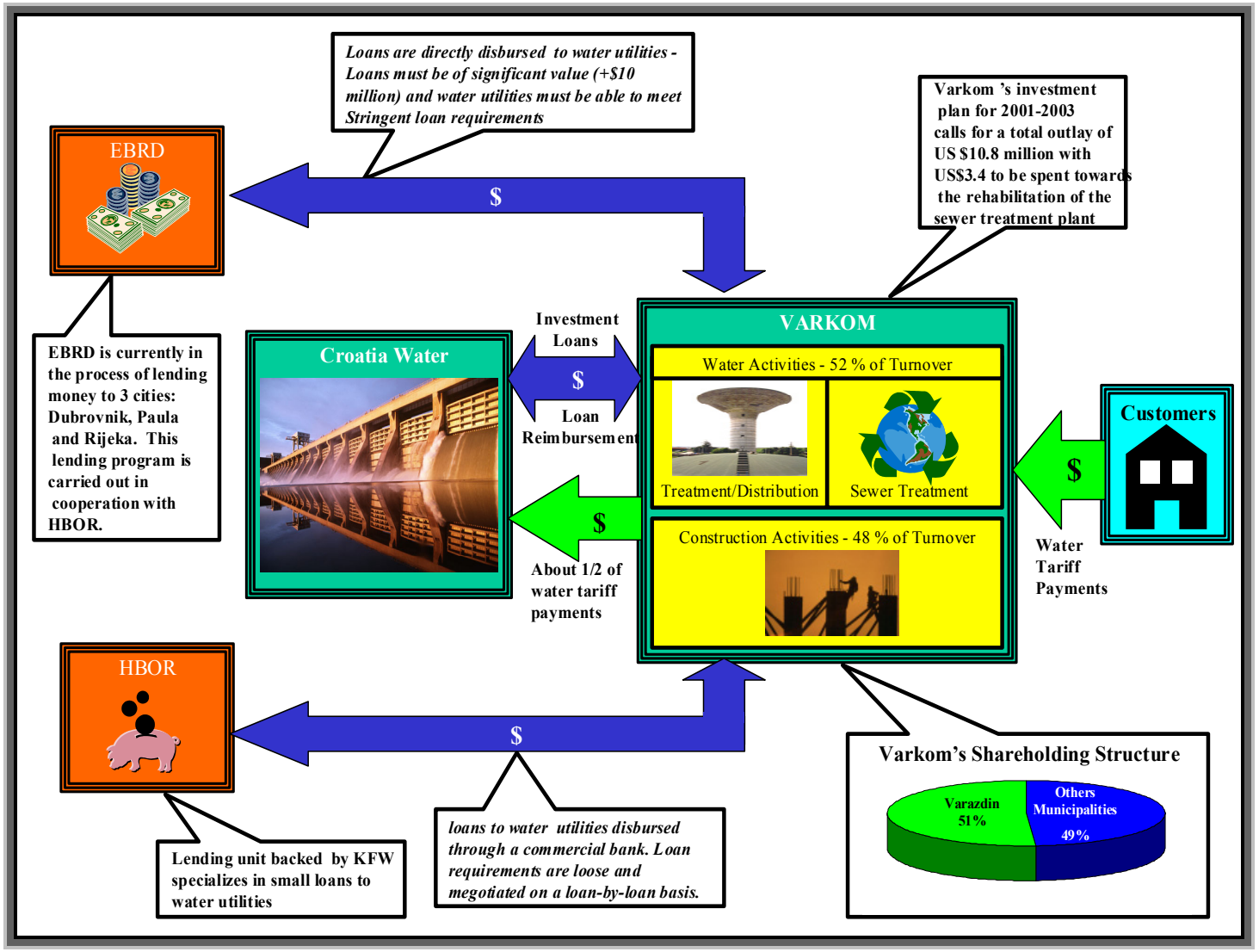
1) **Direct loans:** this approach is used primarily for smaller loans (no more than several million dollars) and does not seem to be utilized often.
2) **Indirect loans:** in this case, HBOR actually disbursed the loan through either a commercial bank or, sometimes, through Croatia Water. Once again, these types of loans seem to apply primarily to loans of smaller values.
3) **Syndicated loans:** in this latter case, HBOR is only one of several lending agencies financing the project. This is the case right now for a loan that is being extended to the cities of Paula and Dubrovnik by HBOR in cooperation with EBRD.

Lending conditions and requirements applied by HBOR appear to vary depending on the approach selected for loan disbursement as well as the amount of the loan. For smaller loans, HBOR has created a specialized lending unit that operates with the support of the German Foreign Aid Agency (KFW). It appears that this unit disbursed most of its loans through commercial banks and uses fairly flexible lending qualification standards (see Exhibit IV-1). In the case of Varkom, this means that HBOR would more than likely not require an audit of the Utility's financial accounts or the publication of a business plan containing a specific timetable for tariff increases. HBOR would demand, however, that either Varkom or its shareholders (i.e.; Varazdin municipality) agree on a set of loan guarantees (e.g.; use Utility's assets as collateral, allowing HBOR to collect directly loan payments at the source or obligates shareholders to make up for any shortfalls of money during the loan repayment phase). These assumptions

would have to be confirmed prior to the loan approval by HBOR itself based on the results of its own due diligence work.

IV.1.3 EBRD

EBRD's involvement in water projects financing in Croatia is still recent and, for the moment, only covers large loans to the Croatian cities of Paula, Dubrovnik and Rijeka. In the case of Varkom, the loan that was being sought only covered the investment required for the rehabilitation of the STP whose value was estimated at 28 million Kunas or 3.3 million USD at



BAH, 2001

Exhibit IV-1: Water Sector Financial Flows – Example of Varkom

today's exchange rate. As this investment is no longer warranted (i.e.; see Chapter III), other Varkom's investment needs would need to be identified to warrant EBRD's interest. Our limited review of Varkom finances and operations indicate that EBRD would more than likely require the implementation of very stringent structural adjustment measures prior to any loan disbursement to Varkom. Practically, this would mean an immediate and substantial increase of Varkom's water tariffs, the transformation of most its receivables into losses, the publication of a completely new set of financial books, the development of a business plan and an agreement on revenues guarantees backed by the Varazdin municipality and/or the federal Government

IV.2 Most Likely Financing Sources for Varkom's Investment Plan

Our review of potential financing sources shows that when we consider both the urgency and the amount of money needed within the framework of Varkom existing investment plan, only two potential sources of funding are available: HBOR and/or Croatia Water. This does not mean, however, that in order for Varkom to secure a loan would juts come down to filling out a loan application with HBOR, Croatia Water or both. Indeed, we would argue that prior to contemplating this investment, Varkom and its shareholders would be wise to review carefully the financial burden associated with taking on such a loan and consider adjustment measures (e.g.; tariff increases, company re-structuring) that would mitigate its associated financial risk.

Chapter V: Recommendations for Further Technical Assistance

V.1 Technical and Engineering Requirements

Varkom has developed a proposed investment program to deal with water quality and wastewater treatment needs. However, its program lacks some important technical analysis and does not address some of the most serious operational problems found. We, thus, recommend that additional engineering studies, and in particular value engineering, studies be carried out to obtain further details on Varkom's investment program.

V.2 Financial and Institutional Requirements

Based on our initial review of Varkom's activities, we have determined that:

- As with many municipally-owned water utilities in the Balkans, there is an ambiguous financial, managerial, and institutional relationship between the water utility and the city government;
- Varkom lacks an overall business plan;
- Varkom's internal operations (particularly financial) make it very difficult to distinguish between different aspects of the enterprise's business and are not consistent with good business practices; and,
- The existing technical documentation to support Varkom's proposed investment program is inadequate.

Until basic institutional, financial, and operational issues are resolved, it is likely that Varkom will have a difficult time securing a loan. Likewise, the management of any investment program will continue to prove difficult. Therefore, in order to help Varkom secure a loan to finance its investment plan, we propose to provide further technical assistance in the following areas:

- Development of a capital works investment plan using various tariff adjustment scenarios;
- Development of a business plan incorporating changes to Varkom current technical, commercial, and financial management practices;
- Development of basic financial projections and performance goals for Varkom's water activities; and,
- Clarification and reform of Varkom's relationship with the City through the development and implementation of Performance Agreement to be signed by both parties.

V.2.1 Proposed Follow on Work

Our proposed follow on work would be divided into two tasks encompassing two different phases of technical intervention with both tasks stretching over a 10-week period.

Task 1: Memorandum of Understanding (MOU) #1 - Agreement to Proceed

Under the first MOU, USAID would agree to provide certain equipment and consulting services and Varkom and the City of Varazdin would agree to certain actions facilitating this USAID assistance.

Under the first Memorandum of Understanding, USAID would agree to two actions:

1. USAID would procure fine bubble diffusers for the wastewater treatment plant at an estimated cost of 50,000 USD. At this time, several manufacturers of this type of equipment have been contacted and their responses are awaited in order to determine how quickly these diffusers could be procured using Varkom's specifications and depending on the time lines in using on-the-shelf versus off-the-shelf equipment.
2. USAID would have its consultants develop materials in support of the rehabilitation and restructuring of Varkom. This would include an investment plan, a tariff structure analysis with proposals for a new tariff structure, and an assessment of restructuring options for Varkom.

In counterpart to this assistance, the City the City and Varkom would agree to three actions:

1. Cover labor and direct costs associated with installation of the diffusers;
2. Accept and implement Varkom's proposed 30% water tariff increase for the year 2001;
3. Delay further investment related to combating the odor problem at the wastewater treatment plant until it has been firmly established whether the installation of the diffusers has successfully addressed this problem;
4. Commit to participating in the USAID consultant's detailed review of the current tariff structure with proposals for a new tariff structure, the development of a new investment plan (including additional investment to mitigate odor problem at the wastewater treatment plan if the proposed diffuser solution proves unsuccessful) and a restructuring plan.

It is envisioned that this first MOU could be drafted by August 15, 2001 and signed by September 15, 2001.

Task 2: MOU #2 - Performance Contract Agreement and Business Plan

Within two months of the signing of the first MOU (i.e.; by November 15th, 2001), USAID and its consultants would present to the City the promised materials: a new investment plan, an analysis of the existing tariff structure and a proposed new tariff schedule, a restructuring program and a draft of the second MOU. The work proposed under this second MOU would go ahead only once the City and Varkom have agreed on long-term tariff adjustments, investment levels and restructuring options.

Following the signature of the second MOU, the materials produced under the first MOU would be integrated by USAID and its consultants into two new implementing documents. First, a business plan for Varkom, including projected financial statements, that would incorporate the proposed new investment plan and restructuring plan. Second, a Performance Contract Agreement between the City and Varkom that would define the rights and obligations of each entity and laying out performance obligations for the Utility.

V.2.2 Estimated Levels of Effort

In order to carry out the proposed work, we have estimated that the following level of efforts would be necessary:

Personnel Categories	Industry Specialist/Engineer Level I	Business and Finance Specialist Level I	Institutional Development Specialist Level I	Attorney Level I	Legal, Engineer and Financial Specialists CCN/TCN
Task 1: MOU 1	20 days	15 days	10 Days	10 days	30 days
Task 2: MOU 2	10 days	15 days	10 Days	15 days	30 days
Total	30 days	30 days	20 Days	25 days	60 days